

MicroLink ISDN/TL V.34

User's Manual



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1 Introduction

About this manual	This manual describes the installation, configuration and operation of the ELSA <i>MicroLink ISDN/TL V.34</i> ISDN terminal adapter.
Symbols and conventions	<p>The following conventions are used in this manual:</p> <ul style="list-style-type: none">◇ NOTE ◇ denotes important information.A filled-in box indicates a list of items:<ul style="list-style-type: none">■ ...Procedures consist of numbered steps:<ul style="list-style-type: none">1. ...Bold text denotes the default values for AT commands and S registers.Brackets (< >) indicate ASCII characters and characters on a keyboard. For example, <CR> means carriage return and <BS> means backspace.
S ₀ interface S/T interface	In this manual, the interface between the ISDN Network Terminator (NT) and the <i>MicroLink ISDN/TL V.34</i> is referred to as the "S ₀ interface" or "S ₀ bus." In the USA this interface is also known as the S/T interface.
Changes to this manual	ELSA <i>MicroLink</i> ® products are subject to continual development. It is therefore possible that slight variations between the printed documentation and the latest release may arise. However, you will always find the latest information in the Support BBS <i>ELSA ONLINE</i> , the ELSA Internet WWW site and CompuServe (see page 109).
Package contents	<p>Please make sure that your package contains the following items:</p> <ul style="list-style-type: none">■ ELSA <i>MicroLink</i>® <i>ISDN/TL V.34</i> terminal adapter■ External power supply (AC adapter)■ ISDN S₀ line connection cable■ RS-232/V.24 serial cable■ 9-pin to 25-pin adapter■ Disks and/or CD-ROM with application software■ Printed manual <p>If any item is missing or damaged, please contact your dealer. (ELSA reserves the right to change package contents without prior notice.)</p>

Notes:

2 Brief Description

Congratulations for purchasing the *MicroLink ISDN/TL V.34* terminal adapter - the most versatile ISDN communications device available!

The *MicroLink ISDN/TL V.34* integrates state-of-the-art ISDN digital technology with high-speed analog modem and facsimile capabilities into a single, convenient desktop device. This unique synergy makes the *MicroLink ISDN/TL V.34* the perfect high-speed solution for all digital and analog communications requirements.

- As an ISDN device, the *MicroLink ISDN/TL V.34* supports data transfer rates up to 115,200 bps across digital communications lines. For increased data throughput, the *MicroLink ISDN/TL V.34* supports V.42bis data compression for effective transfer rates up to 230,400 bps, as recognized at the computer serial interface. This makes the *MicroLink ISDN/TL V.34* ideal for access to the Internet, corporate local-area networks, and on-line information systems.
- As a high-speed analog modem, the *MicroLink ISDN/TL V.34* adheres to the international V.34 and V.Fast standards, V.32bis, V.32, V.22bis, V.22, V.21, V.23, V.42bis and MNP5, so ensuring worldwide compatibility with current analog modems at speeds from 300 to 33,600 bps. V.42 and MNP 4 error correction guarantee error-free, and V.42bis and MNP 5 data compression ensure maximum data throughput. *MicroLink ISDN/TL V.34* uses the V22bis and V.21 for transfers at 300 to 2400 bps.
- As a high-speed facsimile machine, faxes can be exchanged with Group 3 compatible facsimile machines and fax/modems at speeds up to 14,400 bps. In addition, the *MicroLink ISDN/TL V.34* supports fax polling, allowing the preparation of documents for retrieval by remote facsimile machines.

These state-of-the-art features maximize communications activities while reducing the line charges, resulting in significant cost savings.

The *MicroLink ISDN/TL V.34* is also intelligent enough to distinguish among incoming ISDN, modem, and fax calls and can route calls appropriately - even if your software does not support auto-detection capabilities.

Moreover, the *MicroLink ISDN/TL V.34* is compatible with the industry-standard AT command set for trouble-free ISDN or analog communications manually (refer to page 32 for more information) or using your preferred communications software.

ELSA *MicroLink*® products are continually being improved. You will always find the latest information about this product in the Support BBS *ELSA ONLINE*, the ELSA Internet WWW site and CompuServe (see page 109).

2.1 Key Features of the *MicroLink ISDN/TL V.34*

The following section summarizes the key features of the *MicroLink ISDN/TL V.34*.

2.1.1 ISDN Features

Channel bundling This feature allows the two 64,000 bps B (Bearer) channels of an ISDN Basic Rate Interface to be virtually linked, doubling the effective data throughput of

a digital connection to 128,000 bps. This process uses, provisionally, a protocol proprietary to ELSA, so only a connection between two ELSA devices supports this.

D channel protocols	The <i>MicroLink ISDN/TL V.34</i> provides AT commands for selecting the appropriate local D channel protocol. European models support the DSS1 (Euro-ISDN) and German 1TR6 protocols, while US models support the National ISDN-1 protocol (NI-1) and AT&T 5ESS protocols.
PPP conversion	The Point-to-Point Protocol conversion allows the combination of asynchronous PPP computer software with synchronous PPP-ISDN access points, (e.g. via Routers). The conversion complies with RFC 1662.
Automatic detection	The <i>MicroLink ISDN/TL V.34</i> can distinguish between incoming 56,000 and 64,000 bps ISDN calls and adjust its speed accordingly.
ISDN AT command set	The <i>MicroLink ISDN/TL V.34</i> is compatible with the industry-standard AT command set, which allows control of the modem either manually (as described in this manual) or via AT-compatible software.
Automatic cost monitoring	The European version of the <i>MicroLink ISDN/TL V.34</i> (DSS1 and 1TR6 protocols) can monitor ISDN charge information and guarantees that a user-defined number of charge units is not exceeded during a specific period of time. This feature is not offered by the network providers in some countries.

2.1.2 Analog Features

Integrated V.34/V.Fast modem	The <i>MicroLink ISDN/TL V.34</i> provides V.34/V.Fast modem capabilities for exchanging data with analog modems at speeds up to 33,600 bps. With slower remote modems, the maximum possible data exchange rate will automatically be selected.
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To optimize performance:

- The *MicroLink ISDN/TL V.34* supports the V.42 and MNP 4 error-correction protocols, ensuring error-free data transmissions - even over noisy telephone lines - with analog modems that also support these protocols.
- The *MicroLink ISDN/TL V.34* supports the V.42bis and MNP 5 data-compression protocols, ensuring the fastest data throughput possible with analog modems that also support these protocols.

Integrated send/receive facsimile machine	The <i>MicroLink ISDN/TL V.34</i> provides analog facsimile capabilities for sending faxes to and receiving them from Group 3 compatible facsimile machines and fax/modems at speeds up to 14,400 bps. If the remote device cannot operate at 14,400 bps, your <i>MicroLink ISDN/TL V.34</i> automatically falls back to the maximum speed supported by the remote device.
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2.1.3 Transfer Modes

The *MicroLink ISDN/TL V.34* can automatically switch among the ITU-T V.110, ITU-T V.120, and X.75 protocols to match the protocol of, and establish a data connection with, remote systems. This section describes these protocols and the various transfer modes that the *MicroLink ISDN/TL V.34* supports.

V.110	The <i>MicroLink ISDN/TL V.34</i> can operate in accordance with ITU-T V.110 (I.463), providing asynchronous transfer rates of 1200 to 38,400 bps and synchronous transfer rates of 1200 to 64,000 bps.
V.120	The <i>MicroLink ISDN/TL V.34</i> supports the international ITU-T standard V.120 (I.465) at 56,000 and 64,000 bps. This feature allows error-corrected data connections with transfer rates up to 230,400 bps (asynchronous), and ISDN connections with remote stations in the USA.
X.75	The <i>MicroLink ISDN/TL V.34</i> supports X.75/T.70NL.
Automatic protocol detection	Using real-time V.42bis data compression in X.75 and V.120 modes, the <i>MicroLink ISDN/TL V.34</i> can achieve an effective data throughput of up to 230,400 bps.
Bit rate adaptation	The <i>MicroLink ISDN/TL V.34</i> supports V.110 bit rate detection, allowing it to establish a data connection using the fastest speed supported by the remote system. The <i>MicroLink ISDN/TL V.34</i> can also automatically adapt the RS-232/V.24 bit rate to the ISDN line transfer rate, without requiring user intervention.
T-Online	The <i>MicroLink ISDN/TL V.34</i> can access the German T-Online online service in both VT-100 and CEPT/KIT modes using the commands AT\N8 and AT\N9 (refer to page 46).

2.1.4 Additional Features

Asynchronous RS-232-C data port	The <i>MicroLink ISDN/TL V.34</i> can be connected to the RS-232-C data serial port of an IBM, Macintosh, or compatible personal computer. An IBM-compatible serial cable is provided with your <i>MicroLink ISDN/TL V.34</i> .
Front panel status display	Easy-to-read colored LEDs on the front panel provide information as to the <i>MicroLink ISDN/TL V.34</i> 's status.
MSN and EAZ support	With the European version of the <i>MicroLink ISDN/TL V.34</i> , Multiple Subscriber Numbers (MSN, DSS1 protocol) or Terminal Selection Digits (EAZ, German 1TR6 protocol) can be assigned.

Closed user group support	The European version of the <i>MicroLink ISDN/TL V.34</i> can automatically check incoming telephone calls. This feature lets you restrict call acceptance to a private user group, protecting your system against unauthorized access.
Additional information	For added security, the European version of the <i>MicroLink ISDN/TL V.34</i> can also display the telephone number of an incoming call before establishing the connection. In addition, connection costs can be displayed during and after a connection. Connection Status: information about the status of the connection can also be displayed (e.g. ALERTING).
Flash ROM	Flash ROM technology allows the quick and easy update of software, simply by reading in the new file. The state-of-the-art is always just an update away.
230,400 bps	Using a suitable serial interface card, a line bit rate of 230,400 bps is possible.
Ringling bell	Your <i>MicroLink ISDN/TL V.34</i> can alert you of incoming calls by ringing just like a normal telephone. See register S54 (page 67).

2.2 CE Conformity and FCC Rules



The CE seal indicates 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, where an additional national approval certificate is required.

MicroLink ISDN/TL V.34 has been approved by the BZT according to the new European procedure and may therefore be connected to the Euro-ISDN in all countries of the EU. *MicroLink ISDN/TL V.34* therefore complies with:

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

FCC

This equipment has been tested and found to comply with limits for a Class B computing device according to the specifications in 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.

Notes:

3 Installation

This chapter describes installation of the *MicroLink ISDN/TL V.34* terminal adapter.

3.1 Safety Notice

To ensure your safety and the proper operation of the *MicroLink ISDN/TL V.34* and your computer system, please observe the following guidelines:

- Use only the original external power supply shipped with your ISDN terminal adapter.
- Refrain from using a power supply that has been opened or mechanically damaged. Touching the primary voltage (Europe: 230 V, USA: 120 V) with the hand or with metal parts results in an electric shock, which can be deadly.
- Use only the supplied ISDN S₀ line connection cable to connect your *MicroLink ISDN/TL V.34* to an ISDN digital communications line.
- Do not touch the metal pins of the *MicroLink ISDN/TL V.34* connection sockets. Even slight dirt or electrostatic discharging may cause malfunctions or, in extreme cases, damage the device.

3.2 System Requirements

The following are required for the successful installation of the *MicroLink ISDN/TL V.34* terminal adapter:

- An IBM PC or compatible computer with a 9/25-pin serial communications interface (COM port): recommended is a 16550 (FIFO) buffered Universal Asynchronous Receiver/Transmitter (UART) to operate at speeds up to 115,200 bps.
- An NT-1 device (in the US only).
- An ISDN digital communications line.
- An available AC power outlet.

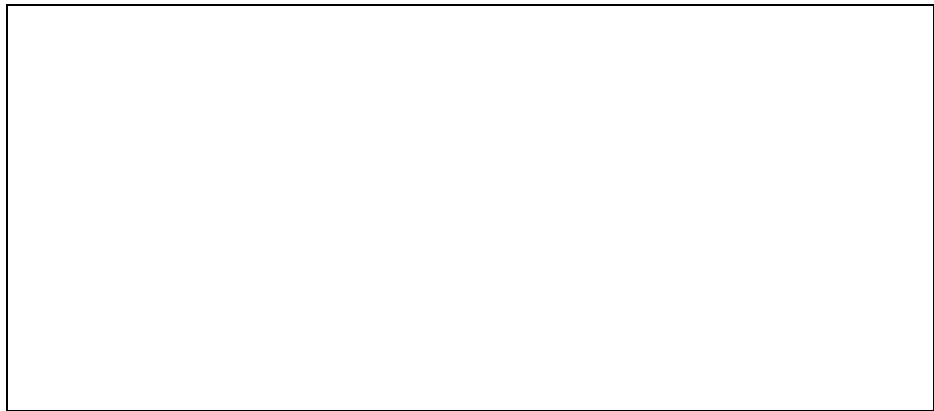
◇ **NOTE** ◇

MicroLink ISDN/TL V.34 can also be connected to the serial port of an Apple Macintosh computer. This connection requires a serial cable with a 9-pin male connector on one end (for connection to the Macintosh) and a 25-pin male connector on the other.

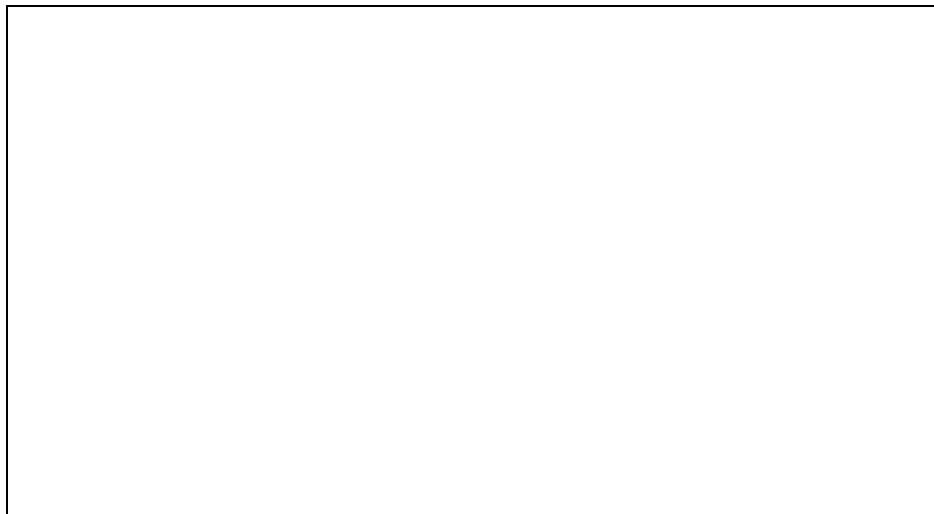
3.3 Installing the Terminal Adapter

During the installation, refer to the following diagrams which show the front and back of your *MicroLink ISDN/TL V.34*.

Front panel LEDs



Back panel connectors



No	Meaning
1	ON/OFF switch
2	AC power connector
3	Serial line connection to computer
4	Reset switch
5	ISDN line connector (S ₀ (S/T) bus interface)

Installation summary

The installation process involves the following steps:

1. **Power supply** Connect the MicroLink ISDN/TL V.34 to an AC power outlet. See page 15.
2. **Serial interface** Connect the MicroLink ISDN/TL V.34 to a computer serial port. See page 15.
3. **ISDN line** Connect the MicroLink ISDN/TL V.34 to an ISDN digital communications line. See page 16.
4. **Switching on** Turn on the MicroLink ISDN/TL V.34. See page 16.

5. Selecting the D channel protocol

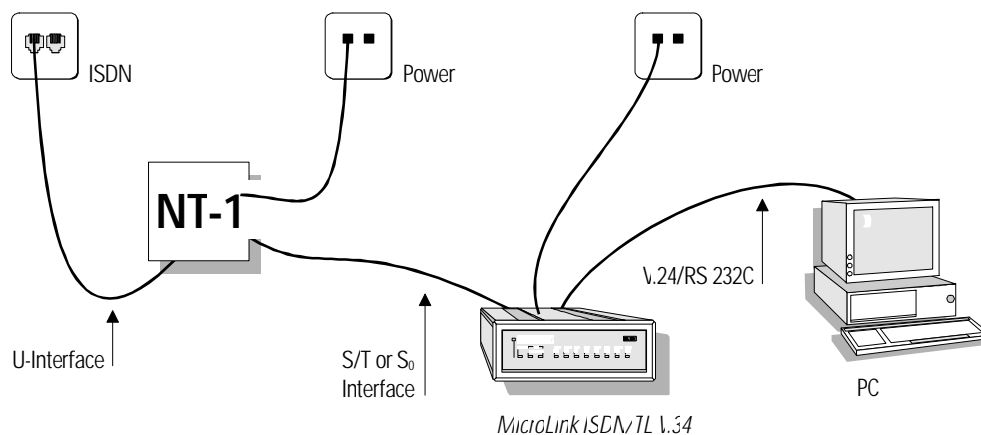
Select the channel protocol. See page 16.

US protocols: enter DN and SPID (see page 17).

◇ NOTE ◇

When connecting to an AC power outlet, use only the external power supply provided with the *MicroLink ISDN/TL V.34*. Do not use a power supply designed for a different device.

Setup diagram



Connecting to an AC power outlet

The following procedure explains how to connect the *MicroLink ISDN/TL V.34* to an AC power outlet. This connection is made using the supplied external power supply (AC adapter).

1. Verify that the voltage of the power line matches the voltage of the supplied AC adapter.
2. Insert the supplied AC adapter cord into the power connector labeled **AC 9V~** on the *MicroLink ISDN/TL V.34* back panel (see the "Back Panel Connectors" diagram, number 3).
3. Insert the wall transformer on the other end of the power cord into a grounded AC outlet.

Connecting to a computer serial port

The *MicroLink ISDN/TL V.34*'s serial port connection is provided by an RS-232 25-pin D-type connector. This connector is located on the back panel of the *MicroLink ISDN/TL V.34*. To make this connection:

1. If your computer is turned on, turn it off.
2. Insert the 25-pin end of the supplied RS-232/V.24 serial cable into the serial connector on your Data Terminal Equipment.

◇ NOTE ◇

If your computer or terminal has a 9-pin serial connector, use the supplied 9-to-25-pin adapter.

3. Insert the other cable end into the DTE connector labeled **V.24/V.28** on the *MicroLink ISDN/TL V.34* back panel (see "Back Panel Connectors" diagram, number 3).

4. Use the standoffs on each end of the cable to secure the cable connector to the DTE serial port and the *MicroLink ISDN/TL V.34*.

Connecting to an ISDN line

The following procedure explains how to connect the *MicroLink ISDN/TL V.34* to an ISDN digital communications line. This procedure assumes an installed ISDN communications line is available. If not, please contact your telephone company to obtain an ISDN line.

1. Connect your NT-1 device to your ISDN communications line. If you need assistance, please refer to the relevant manual.
2. Insert the RJ-11 end of the supplied ISDN S₀ line connection cable into the **ISDN/S₀** connector on the back panel (see "Back Panel Connectors" diagram, number ↵).
3. Insert the other end of the cable into the ISDN telephone wall jack.

Turning on the ISDN terminal adapter

Use the following procedure to turn on the *MicroLink ISDN/TL V.34*.

1. Turn on the *MicroLink ISDN/TL V.34* with the power switch on the back panel. The Test- and ISDN Line LEDs flash as the *MicroLink ISDN/TL V.34* performs a brief self-test. After the tests complete, both LEDs should go OFF.
2. Start the communications software and configure it as follows:
 - Use a baud rate of either 230,400 bps or 115,200 bps.
 - Select the COM port to which the *MicroLink ISDN/TL V.34* is connected, e.g. COM 1 or COM 2.

For more information on performing these steps, refer to the manual for your communications software.

3. Enter local terminal (or "direct connect") mode. Again, refer to your communication software manual for assistance.
4. Type **AT** and press <CR>. An **OK** result code should be displayed on your computer screen. If not, compare the PC-to-Terminal Adapter connection with the "Setup" diagram.

Completing the installation

To complete the installation, refer to the appropriate following section for European or US models as relevant:

European models

The D channel protocol controls the exchange of signals between the local station and the nearest ISDN exchange. The European Community uses either of two D channel protocols:

- The DSS1 channel protocol, also referred to as Euro-ISDN, used in most European Community countries.
- The 1TR6 channel protocol, which is primarily used in Germany.

To ensure compatibility throughout Europe, European versions of the *MicroLink ISDN/TL V.34* support both the international DSS1 channel protocol (Euro-ISDN) and the German 1TR6 channel protocol.

By default, the *MicroLink ISDN/TL V.34* is configured for the DSS1 D-channel protocol. If your local switch requires the 1TR6 channel protocol, type **AT+IDP=1TR6** and press <CR> .

To return the *MicroLink ISDN/TL V.34* to the DSS1 channel protocol, type **AT+IDP=DSS1** and press <CR> .

If required, further settings such as MSN (page 42) can be defined.

This completes the installation procedure for European models.

US models

US versions of the *MicroLink ISDN/TL V.34* require a D channel protocol, a Directory Number (DN) and a Service Profile ID ("SPID" for short) to be defined.

The D channel protocol determines how control signals are exchanged between the local switch and your ISDN terminal adapter. The *MicroLink ISDN/TL V.34* supports two D channel protocols:

- National ISDN-1
- AT&T 5ESS Custom

By default, the *MicroLink ISDN/TL V.34* is configured for the National ISDN-1 channel protocol. For the AT&T 5ESS channel protocol, type **AT+IDP=AT&T** and press <CR> .

To return to the National ISDN-1 channel protocol, type **AT+IDP=NI-1** and press <CR> . (In this command, the letter following the N is an upper-case i.)

Your local ISDN service provider may, depending on the protocol offered, have provided a unique SPID for each device attached to your digital communications line. The following table indicates the parameters required for the systems available:

ISDN Channel Protocol	Number of B-Channels	
	1 B-Channel	2 B-Channels
AT&T 5ESS Custom, point-to-point	No SPID or DN	No SPID or DN
AT&T 5ESS Custom, point-to-multipoint	1 SPID, 1DN	1- or 2 SPID and 1- or 2 DN
National ISDN-1	1 SPID, 1DN	2 SPID and 2 DN

For example, to enter the parameters for the National ISDN-1 protocol, 2 B channels, the following commands must be entered:

AT+ISPID1=0156596200 (For the 1st B-channel)

AT+IDN1=5659620 (For the 1st B-channel)

AT+ISPID2=0156596210 (For the 2nd B-channel)

AT+IDN2=5659621 (For the 2nd B-channel)

No SPID is necessary for the AT&T 5ESS Custom point-to-point configuration (so type **AT+ISPID1=** and **AT+ISPID2=**)

◇ **NOTE** ◇

Each SPID can only be used one at a time. Do not attempt to use one SPID with two ISDN devices simultaneously. This will result in a malfunction!

This completes the installation procedure.

3.4 Installation under Windows 95

Installation

To install your *MicroLink ISDN/TL V.34* under Windows 95, follow the instructions given here:

1. Start Windows 95
2. Switch on your *MicroLink ISDN/TL V.34*.
3. From **My Computer** call the following menus:
4. **Control Panel, Modems**
5. Activate **Don't detect modem, I will select it from a list...**
6. Click on **Have Disk...**, then
7. **Browse...** for your floppy drive or CD-ROM drive (a:\ or d:\ respectively)
8. Select the file MDMELSA.INF (e.g. D:\).

◇ **NOTE** ◇

After copying this file the installation is complete, and the ISDN terminal adapter *MicroLink ISDN/TL V.34* is available for use. The standard software under Windows 95 (e.g. Microsoft Exchange, HyperTerminal etc.) has direct access to your *MicroLink ISDN/TL V.34*.

4 Status Display and Fault Diagnosis

The *MicroLink ISDN/TL V.34* has 11 front panel LEDs for status display.

LED	Status	Meaning
Power	ON	<i>MicroLink ISDN/TL V.34</i> is turned on and receiving power.
Status (see Note)	OFF FLASHING ON	No S_0 current, S_0 bus inactive. Negotiation in process. ISDN line active, connection to ISDN exchange ¹⁾ .
Line	OFF Slow flash (1 per second, 2 or 3 times) Fast flash (3 times per second) ON	No incoming call or connection. Incoming call received, but call is not suited to device. Incoming call not yet accepted. Connection is being established.
TxD (D1)	ON	<i>MicroLink ISDN/TL V.34</i> is receiving either data from the remote system or a command from your computer.
RxD (D2)	ON	<i>MicroLink ISDN/TL V.34</i> is sending data to the remote system or a result code to your computer.
DTR (S1)	ON	Terminal/computer ready for operation (see the AT&D command on page 36).
DSR (M1)	ON	<i>MicroLink ISDN/TL V.34</i> is ready for operation (see the ATID command on page 36).
RTS (S2)	ON	Sending device is enabled (see the ATIQ command on page 50).
CTS (M2)	ON	<i>MicroLink ISDN/TL V.34</i> is ready to send data (see the ATID and ATIQ commands on pages 36 and 50).
DCD (M5)	Red Green Orange	V.110, V.100 or PPP connection established (no error correction or fax connection). V.120, X.75, MNP 4, MNP 5, V.42(bis) connection established (error corrected connection). Channel bundling is enabled. See also the AT&C command on page 34.
Test (PM1)	ON	<i>MicroLink ISDN/TL V.34</i> is performing its self-test.
Note: Most ISDN basic rate interfaces make this LED go ON. With some PBXs, such as Siemens Hicom, the green LED may not go ON before a connection has been established.		

1) In Europe - TEI negotiation OK

In the US - TEI negotiation OK layer 2 active, SPID negotiation OK (if SPID available)

Notes:

5 Operation

5.1 General

This chapter describes how to operate the *MicroLink ISDN/TL V.34*. Topics include:

- Communicating with the *MicroLink ISDN/TL V.34*
- Operating modes
- Typing AT commands
- Resetting the *MicroLink ISDN/TL V.34*
- Performing fax activities
- Performing voice activities

5.2 Communicating with the Terminal Adapter

After installing and configuring the *MicroLink ISDN/TL V.34*, communication activities can be controlled using either the supplied communications software program or another program compatible with the AT command set. There are two ways to communicate with your *MicroLink ISDN/TL V.34*:

- Indirectly, using the commands in your communications software program, or
- Directly, using AT commands.

Indirect method The indirect method involves the use of commands and menus in suitable communications software programs. The user's input via an intuitive interface is converted into the appropriate AT command(s) for issue to the *MicroLink ISDN/TL V.34*. Thus communication with your device is possible without prior knowledge of the AT command set.

Refer to the program manual for instructions on performing these tasks.

Direct method With the direct method, your communications software should be in local terminal (or "direct connect") mode. AT commands can thus be typed in directly.

Before typing AT commands, the *MicroLink ISDN/TL V.34* must be in Command Mode (described in the next section). Entering AT commands is described on page 22. A complete description of the AT commands supported by the *MicroLink ISDN/TL V.34* begins on page 32.

5.3 Operating Modes

The *MicroLink ISDN/TL V.34* has two operating modes: Command Mode and Online Mode.

When using a software interface to communicate indirectly with the modem, these modes will not be apparent to the user.

To use the direct method, the *MicroLink ISDN/TL V.34* must be in Command Mode before typing AT commands. This is described in the next section.

5.3.1 Command Mode

In Command Mode, the AT commands as entered control the *MicroLink ISDN/TL V.34* to perform activities such as dialing or answering a call. The *MicroLink ISDN/TL V.34* automatically defaults to Command Mode in the following cases:

- When it is turned on.
- When it disconnects from a connection.
- If any key on your computer keyboard is touched while during dialing.
- After the *MicroLink ISDN/TL V.34* is reset, using either the Reset button (described on page 25) or the **ATZ** command (described on page 55).

5.3.2 Online Mode

The *MicroLink ISDN/TL V.34* automatically enters Online Mode when it makes a data- or fax connection with a remote modem, fax or ISDN device. Data exchange takes place in this mode.

Commands cannot be entered in Online Mode. Typed entries will be treated as data and sent to the remote device. To send commands the mode must be switched as described in the next section.

5.3.3 Switching Between Modes

The situation may arise when a switch from Online Mode to Command Mode is desirable, e.g. to change a register value during a data transfer.

Using the Escape Characters (default value: **+++**), you can switch from Online Mode to Command Mode while preserving the data connection with the remote modem. The Escape Characters can be changed using the Register **S2**.

The Escape Characters do not require the prefix **AT** or the suffix **<CR>**. A pause is required before and after typing the Escape Characters. The number of seconds to wait is defined by Register **S12**. The default wait time is one second.

The following example shows how to use the Escape Characters:

1. After making a data connection with a remote device, wait at least one second.
2. Type the Escape Character three times (for example, **+++**) and wait at least one second.
3. The *MicroLink ISDN/TL V.34* enters Command Mode, and an **OK** result code is displayed. The desired AT commands can then be entered.
4. To return to Online Mode, type **ATO** and press **<CR>**. A **CONNECT** result code is displayed.
5. To hang up at the end of the data connection, type **ATH** and press **<CR>**.

5.4 Entering AT Commands

AT commands are entered in a command line which can contain one or more AT commands. Enter a command line as follows:

1. Make sure your *MicroLink ISDN/TL V.34* is in Command Mode (refer to page 21).
2. Type the **AT** characters. These characters must be entered at the start of each new command line. These characters provide the *MicroLink ISDN/TL V.34* with the serial port transmission speed, character length and parity settings used by your computer.

◇ **NOTE** ◇ Both **AT** characters must be typed in the same case. Do not type **At** or **aT**.

3. Type one or more commands. A command line can contain a maximum of 255 characters, including **AT**.
4. Press <CR>. The *MicroLink ISDN/TL V.34* sends an **OK** result code and performs the task(s).

◇ **NOTE** ◇ If you receive **ERROR** instead of **OK**, the command line, or a part of it, was not executed. Check for errors in the command line entered.

The following example shows a series of AT commands. Each command line starts with **AT** and has an **OK** result code below it.

Command input in
several command lines

```
at\n3
OK
at\v8
OK
ats0?
000
OK
```

These commands can be entered in sequence in a single command line:

Command input in
one command line

```
at \n3 \v8 s0?
000
OK
```

For better legibility, the individual commands can be separated by blank spaces.

Observe the following guidelines when typing AT commands:

Correcting a typing
mistake

If you make a mistake when typing an AT command, press the Backspace <BS> key to delete the error. You can delete every character on a command line except **AT**.

Enhancing readability

To enhance readability, you can include spaces and punctuation marks such as parentheses and hyphens in your command line. For example:

```
ATD 1 (513) 555-1212
```

Spaces and punctuation marks have no effect on command execution, but they do count toward the 255-character maximum.

Omitting a parameter Some AT commands require a numeric parameter such as 0 or 1. Omitting this parameter results in the default value of 0 being used. The **ATV** command, for example, requires a parameter of 0 to enable numeric result codes or 1 to enable word result codes. If you type **ATV** but fail to include a 0 or 1, the **V0** command is assumed, enabling numeric result codes.

Including other commands If your command line includes a Dial- (**ATD**) or Reset command (**ATZ**), any other accompanying commands should be in front of the **ATD** or **ATZ** command. For example:

AT M3 X5 V1 D 1 513 555 1212

Re-executing a command line To repeat the last command line executed, type **A/** while omitting **AT** in front of it and <CR> afterward. This command is convenient, for example, if the last number called was busy. Typing **A/** lets you automatically redial the call without retyping the command line.

◇ **NOTE** ◇ Resetting your *MicroLink ISDN/TL V.34* or turning it off and on removes the last-executed command from memory, invalidating the **A/** command.

Independent line speed The bit rate your computer uses to communicate with the *MicroLink ISDN/TL V.34* is called the Data Terminal Equipment (DTE) rate or serial port bit rate. The speed your *MicroLink ISDN/TL V.34* uses to transmit data is called the Data Communications Equipment (DCE) rate or DCE line speed.

By default, the DCE rate is determined by the DTE rate. If, for example, your computer sends an AT command line at 19,200 bps to your *MicroLink ISDN/TL V.34*, the *MicroLink ISDN/TL V.34* will use a full-duplex DCE rate of 19,200 bps.

The **AT&G1** and **AT%B** commands can be used to select a DCE rate for your *MicroLink ISDN/TL V.34*, independent of your computer's serial port speed. For example, you can set the DCE rate to a fixed 38,400 bps while the DTE rate remains at 19,200 bps.

If you want to return your *MicroLink ISDN/TL V.34* to using the DTE rate, issue the **AT&G0** command.

ISDN connections with a V.120 or X.75 protocol will always use 64,000 bps or 56,000 bps (see %S AT-command, page 52).

5.5 Resetting the Terminal Adapter

There are two methods for resetting the *MicroLink ISDN/TL V.34*:

- A hardware method, using the Reset button on the back of your *MicroLink ISDN/TL V.34*.
- A software method, using the **ATZ** or the **AT&F** commands.

Both methods are described in the following sections.

Hardware reset
method

The back panel of the *MicroLink ISDN/TL V.34* has a Reset button to reinitialize the ISDN modem. Facing the back panel, you can find the Reset button between the **V.24/V.28** and **ISDN/S₀** connectors (see "Back Panel Connectors" diagram, number 8, page 14).

When the *MicroLink ISDN/TL V.34* is configured for dumb mode (refer to page 38), using the Reset button returns it to normal operation.

The Reset button is recessed to prevent accidental resets. If you want to press the Reset button, do so using a narrow object, such as a pencil.

If you press the Reset button, the following results:

- Any data connection with a remote modem is ended.
- The *MicroLink ISDN/TL V.34* reinitializes itself and performs a self-test.
- All serial ports are cleared of data.
- The last-executed command is lost from memory, invalidating the **A/** command until your *MicroLink ISDN/TL V.34* executes a command.
- The configuration profile is loaded (either the default values or the user values as defined with the commands **AT&W** or **AT*W**).
- The *MicroLink ISDN/TL V.34* enters Command Mode.
- Keeping the reset button pressed for a longer time restores the factory defaults.

Software reset
method

The **ATZ** or **AT&F** command resets the *MicroLink ISDN/TL V.34*. Just type **ATZ** (or **AT&F**) and press <CR> .

5.6 Channel Bundling

Channel bundling allows the two B (data) channels of an ISDN Basic Rate Interface to be bundled into a single, high-speed logical connection. Under ideal conditions, channel bundling doubles the effective data throughput of the ISDN connection. Realized performance gains, however, depend on the type of data transferred.

If channel bundling is enabled (**AT&N1**, refer to page 45), large amounts of data are distributed equally to both B channels. While channel bundling is active, the **DCD (M5)** orange LED on the front panel lights up.

Channel bundling increases line charges because two B channels are used. If desired, Bit 6 of Register **S175** can be set to adapt the establishment of the secondary connection to the ISDN charge information (see page 78).

The *MicroLink ISDN/TLV.34* supports two types of channel bundling: static bundling and dynamic bundling. The settings of register **S175** enable either of these channel bundling methods (refer to page 78).

Static channel bundling With this method, the second B channel connection is established as soon as the first (primary) connection is made. The secondary connection remains active until the primary connection ends.

If the secondary connection cannot be established (or is refused) within 30 seconds, the called side cancels the primary connection (see Register **S175**). The **CONNECT** result code does not appear until the secondary connection is established.

If the secondary connection fails (for example, if the network is busy), the calling side tells the answering side that the second B channel will not be used and establishes a one-channel connection with 64,000 bps or 56,000 bps instead.

Dynamic channel bundling With this method, the secondary connection is established when the throughput limit defined in Registers **S176** and **S177** is reached (refer to page 79). If a secondary connection establishment fails, it retries the connection every 15 seconds, as long as the reason for the secondary connection is valid.

To use your *MicroLink ISDN/TLV.34* in the US, please observe the programming of SPID and DN configurations, as explained under in the US Models section of the Installation chapter (see page 17).

5.7 Fax Operation

The *MicroLink ISDN/TL V.34* can send faxes to and receive faxes from conventional analog fax machines. The software supplied is capable of convenient faxing at speeds from 2400 bps up to 14,400 bps half-duplex, in V.17, V.33, V.29 or V.27ter mode.

5.7.1 Fax Command Sets

The following sections describe the fax command set compatibility.

Class 2/Class 2.0 The *MicroLink ISDN/TL V.34* complies with the fax command set TR-29.2 Class 2 (SP-2388) and TR-29.2 Class 2.0 (TIA/EIA-592) lets you use any standard fax software, such as WinFax or Bitfax. A brief description of the TR-29.2 Class 2 and Class 2.0 fax commands supported by the ELSA *MicroLink*® modems is available in the MODEMS forum file area of the *ELSA ONLINE* Support BBS (see the telephone number on page 57).

Class 1 The *MicroLink ISDN/TL V.34* supports the fax command set Class 1 (TIA/EIA-578). This support is required for E-mail functions using Microsoft Windows for Workgroups and the file transfer function of WinFax PRO 4.0. For a brief description of the Class 1 fax commands supported by the *MicroLink ISDN/TL V.34*, access the MODEMS forum file area of the *ELSA ONLINE* Support BBS (see the telephone number on page 57).

5.7.2 Data Flow in Fax Operation

By default your *MicroLink ISDN/TL V.34* can use both hardware and software handshaking simultaneously during fax Class 1 and Class 2 mode. As soon as a certain handshake method is selected with **ATQ**, only that method is used.

5.7.3 Adaptive Answer

This feature automatically differentiates between incoming fax and data calls. The fax software in use must also support adaptive answer.

Set up your fax software to start when the *MicroLink ISDN/TL V.34* receives "+FDM" or "DATA." If the fax software sends an initialization string, set Register **S14**, bit 6 to 1 (refer to page 60). This prevents the *MicroLink ISDN/TL V.34* from hanging up.

The following fax commands support adaptive answer:

Class 2.0	Modem initialization:	
	AT+FCLASS=2.0	Enter Class 2.0 fax mode
	AT+FAA=1	Set adaptive answer mode (fax/data auto mode)
	AT+FCR=1	Enable fax receiving
	AT+FIS=5	Set V.17, followed by other settings as necessary

Result codes for incoming fax call:

RING Incoming call
 +FCO Fax connect result code

Result codes for incoming data call:

RING Incoming call
 +FDM Detection of data calling tone (1300 Hz)
 CONNECT Data connect result code

Class 2

Modem initialization:

AT+FCLASS=2 Enter Class 2 fax mode
AT+FAA=1 Set adaptive answer mode
 (fax/data auto mode)
AT+FCR=1 Enable fax receiving
AT+FDIS=,5 Set V.17, followed by other settings,
 if necessary

Result codes for incoming fax call:

RING Incoming call
 FAX Detection of fax calling tone (1100 Hz)
 +FCON Fax connect result code

Result codes for incoming data call:

RING Incoming call
 DATA Detection of data calling tone (1300 Hz)
 CONNECT Data connect result code

Class 1

Modem initialization:

AT+FCLASS=1 Enter Class 1 fax mode
AT+FAE=1 Set adaptive answer mode (fax/data auto mode) Other
 settings, if necessary

Result codes for incoming fax call:

RING Incoming call
 FAX Detection of fax calling tone (1100 Hz)
 CONNECT Fax connect result code

Result codes for incoming data call:

RING Incoming call
 DATA Detection of data calling tone (1300 Hz)
 CONNECT Data connect result code

◇ **NOTE** ◇

For fax Class 2 and Class 1, if the *MicroLink ISDN/TL V.34* receives a **RING** result code directly after the **AT+FCLASS=2** or **AT+FCLASS=1** command, it sends the result code at 19,200 bps. If another AT command is sent instead, your *MicroLink ISDN/TL V.34* returns to using the bit rate at which the AT command was sent.

5.8 Voice Operation

The *MicroLink ISDN/TL V.34* provides voice functions that, in connection with the supplied voice software and a PC soundcard, enable the use your *MicroLink ISDN/TL V.34* as an answering machine. For more information on performing voice activities, refer to the voice software documentation.

To obtain a detailed description of the voice commands that the *MicroLink ISDN/TL V.34* supports, call the *ELSA ONLINE* Support BBS.

If, on replay, the voice files sound distorted, the byte order of the voice data may be reversed. Such reversals occur when voice files are recorded using older recording methods. To resolve this problem, refer to Register **S229** on page 81. See also Register **S230**, page 83.

5.9 Dialing and Answering Calls

This chapter describes how to use AT commands to dial and answer calls. If you will be using the commands in your communications software program to originate and answer calls, this chapter can be skipped.

5.9.1 Originating a Call

To originate a call:

1. Type **AT D** *telephone number* , where *telephone number* is the number the *MicroLink ISDN/TL V.34* is to dial.
2. Press <CR>.

A typical Dial command line might look like:

AT D 1 213 555-1212

The data connection between your *MicroLink ISDN/TL V.34* and the remote device ends when any of the following occurs:

- The *MicroLink ISDN/TL V.34* loses the carrier signal from the remote modem.
- You return to the command mode, type **ATH** and press <CR> to hang up.
- The *MicroLink ISDN/TL V.34* detects the drop of the Data Terminal Ready (DTR) interface signal with the **&D2** or **&D3** command in effect.

The *MicroLink ISDN/TL V.34* then hangs up, returns to the Command Mode, and displays the **NO CARRIER** result code.

◇ **NOTE** ◇

If the dialing attempt results in a busy signal, you can type **ATDL** and press <CR> to redial the last telephone number dialed, or type **A/** without pressing <CR> to execute the entire command line again.

5.9.2 Dialing a Stored Telephone Number

To automate your dialing tasks, your *MicroLink ISDN/TL V.34* provides the following methods for storing telephone numbers in nonvolatile memory and dialing the numbers using the fewest number of keystrokes.

Command	Description	Example
Commands for Storing Telephone Numbers		
AT&Zm=n	Store 10 telephone numbers in memory. m = the memory location (0 through 9). n = a telephone number (up to 36 digits).	AT&Z2=5552345<CR>
AT&Z=n	Store telephone number n in memory location 0.	AT&Z=5551212 <CR>
AT\Pn	Store telephone number n in memory location 0.	AT\P=5552424 <CR>
AT\Pmn	Store 10 telephone numbers in memory. m = the memory location (0 through 9). n = a telephone number (up to 36 digits).	AT\P4=5558096 <CR>
ATDn;	Store the telephone number n preceding the semicolon (;). Use ATO to dial the number.	ATD5554321; <CR>
Commands for Dialing Stored Telephone Numbers		
ATDS=m	Dial the number in memory location m that was stored using the AT&Z=n or AT\Pn command.	ATDS=6 <CR>
ATD/m	Same as ATDS=m .	ATD/7 <CR>
ATDS	Dial the number in memory location 0 that was stored using the AT&Zm=n , AT&Z=n , or AT\Pn command.	ATDS <CR>
ATD/	Same as ATDS .	ATD/ <CR>
ATO	Dial the number stored with the ATDn; command. Type this command when there is no data connection with a remote modem.	ATO <CR>
If you try to store a new telephone number in a memory location that already has a stored number, the new number overwrites the old one.		

5.9.3 Answering Calls

There are two ways to answer incoming calls:

- Automatically, where the *MicroLink ISDN/TL V.34* automatically answers a call after a predefined number of rings occurs. See the next section.
- Manually, where you type the **A** command. See the next page.

◇ **NOTE** ◇ If the *MicroLink ISDN/TL V.34* is in dumb mode (refer to page 38), incoming calls can only be answered automatically.

Automatically answering calls

Register **S0** controls the automatic answering feature. This register has a range between 0 and 255. Its default value of 0 disables automatic answering.

To enable automatic answering, use the following procedure to set Register **S0** to a value between 1 and 255:

1. Type **ATS0=n**, where **n** is a number from 1 to 255 that corresponds to the number of rings that must occur before the *MicroLink ISDN/TL V.34* automatically answers the call. For example, to automatically answer calls after the second ring, type **AT S0=2**.
2. Press <CR>. The *MicroLink ISDN/TL V.34* responds with **OK** and enables automatic answering.

Automatic answering stays in effect for as long as the *MicroLink ISDN/TL V.34* is turned on. Resetting it or turning it off returns Register **S0** to the setting specified in nonvolatile memory.

To turn off the automatic answer feature, type **AT S0=0** and press <CR>. The value of Register **S0** returns to 0, disabling automatic answering.

To permanently enable automatic answering, use the **AT&Wn** command to store the automatic answer setting in nonvolatile memory. For example:

- **ATS0=2&W0** sets auto-answering to configuration profile 1.
- **ATS0=2&W1** sets auto-answering to configuration profile 2.

For more information on the **AT&W** command, refer to page 54.

Manually answering calls

When the automatic answer feature is not in use, incoming calls can be manually answered with the **ATA** command.

Should you receive an incoming call, just type **ATA** and press <CR>. Your *MicroLink ISDN/TL V.34*:

- Goes off-hook.
- Answers the incoming call.
- Establishes a connection with the remote ISDN device.
- Enters the Online Mode.

5.10 AT Commands in Detail

Command entry	All commands given to the modem must begin with the ASCII characters AT or at (At or aT are not valid) and end with <CR> (Carriage Return).
Exception	The only exception is the command A/ , which repeats the last command line. This command is entered without AT and must not be followed by <CR>.
Abort command	A command line or screen output (such as display of the register contents with AT%R) can be aborted with <Ctrl><X> or <Ctrl><C>.
Parameters	Commands which require an additional parameter may also be entered without the parameter. A missing parameter is regarded as parameter 0 (e.g. ATE = ATE0).
Identification of the default configuration	Parameter settings that apply to the default configuration of the ISDN terminal adapter, as set at the factory, are marked by the symbol *.

A/ Repeat the last command

AT/

This command repeats the last entered command.

◇ **NOTE** ◇ This command is used without the **AT** prefix, and should not be followed by <CR>.

A Answer incoming call

ATA

This command is for Answering incoming calls by entering **ATA** and <CR>. The *MicroLink ISDN/TL V.34* notifies you of incoming calls with the **RING** (verbose) or **2** (numeric) result code. (Further information to establishing a connection is to be found under registers **S154/S155**, see page 72 and **S160**, page 74.

◇ **NOTE** ◇ If Register **S0** is set to a value other than zero, enabling automatic answering, using the **ATA** command disconnects the telephone line if bit 6 of Register **S14** is set to its default setting of 0. Changing this register value to 1, however, will not disconnect the line; this setting allows your computer to transmit characters to the your *MicroLink ISDN/TL V.34* while the connection is being established.

Please note that registers **S151** "D-channel protocol configuration" and **S152** "Call indication delay" are relevant here. Commands following **ATA** in the command line will not be executed. To include additional commands on the same command line with the **A** command, have them follow **AT** and precede **A**.

B Predefinition of Transfer Type

The **ATB** command lets you specify whether your *MicroLink ISDN/TL V.34* establishes a digital (ISDN) or analog (modem) connection. The following table shows the type of connection your *MicroLink ISDN/TL V.34* will establish for outgoing and incoming calls when various **ATB** commands are in effect.

Command	ATB16	ATB17	ATB18	ATB20	ATB21	ATB22	ATB24	ATB25	ATB26 *
Outgoing	digital	digital	digital	analog	analog	analog	First digital. If not possible, then analog		
Incoming	digital	analog	digital + analog	digital	analog	digital + analog	digital	analog	digital + analog

If the **ATB17**, **ATB18**, **ATB21**, **ATB22**, **ATB25** or **ATB26** command is in effect, your *MicroLink ISDN/TL V.34* accepts all calls with the bearer capabilities "telephone call" or "a/b" services." If the **ATB24**, **ATB25**, or **ATB26** command is in effect, your *MicroLink ISDN/TL V.34* tries to a digital connection first. If this connection is not possible, your *MicroLink ISDN/TL V.34* tries to establish an analog connection.

The **ATB** command works independently of the **ATDI** and **ATDN** commands. This means you can use the **ATDI** command, for example, to dial an ISDN telephone number (specified by **n**) when the **ATB21** command is in effect.

%B ISDN line bit rate in V.110 mode

AT%B300	: 300 bps	(modem operation only)
AT%B1200	: 1200 bps	
AT%B2400	: 2400 bps	
AT%B4800	: 4800 bps	
AT%B7200	: 7200 bps	(modem operation only)
AT%B9600	: 9600 bps	
AT%B12000	: 12,000 bps	(modem operation only)
AT%B14400	: 14,400 bps	(modem operation only)
AT%B16800	: 16,800 bps	(modem operation only)
AT%B19200	: 19,200 bps	
AT%B21600	: 21,600 bps	(modem operation only)
AT%B24000	: 24,000 bps	(modem operation only)
AT%B26400	: 26,400 bps	(modem operation only)
AT%B28800	: 28,800 bps	(modem operation only)
AT%B31200	: 31,200 bps	(modem operation only)
AT%B33600	: 33,600 bps	(modem operation only)
* AT%B38400	: 38,400 bps	(ISDN operation only)

When your *MicroLink ISDN/TL V.34* is in V.110 mode, and the **AT&G1** command is in effect, you can use the **AT%B** command to set the desired ISDN line bit rate, in bits per second (bps). By default, the **AT%G0** command is in effect, which sets the line rate to the serial port rate.

◇ **NOTE** ◇ V.120 and X.75 operation ignore this command and always use a bit rate of 64,000 bps or 56,000 bps.

%C Data compression

AT%C0 : Disable data compression

AT%C1 : Enable V.42bis data compression

AT%C2 : Enable V.42bis data compression

* **AT%C3** : Enable V.42bis data compression

This command enables or disables V.42bis data compression during an error-corrected connection in X.75 or V.120 mode. This command works with the **ATN** command, which determines your *MicroLink ISDN/TL V.34*'s operating mode (refer to page 46).

The default setting, **AT%C3**, enables V.42bis data compression. If this compression method is not supported by the remote modem, your *MicroLink ISDN/TL V.34* attempts to establish a connection without data compression, regardless of the **AT%C** command in effect.

If you desire, you can use the **AT%C0** command to disable data compression.

&C DCD option

AT&C0 : DCD is always active

* **AT&C1** : DCD indicates a connection

AT&C2 : DCD is dropped during disconnection only

This command controls the Data Carrier Detect (DCD) signal. The proper use of this command depends largely on your communications software.

AT&C0 forces the DCD signal active (ON) continuously. If your communication software requires the DCD signal to be ON at all times, use this setting.

The default setting, **AT&C1** forces the DCD signal to follow the state of the data carrier from the remote modem.

AT&C2 drops the DCD signal when a data connection ends.

D Connection establishment

ATDn

This command tells your *MicroLink ISDN/TL V.34* to dial the numbers and any special characters that follow **D** in the command line. You can type up to 36 numbers or any of the following special characters after the **D**. When you execute a command line that contains the **D** command, you can cancel dialing by pressing any key on your keyboard (except the space bar).

Your *MicroLink ISDN/TL V.34* does not execute commands that follow **D** in the command line. To include additional commands on the same command line with the **D** command, have them precede the **D** command

The special characters for dialing stored numbers must come immediately after the command **ATD**. The special characters **I**, **N** and ***** can be entered at any position.

◇ **NOTE** ◇ The *MicroLink ISDN/TLV.34* recognizes the type of call being made (e.g. ISDN, modem, fax or voice) and automatically switches to the necessary mode of operation.

Character	Meaning
S or /	Dial the number stored in nonvolatile memory location 0 using the AT&Z or ATIP command. Example: ATDS <CR>
S=n or /n	Dial the number stored in nonvolatile memory location n using the ATIP command. Example: ATS/0 <CR>
L	Redial the last number. Example: ATDL <CR>
;	In nonvolatile memory, store the digits preceding the semicolon and dial them when an ATO command is executed without a data connection *)
*	Phone number component (e.g. for controlling PBX systems)
#	1TR6 protocol: Dialing code for external calls (valid for some private ISDN branch exchanges). DSS1 protocol: "Sending Complete" (additional information, required for dialing in some European countries).
I	Establish an ISDN connection
N	Establish a modem connection

*) If **ATO** is entered several times in succession, all the digits (up to 36) are concatenated. An **ATH** command or an attempt to establish a connection clears the entire string of digits.

\$D Automatic dialing with DTR

- * **AT\$D0** : Disable DTR dialing
- AT\$D1** : Enable DTR dialing

The default setting, **AT\$D0**, disables Data Terminal Ready (DTR) dialing.

If you use the **AT\$D1** command to enable DTR dialing, and an OFF-to-ON DTR transition occurs, your *MicroLink ISDN/TL V.34* automatically dials the number stored in memory position 0 with the **ATIP** or **AT&Z** command (refer to pages 48 and 56). If no number is stored in position 0, your *MicroLink ISDN/TL V.34* returns an **ERROR** result code.

&D DTR control

AT&Dn (n = 0 to 3; default = 2)

These commands determine how the *MicroLink ISDN/TL V.34* reacts to an ON-to-OFF DTR transition. The action taken depends on the *MicroLink ISDN/TL V.34*'s current operating mode. The following tables show the action taken when the parameter **n** equals a particular value and the *MicroLink ISDN/TL V.34* is in a particular operating mode.

In Command Mode:

n	This Action Occurs...
0	No effect.
1	No effect.
2	An existing connection ends and digits stored with ATDn are cleared.
3	Same as 2, but <i>MicroLink ISDN/TL V.34</i> reinitializes (see AT&Y on page 55).

While a connection is being established, the following apply:

n	This Action Occurs...
0	No effect.
1	Connection establishment aborts.
2	Same as 1.
3	Same as 1, but <i>MicroLink ISDN/TL V.34</i> reinitializes (see AT&Y on page 55).

During an existing connection:

n	This Action Occurs...
0	No effect.
1	<i>MicroLink ISDN/TL V.34</i> enters the Command Mode.
2	Connection ends and <i>MicroLink ISDN/TL V.34</i> enters the Command Mode.
3	Same as 2, but <i>MicroLink ISDN/TL V.34</i> reinitializes (see AT&Y on page 55).

If the **AT&D2** or **AT&D3** command is in effect, an ON-to-OFF DTR transition prevents the *MicroLink ISDN/TL V.34* from accepting calls until DTR goes ON. While DTR is OFF, the remote side receives a "remote station out of order" message.

\D DSR/CTS control

- * **ATID0** : DSR and CTS always ON
- ATID1** : DSR shows B channel switched through, CTS always ON
- ATID2** : DSR always ON, CTS follows DCD
- ATID3** : DSR shows B channel switched through, CTS follows DCD

This command affects the Data Set Ready (DSR) and Clear To Send (CTS) interface lines.

If hardware data flow control is enabled (**ATIQ2** or **ATIQ3** command is in effect), this command setting is meaningless for the CTS interface line.

E Command echo

- ATE0 : Disable command echo
- * ATE1 : Enable command echo

The **ATE** command determines whether your *MicroLink ISDN/TL V.34* echoes the commands you type from your keyboard during Command Mode.

%E Automatic retrain (Modem operation only)

- AT%E0 : Disable automatic retrain
- * AT%E1 : Enable automatic retrain

The **AT%E** command controls whether your *MicroLink ISDN/TL V.34* automatically initiates a retrain when the line quality deteriorates below a certain threshold that may affect data reliability.

AT%E0 does not allow your *MicroLink ISDN/TL V.34* to perform a retrain if the telephone-line quality is poor.

The default setting, **AT%E1**, allows your *MicroLink ISDN/TL V.34* to automatically perform a retrain when necessary and adapt to changes in the telephone-line quality.

&F Restore factory configuration

AT&F

This command loads the *MicroLink ISDN/TL V.34's* factory default settings, returning your ISDN terminal adapter to its original operating parameters. This command does not reset the stored numbers, cost statistics, configuration profiles, the ISDN settings or the serial port bit rate (DTE).

◇ **NOTE** ◇ If a data connection exists with a remote modem, your *MicroLink ISDN/TL V.34* does not execute this command.

\F Display stored numbers

AT\F

This command displays the ISDN numbers stored with the **AT\P** and **AT&Z** commands (refer to pages 48 and 56).

%G Line bit rate control

- * **AT%G0** : Line bit rate determined by serial port rate
- AT%G1** : Line bit rate set with **AT%B**

The default setting, **AT%G0**, sets the ISDN line bit rate to the computer's serial port bit rate during V.110 operation. The **AT** characters on the command line tell your *MicroLink ISDN/TL V.34* to use the same speed and mode as the serial port.

◇ **NOTE** ◇ During X.75 or V.120 operation, this command is ignored and the ISDN bit rate remains fixed at 56,000 bps or 64,000 bps.

AT%G1 lets you use the **AT%B** command (described on page 33) to set the ISDN line bit rate to a speed independent of the serial port bit rate.

&G Set calling tone and guard tone

- * **AT&G0** : Enable calling tone, disable guard tone
- AT&G1** : Enable calling tone, enable 550 Hz guard tone
- AT&G2** : Enable calling tone and 800 Hz guard tone (*default UK*)
- AT&G4** : Disable calling tone and guard tone (*default USA*)
- AT&G5** : Disable calling tone, enable 550 Hz guard tone
- AT&G6** : Disable calling tone, enable 1800 Hz guard tone

The **AT&G** command enables or disables the calling tone and guard tone:

- The calling tone is a periodic tone transmitted between the dialing and connection phases. This tone can lead to disturbances with some foreign modems, and should be disabled in these cases.
- The guard tone is an additional signal sent over the telephone line in V.22bis mode.

H Hang up

ATH

ATH places your *MicroLink ISDN/TL V.34* on-hook. If you switch from Online Mode to Command Mode (using Escape Characters or an ON-to-OFF DTR transition with the **AT&D1** command in effect), you can use **ATH** to hang up and end the current connection.

-H Dumb mode

- * **AT-H0** : Normal operation
- AT-H1** : Dumb mode

The default setting, **AT-H0**, disables dumb mode.

AT-H1 enables dumb mode. In this mode:

- All commands except **ATD** are ignored. (You use **ATD** to dial a number so that a connection can be made.)
- Result codes are suppressed.

Because all commands except **ATD** are ignored, you cannot use the **ATA** command to answer an incoming call. Instead, set Register **S0** to a value other than zero. Dumb mode also prevents you from using **ATH** to hang up a call; the call must be terminated by the remote modem. Handshaking, however, remains active in dumb mode.

To keep the dumb mode setting valid after turning the *MicroLink ISDN/TL V.34* off and on or resetting it, add the **&W** command to the dumb mode command line (for example: **AT-H1&W**); to exit dumb mode, hold down the Reset button on the *MicroLink ISDN/TL V.34* back panel.

I Display product information

- AT10** : Display model number in nnn format
- AT11** : Display checksum
- AT12** : Display checksum result (OK or ERROR)
- AT13** : Display firmware version and release date
- AT14** : Display current parameter settings
- AT15** : Display serial number
- AT16** : Display product name and hardware release
- AT19** : Display the Plug&Play ID text.

The **ATI** command requests information from your *MicroLink ISDN/TL V.34*.

AT10 returns a three-digit ASCII string type number corresponding to the modem product code.

AT11 returns a three-digit ASCII number corresponding to the checksum of the firmware ROM.

AT12 calculates the checksum of the ROM and compares it with the checksum stored in the ROM. If both values are identical, **OK** is returned. Otherwise, **ERROR** is returned.

AT13 returns the firmware version number and the firmware date. This command corresponds to the **AT%V** command.

AT14 returns the current *MicroLink ISDN/TL V.34* configuration.

AT15 returns the *MicroLink ISDN/TL V.34*'s internal factory serial number.

AT16 returns the *MicroLink ISDN/TL V.34*'s product name.

AT19 returns the Plug&Play information text.

+ICLD Store numbers for closed user groups

- AT+ICLDn=s** : Store the number n (n = 1 to 3)
- AT+ICLDn=** : Clear the number n (n = 1 to 3)
- AT+ICLD?** : Clear stored numbers (n = 1 to 3)

The **AT+ICLD** command lets you restrict call acceptance to systems that have one of the three telephone numbers you specify with this command.

Using this command, you can store in nonvolatile memory up to three numbers of remote systems allowed access to your system. Each number can contain 16 digits (0 through 9). Because the numbers are stored in nonvolatile memory, they are preserved when the *MicroLink ISDN/TL V.34* is turned off, reset, or reinitialized. The numbers are automatically recalled the next time the *MicroLink ISDN/TL V.34* is turned on.

When you store at least one number stored in the closed user group list and an incoming call is received, the call is reported, but only accepted if the number of the remote system is in the closed user group list.

If no number is in the closed user group list, all calls are reported. If the Bearer Capability and MSN (DSS1 Multiple Subscriber Number), EAZ (1TR6 terminal selection digit) or DN (US protocol) are valid, the call is accepted.

◇ **NOTE** ◇ You cannot include other commands on the same command line with this command.

The following examples show how to use this command to specify a closed user group.

If the Remote Station is in...	Enter...	Example
Your branch exchange	The PBX extension number	7800 (1TR6: with EAZ, if applicable)
In your city or country	The number along with the city dialing code	024191777800
Outside your country	The number along with the country dialing code	004924191777800

+ICLI Set/display originator MSN

(DSS1)

- AT+ICLI=s** : Store originator MSN s¹⁾
- AT+ICLI=n** : Clear originator MSN n¹⁾
- AT+ICLI=/** : Clear originator MSN, suppress display to remote side¹⁾
- AT+ICLI?** : Display stored originator MSN

1) These functions only work if supported by your network.

The **AT+ICLI** command is valid for the DSS1 protocol (Euro-ISDN) only. If the command is used in 1TR6 mode, it will be ignored before the *MicroLink ISDN/TL V.34* switches to the DSS1 protocol.

This command determines which Multiple Subscriber Number (MSN) appears as the originator address in outgoing calls to the remote system. If a number is entered that was not assigned to the local system as an MSN, the ISDN exchange automatically inserts one of the MSNs assigned to the system.

When you use the **AT+ICLI=s** to store the MSN, the number s can consist of up to 16 digits. Because the number is stored in nonvolatile memory, it is preserved when the *MicroLink ISDN/TL V.34* is turned off, reset, or reinitialized. The number is automatically recalled the next time the *MicroLink ISDN/TL V.34* is turned on.

◇ **NOTE** ◇ Your *MicroLink ISDN/TL V.34* does not execute commands any other commands that appear on the same command line with these commands.

If you use the **AT+ICLI=** command to clear the originator MSN, the ISDN exchange automatically inserts an MSN assigned to the local system.

AT+ICLI=/ suppresses the displaying of any number by the ISDN exchange.

◇ **NOTE** ◇ The functions performed by these commands may depend on regulations of the respective ISDN network provider.

+IDN Set/display directory number

(US protocol only)

- AT+IDNn=s** : Set directory no. (n=1,2)
- AT+IDNn=** : Clear Directory No. (n=1,2)
- AT+IDNn?** : Display directory no. (n=1,2)

With the relevant US protocol defined, the directory number can be set or displayed. The first B channel required **n=1**, the second B channel **n=2**.

The directory number can be up to 12 digits (0..9) long. Changes are stored in the non-volatile memory and are maintained until changed again.

+IDP Set/display D channel protocol

With European firmware:

- * **AT+IDP=DSS1** : Select DSS1 protocol (Euro-ISDN, default in Europe)
- AT+IDP=1TR6** : Select 1TR6 protocol (German ISDN)

With USA firmware:

- * **AT+IDP=NI-1** : Select NI-1 protocol (National ISDN-1, USA default)
- AT+IDP=AT&T** : Select AT&T 5ESS protocol

General query commands

- AT+IDP?** : Display selected protocol
- AT+IDP=?** : Display implemented protocols

The **AT+IDP** command selects the D channel protocol, which handles the control signals between the local station and the nearest ISDN exchange. Executing this command saves the D channel protocol setting in nonvolatile memory. As a result, this setting is preserved when the *MicroLink ISDN/TL V.34* is turned off, reset, or reinitialized. This setting is automatically recalled the next time the *MicroLink ISDN/TL V.34* is turned on. In addition, the **AT&F** (factory reset) command does *not* reset the D channel protocol to the factory default setting.

◇ **NOTE** ◇ Do not execute this command during an existing connection or when you receive an incoming call.

All of the protocols above are point-to-multipoint. The AT&T 5ESS protocol also supplies point-to-point mode. In addition:

- The 1TR6 protocol is supported by the German ISDN only.
- DSS1 is used in most European countries and supported in Germany.

+IEAZ Set/display EAZ digit

(1TR6)

AT+IEAZ=n : Store EAZ (see table below)
AT+IEAZ? : Display EAZ

The **AT+IEAZ** command sets the EAZ (**E**ndgerä**A**uswahl**Z**iffer or "terminal selection digit") and is valid for the 1TR6 protocol (German ISDN) only. Using this command, you can append the terminal selection digit to the normal ISDN number in the 1TR6 protocol to distinguish between several devices sharing the same ISDN line. Only calls with this EAZ are accepted by the *MicroLink ISDN/TL V.34*. Note, however, that if you use this command in DSS1 mode, it will only take effect *after* the *MicroLink ISDN/TL V.34* switches to the 1TR6 protocol.

This command also determines the EAZ that is displayed to the remote side as the originator number when you place outgoing calls. All changes are automatically saved in the non-volatile memory and will stay resident until the next change. The following table shows the available settings:

n	EAZ accepted in Incoming Calls	EAZ sent for display at remote unit in outgoing calls
0	0	0
1..9	0 and 1 through 9, accordingly	1 through 9, accordingly
10..19	0 through 9, accordingly	0 through 9, accordingly
255	any	0

+IMSN Set/display accepted MSNs

(DSS1)

AT+IMSNn=s: Store MSN (n = 0, 1)
AT+IMSNn= : Clear MSN (n = 0, 1)
AT+IMSN? : Display stored MSNs

The **AT+IMSN** command is valid for the DSS1 protocol (Euro-ISDN) only.

This command lets you restrict call acceptance to either of two MSNs in your local ISDN line. Using this command, you can store in nonvolatile memory up to two MSNs allowed to access your system. Each MSN can contain 16 digits (0 through 9), and each number must be entered without country or city dialing codes. Your *MicroLink ISDN/TL V.34* will only accept calls from systems that have either of the two MSNs.

- ◇ **NOTE** ◇ Because the numbers are stored in nonvolatile memory, they are preserved when the *MicroLink ISDN/TL V.34* is turned off, reset, or reinitialized. They will be automatically recalled the next time the *MicroLink ISDN/TL V.34* is turned on.

If no MSN is stored, all calls are accepted, regardless of their target MSN. In addition, incoming calls without a target MSN are always accepted, including the "global" MSN offered by some network providers.

- ◇ **NOTE** ◇ Your *MicroLink ISDN/TL V.34* does not execute commands any other commands that appear on the same command line with these commands.

+ISPID Set/display Service Profile ID

(US protocols only)

- AT+ISPIDn=s : Set Service Profile ID (n=1,2)**
- AT+ISPIDn= : Clear Service Profile ID (n=1,2)**
- AT+ISPIDn? : Display Service Profile ID (n=1,2)**

With the relevant US protocol defined, the Service Profile ID (SPID) can be set or displayed. This number is (or, for channel bundling, these numbers are) allotted to you by the network provider. For every SPID entered, be sure to enter the related DN (see **+IDN=**, above). The first B channel required **n=1**, the second B channel **n=2**.

The directory number can be up to 16 digits (0..9) long. Changes are stored in the non-volatile memory and are maintained until changed again.

A second SPID should only entered if the device is to use both channels simultaneously for channel bundling. If two separate devices are attached to one S₀ interface, then each requires its own SPID/DN pair to be entered as SPID1/DN1. SPID2/DN2 are left empty. With AT&T Point-to-Point connections no SPID is required and no entries should be made.

U

Constant DTE rate

- * **ATUJ0 : DTE rate independent of connection (DCE) bit rate**
- ATUJ1 : DTE rate matches connection (DCE) bit rate**

For direct online connection (**AT\N1**) in modem mode and with V-110 in ISDN mode, it is desirable to maintain a fixed DTE rate.

L

Speaker volume

- ATL0 : Low volume**
- ATL1 : Low volume**
- * **ATL2 : Medium volume**
- ATL3 : High volume**

The **ATL** command controls the volume of the *MicroLink ISDN/TL V.34* speaker. The default setting, **ATL2**, selects medium volume.

%L Bit rate adaptation in answer mode

- AT%L0 : V.110 bit rate adaptation¹⁾
- * AT%L0 : Partial bit rate adaptation²⁾
- AT%L1 : V.110 bit rate adaptation¹⁾
- AT%L1 : V.100 bit rate adaptation²⁾
- AT%L2 : No bit rate adaptation, connection is terminated¹⁾
- AT%L2 : No fallback²⁾
- AT%L3 : V.110 bit rate adaptation¹⁾
- AT%L3 : V.100 bit rate adaptation²⁾

1) in ISDN operation

2) in modem operation

This command can be used to determine the bit rate adaptation while connecting.

The adapted bit rate is always equal or lower than the originally set ISDN line bit rate. Thus no connection can be made if the calling system has a higher ISDN line bit rate than the answering system.

With the standard setting AT%L1 and with AT%L3 the *MicroLink ISDN/TL V.34* operates under the ITU-T recommended V.110 (ISDN) and V.100 (analog) standards. Connected devices operating to these standards automatically adapt to the optimal line bit rate available.

If contact is required with a modem which does not operate with V.100, then the command AT%L0 should be used to enable a partial line bit rate adaptation. Thus the fallback is restricted to one transmission protocol (e.g. v.32bis from 14,400 back to 12,000, 9600, 7200, and 4800 bps). If a connection is still not possible, then configure the modem to AT%L2,m in which case the transmission speed as defined under **AT%B** (see page 33) will be used.

M Speaker control

- ATM0 : Speaker always off
- * ATM1 : Speaker on while waiting for answer tone
- ATM2 : Speaker always on
- ATM3 : Speaker on while waiting for answer tone

The **ATM** command controls the status of the *MicroLink ISDN/TL V.34*'s internal speaker.

ATM0 keeps the speaker off at all times.

The default setting, **ATM1**, keeps the speaker on until the remote carrier is detected.

ATM2 keeps the speaker on at all times.

ATM3 is the same as **ATM1**.

-M Verbose CONNECT result codes

- * **AT-M0** : Verbose CONNECT result codes based on ATV (*default*)
- AT-M1** : Verbose CONNECT result codes independent of ATV

The **AT-M** command determines how much information appears in **CONNECT** result codes.

The default setting, **AT-M0**, relies on the **ATV** command to determine the information shown in **CONNECT** result codes (refer to page 53). The bit rate at which the connection was established is always displayed in the result code.

AT-M1 displays one of the following result codes when an error-correction connection has been made with a modem:

- **CONNECT MNP** for an MNP 1-4 data connection
- **CONNECT MNP 5** for an MNP 5 data connection
- **CONNECT LAPM** for a V.42 data connection
- **CONNECT LAPM/V42BIS** for a V.42bis data connection

The bit rate is not displayed in these **CONNECT** result codes.

◇ **NOTE** ◇ If the **ATX0** is in effect, the **AT-M** command is ignored.

%M v.8 bit rate adaptation (Modem operation only)

- * **AT%M0** : V.8 bit rate adaptation on
- AT%M1** : V.8 bit rate adaptation off

The **AT%M** command controls the bit rate adaptation during the establishment of a connection.

The default setting, **AT%M0**, instructs the *MicroLink ISDN/TL V.34* to operate in accordance with the ITU-T standard. V.8. modems complying with this standard automatically adapt themselves to the transmission bit rate of the other party. If the remote modem does not support V.8, your *MicroLink ISDN/TL V.34* automatically tries to adapt its bit rate according to ITU-T V.100.

&N Channel bundling (ISDN operation only)

- * **AT&N0** : Disable channel bundling
- AT&N1** : Enable channel bundling

The **AT&N** command enables or disables channel bundling. You can use channel bundling to achieve a higher data throughput. The protocol used for channel bundling is manufacturer-specific. Large amounts of data are distributed to both B channels in equal parts. This way the full transmission bandwidth provided by an ISDN Basic Rate Interface can be used.

The default setting, **AT&N0**, disables channel bundling.

AT&N1 enables enable channel bundling. Channel bundling can only be used if the error-corrected X.75 protocol is selected. If the remote side does not support channel bundling, the *MicroLink ISDN/TL V.34* automatically falls back to a one-channel V.120 or V.110 connection.

◇ **NOTE** ◇ Using a second B channel causes additional costs (see Register **S175**, page 78).

\N Operating mode

The **AT\N** command selects the *MicroLink ISDN/TL V.34* operating mode. The following table shows the various modes that can be enabled using this command.

	\N0	\N1	\N2	\N3	\N4	\N5	\N6	\N7*	\N8	\N9	\N10
X.75-T-Online (CEPT/KIT)										■	
X.75-T-Online (VT-100)									■		
X.75			■	↓			↓ ¹⁾	↓ ¹⁾			
V.120					■	↓	■ ²⁾	↓ ²⁾			
V.110 normal	■			■		■		■			
V.110 direct		■									
HDLC-transparent											■

- 1) Used for outgoing calls (European version)
- 2) Used for outgoing calls (US version)

The **AT\N0** command configures the *MicroLink ISDN/TL V.34* for V.110 normal mode operation. The *MicroLink ISDN/TL V.34* establishes physical connections without error correction, regardless of the serial port bit rate.

The **AT\N1** command configures the *MicroLink ISDN/TL V.34* for V.110 direct mode. In this mode:

- No data buffering occurs in physical connections. However, data flow control will be performed if it is enabled at both the local and remote sides.
- The serial port bit rate is always the same as the ISDN line bit rate, and your communications software must adapt to this rate.
- After returning to the Command Mode either by hanging up or using the Escape Characters, the bit rate set by Register **S93** (refer to page 70) is used again. You can use the **ATJ** command (refer to page 43) to determine whether the ISDN line bit rate should also be stored in Register **S93**.

With **AT\N2**, the *MicroLink ISDN/TL V.34* tries to establish an error-corrected X.75 connection. If the remote side does not support X.75, the connection attempt ends.

With **AT\N3**, the *MicroLink ISDN/TL V.34* also attempts an error-corrected X.75 connection. If the remote side does not support X.75, the *MicroLink ISDN/TL V.34* automatically falls back to V.110 normal mode.

With **AT\N4**, the *MicroLink ISDN/TL V.34* tries to establish an error-corrected V.120 connection. If this fails, the connection attempt ends.

With **AT\N5**, the *MicroLink ISDN/TL V.34* also attempts an error-corrected V.120 connection. If the remote side does not support V.120, the *MicroLink ISDN/TL V.34* automatically falls back to V.110 normal mode.

With **AT\N6**, the *MicroLink ISDN/TL V.34* tries to establish an error-corrected X.75 or V.120 connection with incoming calls. Outgoing calls are always treated as an X.75 connection (US version: V.120).

With **AT\N7**, (the default setting for the European version), the *MicroLink ISDN/TL V.34* tries to establish an error-corrected X.75 or V.120 connection with incoming calls. Outgoing calls are always treated as an X.75 connection (US version: V.120). If no connection can be reached, the *MicroLink ISDN/TL V.34* automatically falls back to V.110 normal mode.

With **AT\N8**, the *MicroLink ISDN/TL V.34* tries to establish an error-corrected connection to the German T-Online service (number 01910). In this mode, all VT-100 pages of T-Online can be displayed with a VT-100 compatible terminal program.

With **AT\N9**, the *MicroLink ISDN/TL V.34* tries to establish an error-corrected connection to the German T-Online service (number 01910). In this mode, all Btx pages (CEPT) and KIT graphics pages of T-Online can be displayed with a Btx decoder program (for example *ELSAbtx*) or a KIT decoder, respectively.

With **AT\N10** the *MicroLink ISDN/TL V.34* attempts to establish a non error corrected (HDLC transparent) connection. This mode requires the PPP conversion (see **AT%B**, page 33).

◇ **NOTE** ◇ The automatic switching between bit rates of 56,000 or 64,000 bps works with any X.75 and V.120 variant (see also Register **S163** and S164, page 75). In modem operation, settings **AT\N6** and greater will be treated as **AT\N3**. Should the settings **ATB24**, **ATB25** or **ATB26** be in use, then you should use **AT\N7**.

The following table shows the types of connections which can be established between your *MicroLink ISDN/TL V.34* and an analog modem:

	\N0	\N1	\N2	\N3	\N4	\N5	\N6	\N7*	\N8	\N9	\N10
V.42				(↓)	■	↓	↓	(↓)	(↓)	(↓)	(↓)
MNP			■	↓			■	↓	↓	↓	↓
normal	■			■		■		■	■	■	■
direct		■									

This command selects the error correction method to be used, if required. Other relevant commands include: **AT%C** (data compression, see page 34). The commands **AT\N0** and **AT\N1** disable data compression.

AT\N0: Normal mode is selected. This is a physical connection without error correction.

AT\N1: Direct mode selected. This physical connection has no data buffering or data flow control (handshake). This type of operation is not possible with V.34 or V.Fast Classes, in which case the normal mode is used.

ATN2: An attempt is made to establish an error-corrected connection with MNP. The connection will fail if the remote modem does not support MNP.

ATN3, ATN7 (default), **ATN8, ATN9** and **ATN10:** An attempt is made to establish an error-corrected connection. If this is not possible the modem falls back to normal mode.

ATN4: A V.42 connection will be established. In case of failure, the connection will be broken.

ATN5: A V.42 connection will be established. In case of failure, an automatic fallback to a physical connection results.

ATN6: A V.42 connection will be established. In case of failure, the modem attempts to establish a MNP connection. If this also fails, the connection will be broken.

O Return to Online Mode

ATO

Once your *MicroLink ISDN/TL V.34* connects with a remote modem and enters Online Mode, it can return to Command Mode and keep the data connection when you issue the Escape Characters or when it detects an ON-to-OFF DTR transition with the **&D1** command in effect. You can then use the **ATO** command to return to Online Mode.

This command also instructs your *MicroLink ISDN/TL V.34* to automatically dial a telephone number stored with the **ATDn;** command by typing **ATO** and pressing <CR> when there is no data connection with a remote modem.

ATO1 is similar to the **ATO** command, except your *MicroLink ISDN/TL V.34* performs a retrain before re-entering Online Mode. Use this command if the telephone-line quality has deteriorated.

◇ **NOTE** ◇ Your *MicroLink ISDN/TL V.34* does not execute any other commands that appear on the same command line with **ATO**.

%P Asynchronous/synchronous conversion for PPP

- * **AT%P0** : No asynchronous/synchronous conversion for point-to-point protocol
- AT%P1** : Enable asynchronous/synchronous conversion for point-to-point protocol

The **AT%P** command enables or disables point-to-point protocol asynchronous/synchronous conversion. This conversion lets you use an ISDN Internet access with a standard TCP/IP application package, such as Internet Chameleon from NetManage, or the Windows 95 Internet Explorer, which require a transparent synchronous point-to-point protocol. Enabling this command requires the setting of the HDLC transparent mode or X.75, depending on the opposite (receiving- /sending-) device (with the commands **ATN10** or **ATN2**).

The default setting, **AT%P0**, disables point-to-point protocol asynchronous/ synchronous conversion.

\P Store numbers

AT\PMn

The **AT\PM** command lets you store up to 10 ISDN numbers in the *MicroLink ISDN/TL V.34*'s nonvolatile memory. In this command:

- The **m** indicates a number from 0 to 9 that corresponds to the memory location where the number will be stored.
- **n** indicates the number to be stored, and can contain up to 36 digits.

For example, to store the number 5551212 in location 4, type **AT\PM35551212** and press <CR>.

The *MicroLink ISDN/TL V.34* dials stored numbers with the command **ATD** (see page 3434).

Because the numbers are stored in nonvolatile memory, they are preserved when the *MicroLink ISDN/TL V.34* is reset or turned off; they will be automatically recalled the next time the *MicroLink ISDN/TL V.34* is turned on.

To delete a number from a memory location, use the **AT\PM** command. For example, typing **AT\PM2** and pressing <CR> deletes the number stored in position 2.

The **AT\PM** command corresponds to the **AT&Z** command (refer to page 56). The numbers stored with **AT\PM** can therefore be overwritten by the **AT&Z** command. The number stored in memory position 0 is also used for automatic dialing with DTR (see commands **AT\$D**, **AT&M**).

The stored numbers can be displayed on the screen with the **AT\PF** command.

Commands typed after an **AT\PM** command will not be executed.

Q Enable/disable result codes

- * **ATQ0** : Enable result codes
- ATQ1** : Disable result codes
- ATQ2** : Disable result codes in answer mode

The **ATQ** command determines whether your *MicroLink ISDN/TL V.34* sends result codes that appear on your computer screen.

The default setting, **ATQ0**, allows your *MicroLink ISDN/TL V.34* to send result codes to your computer.

ATQ1 suppresses result codes.

AT&Q2 enables result codes when your *MicroLink ISDN/TL V.34* answers calls but suppresses them when your *MicroLink ISDN/TL V.34* originates calls.

*Q Message after invalid Escape sequence

- * **AT*Q0** : Enable CONNECT message after invalid Escape sequence
- AT*Q1** : Disable CONNECT message after invalid Escape sequence

AT*Q lets you suppress the **CONNECT** result code if the Escape Characters are entered incorrectly.

The default setting, **AT*Q0**, allows CONNECT result codes to appear after the Escape Characters have been entered incorrectly.

AT*Q1 suppresses CONNECT result codes after the Escape Characters have been entered incorrectly.

\Q Data flow control on serial interface

AT\Q0 : No handshaking

AT\Q1 : Bi-directional XON/XOFF software handshaking

AT\Q2 : Unidirectional CTS hardware handshaking

* **AT\Q3** : Bi-directional RTS/CTS hardware handshaking

AT\Q4 : Unidirectional XON/XOFF software handshake

AT\Q5 : Same as \Q2, but CTS is OFF until a connection is made

AT\Q6 : Same as \Q3, but CTS is OFF until a connection is made

The **AT\Q** command lets you select various handshake methods for data flow control on the RS-232/V.24 interface (serial port).

◇ **NOTE** ◇ In asynchronous direct mode both parties must perform data flow control according to V.110 on the ISDN B channel.

If hardware handshaking is selected with **AT\Q2** or **AT\Q3**, the Request To Send (RTS) and Clear To Send (CTS) interface lines control the data flow between your *MicroLink ISDN/TL V.34* and computer.

- If the RTS line is OFF, the *MicroLink ISDN/TL V.34* temporarily stops sending data to your computer.
- When RTS goes ON, the *MicroLink ISDN/TL V.34* resumes data transmission to your computer.

The commands **AT\Q1** and **AT\Q4** select software handshake using the characters XON (<DC1> = <Ctrl> <Q>) and XOFF <DC3> = <Ctrl> <S>.

- If your *MicroLink ISDN/TL V.34* receives an XOFF character from your computer, it temporarily stops sending data to your computer.
- When your *MicroLink ISDN/TL V.34* receives an XON character from your computer, it resumes data transmission to your computer.

◇ **NOTE** ◇ The **AT\X** command (described on page 55) determines whether the XON and XOFF characters are also passed to the remote system or not; by default, they are not transmitted.

When unidirectional handshaking methods are enabled, the *MicroLink ISDN/TL V.34* ignores handshaking signals originating from the computer.

%R Display register contents

AT%R0 : Display two registers per line

AT%R1 : Display one register per line / continuous display

The **AT%R** command lists the current values of the *MicroLink ISDN/TL V.34 S* registers.

S Read/write S register values

- ATSn=x** : Set register **n** to value **x**
- ATSn?** : Read the value of register **n**
- ATSn** : Make register **n** the default register
- AT?** : Read the value of the default register
- AT=x** : Set the default register to value **x**

These commands let you read and change S register values.

To change the value of a register, type **ATSn=x** and press <CR>, where **n** is the number of the register and **x** is the new value. For example, **ATS0=2** <CR> changes the value of Register **S0** (the auto-answer register) to 2.

To read the value of a register, type **ATSn?** and press <CR>, where **n** is the number of the register whose value you want to read. For example, **ATS4?** <CR> displays the value of Register **S4** on your computer screen.

If you read or change the value of a certain register frequently, you can make that register the "default" register and then use fewer keystrokes to read or change its value.

To specify a default register, type **ATSn** and press <CR>, where **n** is the number of the register you want as the default register. For example, **ATS8** <CR> makes Register **S8** the default register.

To read the value of a default register, type **AT?** and press <CR>. In our previous example, typing **AT?** <CR> displays the value of Register **S8** on your computer screen.

To change the value of a default register, type **AT=x** and press <CR>, where **x** is the new value for the default register. In our previous example, typing **AT=5** <CR> changes the value of Register **S8** to 5.

◇ **NOTE** ◇ If you omit **n** when typing this command, Register **S0** is assumed. If you specify an invalid register, the *MicroLink ISDN/TL V.34* returns either **OK** or **ERROR**, depending on the value of Register **S96** and the register referenced prior to this command remains the default register.

%S ISDN bit rate setting (V.120, X.75, HDLC)

- * **AT%S0** : ISDN bit rate 64,000 bps (**European default**)
- * **AT%S1** : ISDN bit rate 56,000 bps (**US default**)

The **AT%S** command lets you set the ISDN bit rate. This command sets the values of Register **S171**, bit 5 and Register **S172**, bit 7.

◇ **NOTE** ◇ You can use the **ATI4** command to view the contents of Register **S171**.

&S DSR control

- * **AT&S0** : DSR is always active
- AT&S1** : DSR indicates B channel switched through

The **AT&S** command controls the Data Set Ready (DSR) interface line.

The default setting, **AT&S0**, keeps this line is always ON. Use this setting if your communication software requires the DSR signal to be present at all times.

AT&S1 instructs your *MicroLink ISDN/TL V.34* to turn on the DSR signal when it performs the handshaking sequence with the remote modem.

\T Inactivity timer

AT\Tn (n = 0 to 255 * 10 seconds; default = 0)

The **AT\T** command determines how long a connection is maintained if no data is sent or received within the time specified here. The default value, 0, disables the inactivity timer.

◇ **NOTE** ◇ For more information, see Register **S30** on page 63.

UPX Start firmware upload in Flash ROM

ATUPX

If your *MicroLink ISDN/TL V.34* is equipped with Flash ROM firmware, the command **ATUPX** readies the device to receive a firmware update from your PC. The firmware file is to be sent using the XModem protocol. This data is to be found on the CD-ROM or diskette enclosed with your *MicroLink ISDN/TL V.34*. The latest firmware versions can be downloaded using ELSA's online service (Mail box *ELSA ONLINE*, GO ELSA in CompuServe, Internet: <http://www.elsa.de> or <http://www.elsa.com>).

If your device is not equipped with Flash ROM, then an error message will be displayed.

The data transfer rate for the upload is the speed that was last used, up to a maximum of 57,600bps.

V Form of result codes

ATV0 : Send numeric result codes

* **ATV1** : Send word result codes

The **ATV** command lets you choose whether result codes sent by the *MicroLink ISDN/TL V.34* to your computer are displayed as digits or words. The result codes in short form and verbose form are listed in section 5.12, page 84.

%V Display firmware version

AT%V

The **AT%V** command displays the firmware version of the *MicroLink ISDN/TL V.34* on your computer screen.

&V Display configuration profiles

AT&V

The **AT&V** command displays on your computer screen the current configuration and the two stored configuration profiles 0 and 1 stored with the **AT&W** and **AT*W** commands (described on page 54).

\W CONNECT messages for error-corrected connections

ATV0 : No modified CONNECT result codes

ATV1 : Identification of error-corrected connections

ATV2 : Identification of error-corrected connections and error correction method

*** ATV8 : Comprehensive CONNECT result codes**

With the **ATV0** setting, messages reporting a successful connection are always displayed in the format **CONNECT xxxxx**, where **xxxxx** is the ISDN line bit rate of the connection.

With **ATV1** messages reporting a successful error-corrected connection are displayed in the format **CONNECT xxxxx/REL**.

With **ATV2** the ISDN terminal adapter also reports the error correction method used, for example **CONNECT xxxxx/REL-LAPB**.

With **ATV8** detailed connect messages are displayed, for example **CONNECT xxxxx/ISDN/V110**.

An overview of all possible **CONNECT** messages can be found in section 5.12, page 83.

◇ **NOTE** ◇ If *MicroLink ISDN/TL V.34* is configured to **ATX0** or **AT-M1**, the **ATV** command has no influence on the verbose **CONNECT** messages.

&W Save current configuration profile

AT&Wn : Save configuration profile n (n = 0 or 1)

The **AT&W** command lets you store two configuration profiles in the *MicroLink ISDN/TL V.34*'s nonvolatile memory. The **n** is either the number 0 or 1 and corresponds to a particular profile. Because these values are stored in nonvolatile memory, they are preserved when the *MicroLink ISDN/TL V.34* is turned off, reset, or reinitialized; they are automatically recalled the next time the *MicroLink ISDN/TL V.34* is turned on. The following list shows the commands and registers whose values can be saved in nonvolatile memory using the **AT&W** command:

%B	E	%L	\Q	\W	S21	S31	S52	S153	S173	S179
%C	%E	-M	*Q	X	S22	S36	S93	S162	S174	
&C	%G	&N	%S	\X	S23	S37	S95	S167	S175	
&D	&G	\N	&S	&Y	S27	S40	S96	S168	S176	
\$D	-H	%P	\T	S0	S28	S46	S151	S171	S177	
\D	\J	Q	V	S14	S30	S51	S152	S172	S178	

◇ **ATTENTION** ◇ Registers whose current value cannot be stored with the **AT&W** command are saved with their default values. Therefore, the **AT&W** command may overwrite those register values stored with **AT*W** (described next).

***W Save extended configuration profile**

AT*Wn : Save extended configuration profile n (n = 0, 1)

In addition to the parameters and registers stored with **AT&W**, this command also saves the values of the registers **S2**, **S3**, **S4**, **S5** and **S12** in the non-volatile memory of the ISDN terminal adapter.

X Reaction to busy line/CONNECT message

ATX0 : Busy line reported with NO CARRIER

- ATX1 : Busy line reported with NO CARRIER**
- ATX2 : Busy line reported with NO CARRIER**
- ATX3 : Busy line reported with BUSY**
- * **ATX4 : Busy line reported with BUSY**

The **ATX** command selects whether a busy ISDN line is reported with **NO CARRIER** or with **BUSY** by the *MicroLink ISDN/TL V.34*.

Note that when the **ATX0** command is in effect, only the **CONNECT** (verbose form) or **1** (abbreviated form) result code is reported for successful data connections, regardless of the bit rate and type of the connection.

◇ **NOTE** ◇ The commands **ATX2** and **ATX4** react like **ATX1** and **ATX3** respectively, and are for purposes of compatibility only.

\X Handling of XON/XOFF characters

- * **ATX0 : XON/XOFF characters are not passed to the remote side**
- ATX1 : XON/XOFF characters are passed to the remote side**

If the **ATIQ1** or **ATIQ4** command is in effect, enabling software flow control between your *MicroLink ISDN/TL V.34* and computer, you can use the **ATX** command to determine whether the XON and XOFF characters are sent to the remote modem.

The default setting, **ATX0**, does not send the XON/XOFF characters to the remote system.

ATX1 sends the XON and XOFF characters to the remote system.

&Y Select startup configuration profile

- AT&Y0 : Load configuration profile 0 at startup**
- AT&Y1 : Load configuration profile 1 at startup**

The **AY&Y** command determines whether stored configuration profile 0 or 1 is loaded after the *MicroLink ISDN/TL V.34* is turned on, reset, or reinitialized following an ON-to-OFF DTR transition with the appropriate **AT&D** command in effect (refer to page 36).

The default setting, **&Y0**, loads the parameters from configuration profile 0 the next time the *MicroLink ISDN/TL V.34* is turned on, reset, or reinitialized. To use the parameters from profile 1 instead, issue the **AT&Y1** command.

Z Load configuration profile

- ATZn : Load configuration profile n (n = 0 or 1)**

Any existing connection is terminated. Afterwards, the parameter settings saved with **AT&W** or **AT*W** (configuration profile 0 or 1, refer to page 54) are loaded from the nonvolatile memory of the *MicroLink ISDN/TL V.34* and become effective.

◇ **NOTE** ◇ Your *MicroLink ISDN/TL V.34* does not execute commands that follow **ATZ** in the command line. To include additional commands on the same command line with the **ATZ** command, have them follow **AT** and precede **Z**.

&Z Store numbers

AT&Zm=n : Store number **n** in position **m**
AT&Z=n : Store number **n** in position **0**

The **AT&Z** command provides various ways of storing numbers in the *MicroLink ISDN/TL V.34*'s nonvolatile memory.

The **AT&Zn=** command lets you store up to 10 telephone numbers in nonvolatile memory. After storing one or more numbers, you can dial them using the **ATDS**, **ATDS=m**, **ATD/**, and **ATD/m** commands (described on page 34). To view the stored numbers on your computer screen, use the **AT\F** command.

In the **AT&Zm=n** command:

- The **n** is a number between 0 and 9. This is the memory position under which the telephone number will be stored.
- The **m** is the actual telephone number and is entered after the equals sign.

Alternatively, you can use the **AT&Z=n** command to store a telephone number in memory position 0.

The **AT&Z** command corresponds to the **AT\P** command (refer to page 48). The numbers stored with **AT&Z** can therefore be overwritten by the **AT\P** command. The number stored in position 0 is also used for automatic dialing with DTR (see the commands **AT\$D** and **AT&M**).

◇ **NOTE** ◇ Your *MicroLink ISDN/TL V.34* does not execute commands that follow **AT&Z** in the command line. To include additional commands on the same command line with the **AT&Z** command, have them follow **AT** and precede **&Z**.

5.11 Registers

MicroLink ISDN/TL V.34 has internal registers you can use to modify the configuration of the ISDN terminal adapter (see **ATSn** command, page 51).

Bit-mapped registers Be very careful with changing bit-mapped registers, i.e. registers which control more than one single function! The bit-mapped registers mainly serve for the display of the status of the ISDN terminal adapter. To change the configuration of your ISDN terminal adapter, you should use the safer and more convenient AT commands instead. The default values for the individual bits are printed in **bold** face.

Changing individual bits The following example illustrates how to change the value of a bit-mapped register. To set, for example, bit 6 of register **S14** (allow polling during connection establishment), proceed as follows:

- First, use the **ATS14?** command to display the current value of register **S14** (current value = 10).
- Add the decimal value of bit 6 = 1 (decimal value = $2^6 = 64$) to the current register value (new register value = $10 + 64 = 74$).
- Set register **S14** to the new value (74) with the **ATS14=74** command. This will set bit 6 of **S14** to 1 without affecting the other bits.

◇ **NOTE** ◇

To make the new value remain valid even after the ISDN terminal adapter is switched off, the active configuration profile must be saved with the **AT*W** command.

S0 Number of RINGs to auto-answer

Range	:	0..255 RING result codes
Default value	:	0 (automatic answering disabled)
Storage in nonvolatile memory	:	AT&W or AT*W

Register **S0** specifies the number of **RING** result codes that must occur for your *MicroLink ISDN/TL V.34* to automatically answer an incoming call. When your *MicroLink ISDN/TL V.34* detects an incoming call, the result code **RING** is issued every five seconds, for as long as the call waits on the line. The default value, 0, disables automatic answering. You can then use the **ATA** command (described on page 32) to manually answer calls.

When the value of Register **S0** is greater than zero, you can cancel the connection-establishment process by typing any character except <LF> on your keyboard. If Register **S14**, bit 6 is set to 1, however, the connection is not terminated and your computer can send signals to the *MicroLink ISDN/TL V.34* during the establishment of a connection (refer to page 60). By default, Register **S14**, bit 6 is set to 0.

S1 RING counter

Range	:	0 to 255 RING result codes
Default value	:	0
Storage in nonvolatile memory	:	no

Register **S1** counts the number of received incoming **RING** result codes, which are issued every five seconds when an incoming call is detected. The contents of Register **S1** reset to zero when the call is accepted or withdrawn.

S2 Escape character

Range	:	0 to 127 (decimal)
Default value	:	43 (+)
Storage in nonvolatile memory	:	AT*W

Register **S2** specifies the ASCII value of the Escape Character. This is the character you type three times to switch from Data Mode to Online Mode while maintaining the connection with the remote modem.

The default value (43) is equivalent to the ASCII character +. You can change this register to any value from 0 to 255. Values greater than 127 disable the escape feature, preventing you from returning to the Command Mode.

If you will be automatically answering calls, you may want to either disable the Escape Characters or set them to a value other than that used by the originating modem, so that the use of the escape sequence by the calling computer won't make your computer switch to Command Mode.

If you disable the Escape Characters, you can return to Command Mode by having the remote modem hang up, or by having an ON-to-OFF transition of the Data Terminal Ready (DTR) interface signal occur with the **&D1**, **&D2**, or **&D3** command in effect.

S3 Carriage Return character

Range	:	0 to 127 (decimal)
Default value	:	13 (Carriage Return)
Storage in nonvolatile memory	:	AT*W

Register **S3** specifies the ASCII value of the carriage return (or end- of-line) character. This is the character that you use to end the command line and also the character that appears after your modem sends you a result code.

The default value is 13. You may want to change the default value if you are using nonstandard equipment.

S4 Line Feed character

Range	:	0 to 127 (decimal)
Default value	:	10 (Line Feed)

Storage in nonvolatile memory : **AT*W**

Register **S4** specifies the ASCII value of the line feed character. The default value is 10, although you can change it to another ASCII value between 0 and 127.

S5 Backspace character

Range : 0 to 32, 127 (decimal)
Default value : 8 (Backspace)
Storage in nonvolatile memory : **AT*W**

Register **S5** specifies the ASCII value of the backspace character. This character is the character created by pressing the <BS> key and the character echoed to move the cursor to the left.

S7 Waiting for carrier (Modem operation only)

Range : 10 to 100 seconds (10 to 59 in the UK)
Default value : 90 seconds (59 seconds in the UK)
Storage in nonvolatile memory : **AT*W**

Register **S7** specifies the maximum number of seconds your *MicroLink ISDN/TL V.34* waits for a remote modem's carrier signal before hanging up.

S10 Delay for hang up after carrier loss (Modem operation only)

Range : 1 to 255 1/10 seconds
Default value : 3 (0.3 seconds)
Storage in nonvolatile memory : **AT*W**

Register **S10** specifies the time between when the remote carrier signal is lost and when your *MicroLink ISDN/TL V.34* hangs up.

S12 Escape prompt delay

Range	:	0 to 255 1/50 seconds
Default value	:	50 (1 second)
Storage in nonvolatile memory	:	AT*W

Register **S12** specifies the time delay required before and after you type the Escape Characters. The guard time ensures that your *MicroLink ISDN/TL V.34* does not misinterpret the escape characters as data.

IMPORTANT If Register **S12** equals 0, there will be no time requirement for entering the escape character sequence.

S14 Bit-mapped options

Register **S14** is a bit-mapped register whose contents can be stored in nonvolatile memory using the command **AT&W** or **AT*W**. The following table shows the individual bits of Register **S14** and any equivalent AT commands. Default settings are shown in **bold**.

Bit	Dec.	Meaning	
0	0	reserved	
1	0	0 = command echo disabled	ATE0
	2	1 = command echo enabled	ATE1
2	0	0 = result codes enabled	ATQ0
	4	1 = result codes disabled	ATQ1
3	0	0 = numeric (digit) result codes	ATV0
	8	1 = word (verbose) result codes	ATV1
4	0	0 = normal operation	ATH0
	16	1 = dumb mode	ATH1
5	0	reserved	
6	0	0 = polling allowed during connection establishment	
	64	1 = polling not allowed during connection establishment	
7	0	0 = MicroLink ISDN/TL V.34 is in answer mode	
	128	1 = <i>MicroLink ISDN/TL V.34</i> is in originate mode	

S21 RS-232/V.24 control and signaling lines

Register **S21** is a bit-mapped register whose contents can be stored in nonvolatile memory using the command **AT&W** or **AT*W**. The following table shows the individual bits of Register **S21** and any equivalent AT commands. Default settings are shown in **bold**.

Bit	Dec.	Meaning
0..1	0	none
2	0	reserved

Bit	Dec.	Meaning	
3..4	0	0 = ignore DTR status change	AT&D0
	8	1 = change to Command Mode after an ON-to-OFF DTR transition	AT&D1
	16	2 = disconnect after an ON-to-OFF DTR transition	AT&D2
	24	3 = disconnect and reinitialization after an ON-to-OFF DTR transition	AT&D3
5	0	0 = DCD signal is always active (ON)	AT&C0
	32	1 = DCD signal indicates existing connection	AT&C1
6..7	0	none	

S22 Establishing a connection

Register **S22** is a bit-mapped register whose contents can be stored in nonvolatile memory using the command **AT&W** or **AT*W**. The following table shows the individual bits of Register **S22** and any equivalent AT commands. Default settings are shown in **bold**.

Bit	Dec.	Meaning	
0..1	0	0 = low speaker volume	ATL0
	1	1 = low speaker volume	ATL1
	2	2 = medium speaker volume	ATL2
	3	3 = maximum speaker volume	ATL3
2..3	0	0 = speaker always off	ATM0
	4	1 = speaker on when dialing and waiting for answer tone	ATM1
	8	2 = speaker always on	ATM2
	12	3 = speaker on when waiting for answer tone	ATM3
4..6	0	Busy line → NO CARRIER; only 'CONNECT' or '1'	ATX0
	64	Busy line → NO CARRIER	ATX3
	80	Busy line → NO CARRIER	ATX2
	96	Busy line → BUSY	ATX3
	112	Busy line → BUSY	ATX4
7	0	none	

S23 Bit-mapped options

Register **S23** is a bit-mapped register whose contents can be stored in nonvolatile memory using the command **AT&W** or **AT*W**. The following table shows the individual bits of Register **S23** and any equivalent AT commands. Default settings are shown in **bold**.

Bit	Dec.	Meaning	
0..5	0	reserved	
6..7	0	0 = guard tone off	AT&G0 / AT&G4
	64	1 = guard tone 550 Hz	AT&G1 / AT&G5
	128	2 = guard tone 1800 Hz	AT&G2 / AT&G6

S27 Bit-mapped options

Register **S27** is a bit-mapped register whose contents can be stored in nonvolatile memory using the command **AT&W** or **AT*W**. The following table shows the individual bits of Register **S27** and any equivalent AT commands. Default settings are shown in **bold**.

Bit	Dec.	Meaning	
0-5	0	reserved	
6	0 64	0 = ITU-T V.21/V.22bis 1 = Bell 103/212A	ATB0 ATB1
7	0 128	0 = duplex 1 = half-duplex	

S28 Bit-rate adaptation

Register **S28** is a bit-mapped register whose contents can be stored in nonvolatile memory using the command **AT&W** or **AT*W**. The following table shows the individual bits of Register **S28** and any equivalent AT commands. Default settings are shown in **bold**.

Bit	Dec.	Meaning	
0-1	0	reserved	
2..3	0	0 = V.110 bit rate adaptation enabled ¹⁾ Partial adaptation in modem mode ²⁾	AT%L0
	4	1 = V.110 bit rate adaptation enabled¹⁾ V.100 bit rate adaptation in modem mode²⁾	AT%L1
	8	2 = V.110 bit rate adaptation disabled, connection will be broken ¹⁾ No fallback ²⁾	AT%L2
	12	3 = V.110 bit rate adaptation enabled ¹⁾ V.100 bit rate adaptation ²⁾	AT%L3
4..5	0	reserved	
6	0 64	0 = disable automatic retrain (analog) 1 = enable automatic retrain (analog)	AT%E0 AT%E1
7	0	reserved	

1) in ISDN mode

2) in modem mode

S29 Bit-mapped options

Register **S29** is a bit-mapped register whose contents can be stored in nonvolatile memory using the command **AT&W** or **AT*W**. The following table shows the individual bits of Register **S29** and any equivalent AT commands. Default settings are shown in **bold**.

Bit	Dec.	Meaning	
0	0	0 = automatic fallback to V.23 allowed	
	1	1 = automatic fallback to V.23 not allowed	
1	0	0 = disable asymmetric bit rates	
	2	1 = enable asymmetric bit rates	
2	0	0 = enable V.8 negotiation	AT%M0
	4	1 = disable V.8 negotiation	AT%M1
3	0	reserved	
4	0	0 = enable V.34/V.Fast Class rate renegotiation	
	16	1 = disable V.34/V.Fast Class rate renegotiation	
5	0	0 = disable V.32 clear down sequence	
	32	1 = enable V.32 clear down sequence	
6	0	0 = V.32: 9600 bps uncoded	
	64	1 = V.32: 9600 bps Trellis coded	
7	0	0 = V.8 answer tone with V.Fast Class ID	
	128	1 = V.8 answer tone without V.Fast Class ID	

S30 Inactivity timer

Range	:	0 to 255 in 10-second intervals
Default value	:	0 (timer disabled)
Storage in nonvolatile memory	:	AT&W or AT*W

Register **S30** specifies the number of seconds without data being sent, after which your *MicroLink ISDN/TL V.34* will disconnect from a remote modem.

S31 DTR dialing

Register **S31** is a bit-mapped register whose contents can be stored in nonvolatile memory using the command **AT&W** or **AT*W**. The following table shows the individual bits of Register **S31** and any equivalent AT commands. Default settings are shown in **bold**.

Bit	Dec.	Meaning	
0..2	0	0 = no guard tone, calling tone on	AT&G0
	1	1 = guard tone 550 Hz, calling tone on	AT&G1
	2	2 = guard tone 1800 Hz, calling tone on	AT&G2
	4	4 = no guard tone, calling tone off	AT&G4
	5	5 = guard tone 550 Hz, calling tone off	AT&G5
	6	6 = guard tone 1800 Hz, calling tone off	AT&G6
3	0	0 = Calling tone, ITU-T V.25	
		1 = Calling tone, ITU-T V.8	
4	0	Reserved	
5	0	0 = DTR dialing disabled	AT\$D0
	32	1 = DTR dialing enabled	AT\$D1
6..7	0	reserved	

S36 Operating mode

Register **S36** is a bit-mapped register controlling the operating mode, whose contents can be stored in nonvolatile memory using the command **AT&W** or **AT*W**. The following table shows the individual bits of Register **S36** and any equivalent AT commands. Default settings are shown in **bold**.

Bit	Dec.	Meaning	
0..3	0	0 = normal mode (V.110/V.100)	AT\N0
	1	1 = direct mode (V.110/V.100)	AT\N1
	2	2 = X.75 without fallback/MNP	AT\N2
	3	3 = X.75/V.42, MNP with fallback to normal mode	AT\N3
	4	4 = V.120 without fallback/V.42	AT\N4
	5	5 = V.120/V.42 with fallback to normal mode	AT\N5
	6	6 = X.75 or V.120 without fallback/V.42 with fallback to MNP	AT\N6
	7	7 = X.75 or V.120 with fallback to normal mode	AT\N7
	8	8 = VT-100 mode, for German T-Online service only	AT\N8
	9	9 = CEPT and KIT mode, for German T-Online service only	AT\N9
		10= Connection without error correction, no fallback	AT\N10
4..6	0	reserved	
7	0	0 = channel bundling disabled	AT&N0
	128	1 = channel bundling enabled	AT&N1

S37 Line bit rate

Register **S37** indicates the selected line bit rate in V.110 operation. The contents of Register **S37** can be stored in the nonvolatile memory using the command **AT&W** or **AT*W**. The following table shows the individual bits of Register **S37** and any equivalent AT commands. Default settings are shown in **bold**.

Bit	Dec.	Meaning		
0..4	3	3 = Line bit rate 300 bps	AT%B300	
	5	5 = Line bit rate 1200 bps	AT%B1200	
	6	6 = Line bit rate 2400 bps	AT%B2400	
	7	7 = Line bit rate 4800 bps	AT%B4800	
	9	9 = Line bit rate 9600 bps	AT%B9600	
	10	10 = Line bit rate 12,000 bps	AT%B12000	
	11	11 = Line bit rate 14,400 bps	AT%B14400	
	12	12 = Line bit rate 16,800 bps	AT%B16800	
	13	13 = Line bit rate 19,200 bps	AT%B19200	
	14	14 = Line bit rate 21,600 bps	AT%B21600	
	15	15 = Line bit rate 21,000 bps	AT%B24000	
	16	16 = Line bit rate 26,400 bps	AT%B26400	
	17	17 = Line bit rate 28,800 bps	AT%B28800	
	18	18 = Line bit rate 31,200 bps	AT%B31200	
	19	19 = Line bit rate 33,600 bps	AT%B33600	
	21	21 = Line bit rate 38,400 bps	AT%B38400	
	5	0	reserved	
	6	0	0 = Line bit rate depends on serial port bit rate	AT%G0
		64	1 = Line bit rate determined by AT%B	AT%G1
7	0	0 = serial port bit rate remains unchanged	ATJU0	
	128	1 = serial port bit rate adapted to ISDN line bit rate	ATJU1	

S46 Data compression

Register **S46** enables or disables V.42bis data compression. The contents of Register **S46** can be stored in the nonvolatile memory using the command **AT&W** or **AT*W**. The following table shows the individual bits of Register **S46** and any equivalent AT commands. Default settings are shown in **bold**.

Bit	Dec.	Meaning	
0..3	0	0 = data compression disabled	AT%C0
	1	1 = V.42bis data compression is enabled ¹⁾ MNP5 data compression is enabled ²⁾	AT%C1
	2	2 = V.42bis data compression is enabled	AT%C2
	3	3 = V.42bis data compression enabled¹⁾ MNP5 data compression is enabled²⁾	AT%C3
4..7	0	reserved	

S48 Bit-mapped options

Register **S48** is a bit mapped register whose contents can be stored in nonvolatile memory using the command **AT&W** or **AT*W**. The following table shows the individual bits of Register **S48** and any equivalent AT commands. Default settings are shown in **bold**.

Bit	Dec.	Meaning
0..1	0	reserved
2	0 4	0 = Detect phase off 1 = Detect phase on
3..4	0 8 16	0 = no buffering in the negotiating phase 1 = data buffering in the negotiating data phase 2 = no data buffering, fallback character detection
5..7	0	reserved

S51 Data flow control

Register **S51** is a bit-mapped register whose contents can be stored in nonvolatile memory using the command **AT&W** or **AT*W**. The following table shows the individual bits of Register **S51** and any equivalent AT commands. Default settings are shown in **bold**.

Bit	Dec.	Meaning	
0..3	0	0 = no handshake	ATIQ0
	1	1 = XON/XOFF bi-directional	ATIQ1
	2	2 = RTS/CTS unidirectional	ATIQ2
	3	3 = RTS/CTS bi-directional	ATIQ3
	4	4 = XON/XOFF unidirectional	ATIQ4
	5	5 = same as IQ2, but CTS OFF until connection established	ATIQ5
	6	6 = same as IQ3, but CTS OFF until connection established	ATIQ6
4	0	0 = XON/XOFF characters are not passed to remote station	ATIX0
	16	1 = XON/XOFF characters are passed to remote station	ATIX1
5..7	0	none	

S52 RS-232/V.24 signaling lines

Register **S52** is a bit-mapped register whose contents can be stored in nonvolatile memory using the command **AT&W** or **AT*W**. The following table shows the individual bits of Register **S52** and any equivalent AT commands. Default settings are shown in **bold**.

Bit	Dec.	Meaning	
0..1	0	0 = DSR always active, CTS always active	ATID0&S0
	1	1 = DSR indicates B channel switched through, CTS always active	ATID1&S1
	2	2 = DSR always active, CTS follows DCD	ATID2
	3	3 = DSR indicates B channel switched through, CTS follows DCD	ATID3

Bit	Dec.	Meaning
2..3	0	0 = DCD is always active (depending on Register S 21, page 60) AT&C0
	0	0 = DCD indicates existing connection (depending on register S 21, page 60) AT&C1
	8	2 = DCD off for 0.5 seconds during disconnection AT&C2
4..5	0	0 = DSR always active, CTS always active AT\D0&S0
	32	1 = DSR indicates B channel switched through, CTS always active AT\D1&S1
6..7	0	0 = CTS status determined by AT\Dn
	64	1 = CTS follows RTS (asynchronous half-duplex simulation)
	128	2 = CTS follows RTS after 0.5 to 0.6 seconds

S54 Call indication options

Register **S54** is a bit-mapped register whose contents can be stored in nonvolatile memory using the command **AT&W** or **AT*W**. Default settings are shown in **bold**.

Bit	Dec.	Meaning
0	0	0 = Incoming call indicated by display, RINGING
	1	1 = Incoming call also indicated by acoustic ringing signal
1..2	0	0 = ringing pattern 1
	2	1 = ringing pattern 2
	4	2 = ringing pattern 3
	8	3 = ringing pattern 4
3..4	0	0 = volume 0
	8	1 = volume 1
	16	2 = volume 2
	24	3 = volume 3

S64 Modem transmitted signal-strength setting

Available values	:	10..15 (-x.5 dBm)
Standard value	:	10 (-10.5 dBm)
Storage in no-volatile memory	:	AT*W

With register S64 the transmitted signal strength can be set. The value 10 represents a signal strength of -10.5 dBm.

S86 Call failure reason code

(Modem operation only)

When your *MicroLink ISDN/TL V.34* sends you a **NO CARRIER** result code, it stores a value in Register **S86** that indicates the reason why the connection disconnected. You can read the value of this register to determine the reason for the disconnection. If you receive more than one **NO CARRIER** result code, only the first cause will be shown in this register.

Dec	Meaning
.	
0	Normal disconnection, no error occurred
4	Loss of carrier
5	Negotiation phase failed; modem at remote station has no error correction
6	Remote modem is not answering protocol requests
7	Remote modem is only functioning synchronously
8	Modems could not find a common framing
9	Modems could not find a common protocol
10	Remote modem is sending wrong protocol requests
11	Synchronous information (data or flags) missing; connection termination after 30 seconds
12	Normal disconnect, initiated by the remote modem
13	Remote modem is no longer answering; disconnect after 10 retransmissions
14	Protocol violation
15	Compression error
16	Inactivity time has elapsed
17	No loop current (not in the United Kingdom and USA)
20	Busy tone detected
21	No dial tone detected
22	No answer tone detected (time-out S7)
23	No connection reached (time-out) or wrong modulation type
24	Fallback not permitted because of AT%L2
25	No modem or fax is answering at the number called
30	ATH (online)
31	ATZ (online)
42	Hang-up caused by loss of synchronisation
43	Hang-up caused by clear down sequence
68	No response to automatic resynchronisation

S87 Current Line bit rate

Register **S87** is a read-only register that contains the ISDN line bit rate of the current connection. The individual bits of **S87** have the following meaning:

Bit	Dec.	Meaning
0..4	0	0 = no connection established
	3	3 = Modem connection, 300 bps
	5	5 = ISDN or modem connection with 1200 bps
	6	6 = ISDN or modem connection with 2400 bps
	7	7 = ISDN or modem connection with 4800 bps
	9	9 = ISDN or modem connection with 9600 bps
	10	10 = Modem connection, 12,000 bps
	11	11 = Modem connection, 14,400 bps
	12	12 = Modem connection, 16,800 bps
	13	13 = ISDN or modem connection with 19,200 bps
	14	14 = Modem connection, 21,600 bps
	15	15 = Modem connection, 24,000 bps
	16	16 = Modem connection, 26,400 bps
	17	17 = Modem connection, 28,800 bps
	18	18 = Modem connection, 31,200 bps
	19	19 = Modem connection, 33,600 bps
21	21 = ISDN connection with 38,400 bps	
22	22 = ISDN connection with 48,000 bps	
23	23 = ISDN connection with 56,000 bps	
24	24 = ISDN connection with 64,000 bps	
5	0	0 = one-channel connection
	32	1 = ISDN connection at 128,000/112,000 bps (second B channel with 64,000/56,000 bps active)
6	0	0 = no fax connection
	64	1 = fax connection established
7	0	0 = ISDN connection
	128	1 = Modem / fax connection

S93 Serial port bit rate

Register **S93** is a bit-mapped register whose contents can be stored in nonvolatile memory using the command **AT&W** or **AT*W**. The following table shows the individual bits of Register **S93**. Default settings are shown in **bold**.

Bit	Dec.	Meaning
0..4	0	0 = no connection established
	5	5 = serial port bit rate 1200 bps
	6	6 = serial port bit rate 2400 bps
	7	7 = serial port bit rate 4800 bps
	9	9 = serial port bit rate 9600 bps
	13	13 = serial port bit rate 19,200 bps
	21	21 = serial port bit rate 38,400 bps
	22	22 = serial port bit rate 48,000 bps
	23	23 = serial port bit rate 56,000 bps
	24	24 = serial port bit rate 64,000 bps
25	25 = serial port bit rate 230,400 bps	
5	0	reserved
6..7	0	0 = data format 8N1
	64	1 = data format 7E1
	128	2 = data format 7O1
	192	3 = data format 7N2

◇ **NOTE** ◇ This register is overwritten each time your *MicroLink ISDN/TL V.34* executes a valid command line that contains the **AT** command. When the command **ATV1** is in effect, this register is set to the value of Register **S87** (bit 0-4, ISDN line bit rate) after a V.110 connection has been established.

S95 Result codes

Register **S95** is a bit-mapped register whose contents can be stored in nonvolatile memory using the command **AT&W** or **AT*W**. The following table shows the individual bits of Register **S95** and any equivalent AT commands. Default settings are shown in **bold**.

Bit	Dec.	Meaning	
0..3	0	0 = no modified CONNECT result codes	ATV0
	1	1 = indication of error-corrected connections	ATV1
	2	2 = indication of error-corrected connections and error correction method	ATV2
	8	8 = extensive CONNECT result codes (ELSA standard)	ATV8
4	0	0 = CONNECT result codes with bit rate (depends on ATV)	AT-M0
	16	1 = CONNECT result codes without bit rate	AT-M1
5	0	0 = CONNECT result code after invalid escape sequence	AT*Q0
	32	1 = no CONNECT result code after invalid escape sequence	AT*Q1

Bit	Dec.	Meaning	
6..7	0	0 = result codes enabled	ATQ0
	64	1 = result codes disabled	ATQ1
	128	2 = result codes disabled in answer mode	ATQ2

S96 AT command interpreter

Register **S96** is a bit-mapped register whose contents can be stored in nonvolatile memory using the command **AT&W** or **AT*W**. The following table shows the individual bits of Register **S96**. Default settings are shown in **bold**.

Bit	Dec.	Meaning
0..1	0	reserved
2	0	0 = message "Press any key to continue" enabled
	4	1 = message "Press any key to continue" disabled
3..4	0	0 = German user interface (default for European version)
	8	1 = English user interface (default for US version)
	16	2 = reserved
	24	3 = reserved
5..6	0	reserved
7	0	0 = disable error result code for access of invalid or protected S register (→ OK)
	128	1 = enable error result code for access of invalid or protected S register (→ ERROR)

S151 D channel protocol configuration

Register **S151** controls settings for the ISDN D channel. The contents of Register **S151** can be stored in the nonvolatile memory using the **AT*W** command. The individual bits have the following meaning:

Bit	Dec.	Meaning
0	0	0 = send error result code to network if device busy or not ready
	1	1 = do not send result code to network if device busy or not ready
1	0	0 = Incoming calls signaled with ALERT
	1	1 = No ALERT signaling for incoming calls
2	0	0 = V.120: LLC (Low Layer Capability) not signaled in D-channel V.110: BC (Bearer Capability) and LLC (Low Layer Capability) not signaled in D-channel
	4	1 = V.120: LLC (Low Layer Capability) signaled in D-channel V.110: BC (Bearer Capability) and LLC (Low Layer Capability) signaled in D-channel
3	0	reserved
4	0	0 = Incoming calls on B channel 1 will be accepted
	16	1 = Incoming calls on B channel 1 will be ignored
5	0	0 = Incoming calls on B channel 2 will be accepted
	32	1 = Incoming calls on B channel 2 will be ignored
6..7	0	reserved

Using Low Layer Capability for V.120 enables you to access all CompuServe V.120 nodes. Not enabling LLC can lead to problems with connections to some CompuServe V.120 nodes. When using the Bearer Capability for V.110, the bit rates 1200, 2400, 4800, 9600 and 19,200 bps can be signaled, but not 38,400 bps.

S152 Call indication delay

Range	:	0 to 50 1/10 seconds
Default value	:	0
Storage in nonvolatile memory	:	AT&W or AT*W

Register **S152** specifies a delay between when an incoming call is made to your system and when that call is reported to your computer. This delay lets you give priority to an ISDN device other than your *MicroLink ISDN/TL V.34*. By specifying a delay, you avoid "competition" between ISDN devices that share the same communication line and have the same Bearer Capability/Service Indicator and Multiple Subscriber Number or EAZ digit.

The default value, 0, disables the call indication delay.

S153 CONNECT / NO CARRIER result code

Register **S153** is a bit-mapped register whose contents can be stored in nonvolatile memory using the command **AT&W** or **AT*W**. The following table shows the individual bits of Register **S153**. Default settings are shown in **bold**.

Bit	Dec.	Meaning
0	0 1	0 = remote number is not displayed after CONNECT 1 = remote number is displayed after CONNECT
1	0 2	0 = remote number is not displayed after RING 1 = remote number is displayed after RING
2	0 4	0 = MSN/EAZ dialed by the remote side is not displayed 1 = if bit 0 and/or bit 1=1, MSN/EAZ dialed by the remote side is displayed
3..5	0	reserved
6	0 64	0 = Result codes are not displayed: CONNECTING, ALERTING, CALL SENT 1 = Result codes are displayed: CONNECTING, ALERTING, CALL SENT
7	0 128	0 = reason of disconnection is not displayed 1 = reason of disconnection appears after NO CARRIER, according to Registers S154 and S155

S154/S155 Error codes

If a connection error occurs (connection establishment failed or connection canceled), a value corresponding to the cause of the failure is written to Registers **S154** and **S155**:

- Register **S154** indicates where the error occurred.
- Register **S155** shows the exact reason for the failure.

Both registers are read only. For more information on error codes, refer to page 99.

S156 Data packet repetitions received on D channel

Range	:	0 to 255 repetitions per 250 data packets
Default value	:	0
Storage in nonvolatile memory	:	no

Register **S156** is a read-only register that shows the ratio of transmission errors received on the control channel (D channel) per 250 data packets; that is, how many 250 data packets had to be repeated. To return this register to a value of 0, turn your *MicroLink ISDN/TL V.34* off and on.

S157 Data packet repetitions sent on D channel

Range	:	0 to 255 repetitions per 250 data packets
Default value	:	0
Storage in nonvolatile memory	:	no

Register **S157** is a read-only register that shows the ratio of data packet repetitions sent on the control channel (D channel) for every 250 data packets; that is, how many 250 data packets had to be resent due to transmission errors. To return this register to a value of 0, turn your *MicroLink ISDN/TL V.34* off and on.

S158 Current / last B channel

Register **S158** is a read-only register that shows which B channel is currently being used or has been used last.

x	Meaning
000	no connection has been established
001	current/last connection on B channel 1
002	current/last connection on B channel 2

S159 S₀ interface status

Register **S159** is a read-only register that shows the current status of the ISDN S₀ interface.

Bit	Dec.	Meaning
0	0	0 = no power on S ₀ bus detected
	1	1 = normal or restricted power condition on S ₀ bus
87	0	reserved
2	0	0 = S ₀ bus not activated
	4	1 = S ₀ bus activated
3	0	0 = no TEI assigned
	8	1 = TEI assigned
4	0	0 = D channel level 2 not established
	16	1 = D channel level 2 established
5..6	0	reserved
7	0	SPID initialization not completed (US protocol only)
	128	SPID initialization completed (US protocol only)

S160 Information about last call

Register **S160** is a read-only register that contains information about the last call that came across the ISDN S₀ interface.

Dec.	Hex.	Meaning
000	00h	no incoming call yet
016	10h	call is currently being reported
017	11h	call was accepted
018	12h	call was withdrawn or answered by another device on the S ₀ bus
032	20h	call had wrong Bearer Capability (DSS1) or wrong Service Indicator (1TR6)
033	21h	call had wrong MSN, EAZ or DN
048	30h	DTR (line S1) was OFF, call was rejected
049	31h	ISDN adapter was already connected or establishing another connection (BUSY)
064	40h	number check not OK (see AT+ICLDn command)
065	41h	number check not OK, no number was given

S162 Selecting a preferred B channel

Register **S162** is a bit-mapped register whose contents can be stored in nonvolatile memory using the command **AT&W** or **AT*W**. The following table shows the individual bits of Register **S162**. Default settings are shown in **bold**.

Bit	Dec.	Meaning
0..1	0	0 = any B channel can be used
	1	1 = B1 channel has priority, can be switched to B2 by the exchange if B1 busy
	2	2 = B2 channel has priority, can be switched to B1 by the exchange if B2 busy

S163/S164 Service Indicator/ Additional Service Indicator

Registers **S163** and **S164** are read-only registers that show the Service Indicator or the Additional Service Indicator of the last connection or the last incoming call, if no connection could be established. Encoding is realized with 1TR6 code.

S163	S164	Meaning
007	169	Bit rate adaptation to 56,000 bps (automatic switching to 56,000 bps with V.120/X.75/HDLC)
	other	Data transfer at 64,000 bps

S165 DSS1 (Euro-ISDN) error codes

Register S165 displays detailed error codes which can be used for localizing the source of a problem (e.g. no connection established or connection broken). This is a read-only register. A list of these error codes can be found in the appendix "Error Codes".

S167 Maximum number of charge units for cost monitoring (DSS1/1TR6)

Range	:	0 to 255 * 10 units
Default value	:	0
Storage in nonvolatile memory	:	AT&W or AT*W

Register **S167** is used by the European version of *MicroLink ISDN/TL V.34* only (DSS1 and 1TR6 protocols). This register sets the maximum allowed number of ISDN charge units that may be used within the number of days specified by Register **S168**.

If the number of charge units is exceeded, no more connections can be made in this time period. If the time limit is exceeded during an existing connection, the connection ends.

Turning the *MicroLink ISDN/TL V.34* off and on resets the number of remaining charge units for the current period to the value stored in Register **S167**.

The default setting, 0, disables cost monitoring .

S168 Time period for cost monitoring (DSS1/1TR6)

Range	:	0 to 255 days
Default value	:	0
Storage in nonvolatile memory	:	AT&W or AT*W

Register **S168** is used by the European version of *MicroLink ISDN/TL V.34* only (DSS1 and 1TR6 protocols). This register sets the number of days during which the number of charge units set in Register **S167** can be used. For example, if you set Register **S168** to 2, the number of available charge units resets to the value stored in Register **S167** every two days.

The default setting, 0, prevents the number of available charge units from being reset to the Register **S167** value after the allowed number of units has been used. To disable the cost lock, set either Register **S169** to a value less than 0, or set Register **S167** to 0.

S169 Remaining charge units of cost monitoring period (DSS1/1TR6)

Range	:	0 to 255 * 10 units
Default value	:	0
Storage in nonvolatile memory	:	no

Register **S169** is used by the European version of *MicroLink ISDN/TL V.34* only (DSS1 and 1TR6 protocols). This register specifies the number of remaining charge units that can be used in the current cost monitoring period (see Registers **S167** and **S168**). When the *MicroLink ISDN/TL V.34* is turned off and on, Register **S169** resets to the value of Register **S167**. To disable a cost lock, either set Register **S169** to a value greater than 0, or set Register **S167** to 0.

S170 Remaining days of cost monitoring period

(DSS1/1TR6)

Range	:	0 to 255 days
Default value	:	0
Storage in nonvolatile memory	:	no

Register **S170** is used by the European version of *MicroLink ISDN/TL V.34* only (DSS1 and 1TR6 protocols). This register specifies the number of days remaining before the number of charge units resets to the maximum limit set specified by Register **S167** (see Registers **S167** and **S168**). When the *MicroLink ISDN/TL V.34* is turned off and on, Register **S170** resets to the value of Register **S168**.

S171 Additional X.75 settings

Register **S171** specifies additional X.75 protocol information. The contents of Register **S171** can be stored in the nonvolatile memory using the command **AT&W** or **AT*W**. The following table shows the individual bits of Register **S171**. Default settings are shown in **bold**.

Bit	Dec.	Meaning
0..2	0	0 = data block size 128 bytes
	1	1 = data block size 256 bytes
	2	2 = data block size 512 bytes
	3	3 = data block size 1024 bytes
	4	4 = data block size 2048 bytes
3	0	reserved
4	0	No synchronization/asynchronization conversion for point-to-point protocol AT%P0
	16	Synchronization/asynchronization conversion for point-to-point protocol AT%P1
5	0	0 = 64,000 bps (default for Europe) AT%S0
	32	1 = 56,000 bps with AT\N2, AT\N4, AT\N6, AT\N7 and AT\N10 (default for US) AT%S1
6..7	0	0 = no T.70NL header
	64	1 = no T.70NL header
	128	2 = T.70NL header, usable block size reduced by 2 bytes
	192	3 = T.70NL header, total block size extended by 2 bytes

S172 Additional V.120 settings

Register **S172** can be used to specify additional details for the V.120 protocol. The contents of Register **S172** can be stored in the nonvolatile memory using the command **AT&W** or **AT*W**. The following table shows the individual bits of Register **S172**. Default settings are shown in **bold**.

Bit	Dec.	Meaning
0	0	0 = data block size 127 Bytes
	1	1 = data block size 259 Bytes
1..6	0	reserved

Bit	Dec.	Meaning	
7	0	0 = 64,000 bps (default for European version)	AT%S0
	128	1 = 56,000 bps (default for US version)	AT%S1

S173 Additional V.110 settings

Register **S173** can be used to specify additional details for the V.110 protocol. The contents of Register **S173** can be stored in the nonvolatile memory using the command **AT&W** or **AT*W**. The following table shows the individual bits of Register **S173**. Default settings are shown in **bold**.

Bit	Dec.	Meaning
0	0	reserved
1..2	0	0 = no parity, asynchronous
	2	1 = odd parity, asynchronous (additional bit)
	4	2 = even parity, asynchronous (additional bit)
	6	3 = "1" parity, asynchronous (additional bit)
3	0	0 = RTS, DCD, DSR normal operation, asynchronous
	8	1 = V.110 half-duplex operation, asynchronous (direct mode ATN1 only)
4	0	0 = bit rate tolerance 12.5%, asynchronous
	16	1 = bit rate tolerance 25%, asynchronous
5	0	0 = 1 stop bit, asynchronous
	32	1 = 2 stop bits, asynchronous
6..7	0	0 = 8 bits/character, asynchronous (no parity bit)
	64	1 = 7 bits/character, asynchronous (no parity bit)
	128	2 = 6 bits/character, asynchronous (no parity bit)
	192	3 = 5 bits/character, asynchronous (no parity bit)

S174 ISDN/modem operation

Register **S174** can be used to switch between ISDN and modem operation. You can use the **ATDI** and **ATDN** commands to overwrite the connection type specified by this register. The contents of Register **S174** can be stored in the nonvolatile memory using the command **AT&W** or **AT*W**. Default settings are shown in **bold**.

Bit	Dec.	Meaning
0..1	0	0 = accept ISDN calls
	1	1 = accept modem calls
	2	2 = accept ISDN and modem calls.
2..3	0	0 = outgoing ISDN call
	4	1 = outgoing modem call
	8	2 = place ISDN call initially; if an error occurs, place a modem call
4..7	0	reserved

S175 Channel bundling

Register **S175** controls additional settings for B channel bundling. The contents of Register **S175** can be stored in the nonvolatile memory using the command **AT&W** or **AT*W**. The following table shows the individual bits of Register **S175**. Default settings are shown in **bold**.

Bit	Dec.	Meaning
0..1	0	reserved
2	0 4	0 = static channel bundling (second B channel always active) ¹⁾ 1 = dynamic channel bundling (second B channel only active when needed) ²⁾
3	0 8	0 = connection hold time starts when throughput falls below the limit ³⁾ 1 = connection hold time starts with each charge unit ⁴⁾
4	0 16	0 = secondary connection with the same number as primary connection 1 = secondary connection with the same number as primary connection without SPC flag
5	0 32	0 = supplied number (CLIP) not required for identification of second B channel 1 = supplied number (CLIP) required for identification of second B channel
6	0 64	0 = CONNECT reported after primary connection establishment 1 = CONNECT reported after secondary connection establishment
7	0 128	0 = normal DSR function 1 = DSR off when secondary connection is established

¹⁾ The secondary connection must be established (or the cancellation must be reported to the remote side) within 30 seconds; otherwise, the primary connection is canceled.

²⁾ The secondary connection is made when the throughput limit is exceeded. If the secondary connection fails, call establishment is retried every 15 seconds as long as the reason for the secondary connection lasts. Error messages resulting from these attempts are neither saved nor reported.

³⁾ The secondary connection is dropped after the time set in Register **S178** (connection hold time).

⁴⁾ The connection hold time starts with every charge information (beginning of a new charge unit) if the throughput limit is exceeded. When the throughput falls below the limit, the secondary connection is dropped after the connection hold time elapses. The connection hold time equals the length of one charge unit minus three seconds so that the secondary connection can be dropped three seconds before the next charge unit begins. During the first charge unit (where the length of the unit is not yet known), Register **S178** determines the connection hold time.

S176 Throughput limit for channel bundling

Range	:	0 to 255 × 100 bytes/sec
Default value	:	70 (7000 bytes/sec)
Storage in nonvolatile memory	:	AT&W or AT*W

Register **S176** specifies the data throughput limit that must be exceeded for the second B channel to be established. This register is only used if bit 2 of Register **S175** (dynamic channel bundling) is set to a value other than 0.

The second B channel can only be established if the throughput limit is below the maximum throughput of one B channel (that is, the value should not exceed 78 = 7800 bytes/sec).

S177 Throughput averaging time for channel bundling

Range	:	0 to 32 seconds
Default value	:	0
Storage in nonvolatile memory	:	AT&W or AT*W

Register **S177** specifies the time during which the average data throughput is calculated in order to smooth short fluctuations of the throughput (such as those induced by handshaking).

The default setting, 0, disables data averaging. This register is only used if bit 2 of Register **S175** (dynamic channel bundling) is set to a value other than 0.

S178 Connection hold time for channel bundling

Range	:	0 to 255 × 10 seconds
Default value	:	2 (20 seconds)
Storage in nonvolatile memory	:	AT&W or AT*W

Register **S178** specifies the time (0 to 2550 seconds) during which the second B channel is held after the throughput falls below the limit defined by Register **S176**. If the throughput falls below the limit and the connection hold time elapses, the second B channel disconnects. This register is only used if bit 2 of Register **S175** (dynamic channel bundling) is set to a value other than 0. Bit 3 of Register **S175** controls the beginning of the connection hold time.

S179 Bearer capability

Register **S179** controls the bearer capabilities for all outgoing analog connections. The contents of Register **S178** can be stored in the nonvolatile memory using the command **AT&W** or **AT*W**. The following table shows the individual bits of Register **S179**. Default settings are shown in **bold**.

Bit	Dec.	Meaning
0..2	0	0 = telephone service (3.1 kHz)
	1	1 = telephone service (analog)
	2	2 = Group 2 fax operation
	3	3 = Group 3 fax operation
	4	4 = data transfer via modem operation
	5	5 = Btx via modem operation

◇ **NOTE** ◇

Register **S179** sets up the service indicator for all connections in ISDN operation, so that e.g. from one device, only calls with the service indicator "Fax operation" are accepted, and from another device, only calls with the service indicator "telephone service" are accepted.

S190 Remote number

Register **S190** is a string register that contains the ISDN number of the currently or last connected remote system (up to 36 digits). If no connection has been established, no number is issued. To reset the contents of this register to zero, use the command **ATS190=0**.

S191 Charge units for current / last connection (DSS1/1TR6)

Register **S191** is used by the European version of *MicroLink ISDN/TL V.34* only (DSS1 and 1TR6 protocols). This register is a string register that shows the number of charge units or the total charge (depending on the network provider) for the current or last connection. This register can contain up to 10 characters. To reset the contents of this register, use the command **ATS191=0**. Depending on the network provider, the charge units may not be written to this register before the connection ends.

S192 Total charge units (DSS1/1TR6)

Register **S192** is used by the European version of *MicroLink ISDN/TL V.34* only (DSS1 and 1TR6 protocols). This register is a string register that contains the total number of charge units or the total charge (depending on the network provider) for all previous connections. This register does not reflect current connections. This register can store up to 10 characters. To reset the contents of this register, use the command **ATS192=0**.

S193 MSN / EAZ / DN of last incoming call

Register **S193** is used by the European version of *MicroLink ISDN/TL V.34* only (DSS1 and 1TR6 protocols). This register is a string register that contains the remote system's Multiple Subscriber Number (MSN, with DSS1 protocol) or the EAZ (terminal selection digit, with 1TR6 protocol) for the most recently dialed call. This register can store up to 16 characters.

If no connection has been made, or if the last connection originated with an outgoing call, no number is issued. To clear the contents of this register, use the command **ATS193=0**, **AT&F** (refer to page 37), or **ATZ** (refer to page 55).

S229 Byte order for saved voice data

Valid values	:	0 or 1 (decimal)
Default value	:	0 (new method)
Storage in non-volatile memory	:	AT*W

Register **S229** controls the order in which bytes of recorded voice data are saved and played. The default setting, 0, selects the new method. Use this method if the older method causes voice files to sound distorted. To reverse the byte order, use the command **ATS229=1**.

You can use the **AT*W** command to save this register setting in nonvolatile memory, or include the command in the initialization of your voice program.

◇ **NOTE** ◇ The **AT&F** command does not reset the value of Register **S229** to the factory default.

S230 Voice option

Register **S230** controls the voice output from your *MicroLink ISDN/TL V.34*. With voice data, the best results are achieved via a PC soundcard. Even without a soundcard, incoming messages can be replayed via the *MicroLink ISDN/TL V.34*'s in-built loud speaker, although with limited audio quality. The contents of Register **S178** can be stored in the nonvolatile memory using the command **AT&W** or **AT*W**. The following table shows the individual bits of Register **S179**. Default settings are shown in **bold**.

Bit	Dec.	Meaning
0	0	0 = No voice output via loud speaker
	1	1 = Voice output via loud speaker enabled.
1...7	0	reserved

5.12 Result Codes

AT commands with effects on result codes

Unless the result codes from the ISDN terminal adapter are disabled with the **ATQ1** command (see page 49), the ISDN terminal adapter will acknowledge command entries and issue messages - for example to report an incoming call or a successful connection.

With the default setting **ATV1** the ISDN terminal adapter sends the result codes in verbose form (followed by <CR> and <LF>). With **ATV0** the result codes are displayed in abbreviated form as digits (followed by <CR>).

V1	V0	Meaning
OK	0	command line executed
RING	2	incoming call
NO CARRIER	3	connection establishment failed, disconnected by the remote side, or inactivity time elapsed (see also registers S154/S155, page 72)
78 ERROR	4	error in command line
NO DIALTONE	6	no connection to ISDN exchange, or own line busy
BUSY	7	called system or ISDN network busy
CALL SENT	252	number complete, call is being processed
ALERTING	253	remote station indicates call
CONNECTING	254	call accepted by remote station, negotiating line protocol

Remote number

In incoming calls the ISDN supplies the number of the calling system, unless this feature is disabled by the remote side. Register S153 (see page 72) controls whether the number is displayed after the **RING** message and/or after the **CONNECT** message.

Examples:

RING;024191777800
CONNECT;024191777800
CONNECT 64000/ISDN/V120;024191777800

or, if abbreviated messages are enabled:

2;024191777800
1;024191777800
221;024191777800

In addition, the Multiple Subscriber Number (MSN), EAZ or DN dialed by the remote side can be displayed. This can be enabled in register S153 (see page 72).

Example:

RING;024191777800;MSN

CONNECT messages

The format of the **CONNECT** messages, i.e. the result codes indicating a successful connection, is influenced by the commands **AT-M**, **ATV**, and **ATX** (see pages 45, 53 and 54). The possible **CONNECT** messages are listed on the following page.

NO CARRIER When the message **NO CARRIER** is displayed, the cause of the disconnection can be determined by means of the registers S153 and S154 (see page 72).
Example: **NO CARRIER;000;000** = normal disconnection by the remote side.

The following table lists the supported result codes in ISDN mode:

V1	V0	X0	X1 X2 X3 X4	-M0	-M1	IV0	IV1	IV2	IV8	Connection type
CONNECT	1	■		■	■	■	■	■	■	Connection of any type with any line bit rate
CONNECT 1200	5									Transfer bit rate with 1200..128,000 bps duplex (independent of transfer protocol)
CONNECT 2400	10									
CONNECT 4800	30									
CONNECT 9600	32		■	■		■		■	■	
CONNECT 19200	32									
CONNECT 38400	32									
CONNECT 48000	32									
CONNECT 56000	32									
CONNECT 64000	32									
CONNECT 112000	32									
CONNECT 128000	32									
CONNECT 56000/REL	32		■	■			■			V.120 or X.75 connection
CONNECT 64000/REL	32									
CONNECT 56000/REL-LAPB	32		■	■				■		V.120 or X.75 connection
CONNECT 64000/REL-LAPB	32									
CONNECT 1200/ISDN/V110	202									V.110 connection with 1200..64,000 bps duplex
CONNECT 2400/ISDN/V110	203									
CONNECT 4800/ISDN/V110	204									
CONNECT 9600/ISDN/V110	205									
CONNECT 19200/ISDN/V110	206		■	■					■	
CONNECT 38400/ISDN/V110	207									
CONNECT 48000/ISDN/V110	208									
CONNECT 56000/ISDN/V110	209									
CONNECT 64000/ISDN/V110	210									
CONNECT 56000/ISDN/HDLC	211									V.120, X.75 or HDLC connection without data compression
CONNECT 64000/ISDN/HDLC	212									
CONNECT 56000/ISDN/V120	221									
CONNECT 64000/ISDN/V120	222		■	■					■	
CONNECT 56000/ISDN/X75	231									
CONNECT 64000/ISDN/X75	232									
CONNECT 112000/ISDN/X75	233									
CONNECT 128000/ISDN/X75	234									

V1	V0	X0	X1 X2 X3 X4	-M0	-M1	\V0	\V1	\V2	\V8	Connection type
CONNECT 56000/ISDN/V120/V42BIS CONNECT 64000/ISDN/V120/V42BIS CONNECT 56000/ISDN/X75/V42BIS CONNECT 64000/ISDN/X75/V42BIS CONNECT 112000/ISDN/X75/V42BIS CONNECT 128000/ISDN/X75/V42BIS	225 226 235 236 237 238		■	■					■	V.120 or X.75 connection with data compression
CONNECT 56000/ISDN/X75/MLP CONNECT 64000/ISDN/X75/MLP CONNECT 112000/ISDN/X75/MLP CONNECT 128000/ISDN/X75/MLP	241 242 243 244			■	■	■	■		■	X.75 connection with 56,000.. 128,000 bps duplex
CONNECT 56000/ISDN/X75/V42BIS/MLP CONNECT 64000/ISDN/X75/V42BIS/MLP CONNECT 11200/ISDN/X75/V42BIS/MLP CONNECT 128000/ISDN/X75/V42BIS/MLP	245 246 247 248			■	■	■	■		■	X.75 with V.42bis connection with 56,000.. 128,000 bps duplex
CONNECT ISDN/V110 CONNECT ISDN/V120 CONNECT ISDN/X75	*) *) *)		■		■	■	■		■	V.110, V.120 or X.75 connection, independent of transfer rate
CONNECT ISDN/V120/V42BIS CONNECT ISDN/X75/V42BIS	*) *)		■		■	■	■		■	V.120, X.75 connection with data compression and independent of transfer rate

*) The command **AT-M1** has no effect on the abbreviated result codes. They are the same as with **AT-M0**.

The following table lists the supported result codes in MODEM mode:

V1	V0	X0	X1 X2 X3 X4	-M0	-M1	W0	W1	W2	W8	Type of Connection
CONNECT	1	■		■	■	■	■	■	■	independent of transfer rate and protocol
CONNECT 300	1									Transfer rate 300..33,600 bps duplex, no error correction / data compression
CONNECT 1200	5									
CONNECT 2400	10									
CONNECT 4800	11									
CONNECT 7200	16									
CONNECT 9600	12									
CONNECT 12000	13									
CONNECT 14400	14									
CONNECT 16800	110		■	■		■	■	■	■	
CONNECT 19200	111									
CONNECT 21600	112									
CONNECT 24000	113									
CONNECT 26400	114									
CONNECT 28800	115									
CONNECT 31200	116									
CONNECT 33600	117									
CONNECT 75/1200	52									
CONNECT 1200/75	53									
CONNECT 300	1									Transfer rate 300 bps duplex with MNP or Transfer rate 1200..33,600 bps duplex with MNP or V.42(bis)
CONNECT 1200	5									
CONNECT 2400	10									
CONNECT 4800	30									
CONNECT 7200	34									
CONNECT 9600	32									
CONNECT 12000	36									
CONNECT 14400	38		■	■		■				
CONNECT 16800	130									
CONNECT 19200	132									
CONNECT 21600	134									
CONNECT 24000	136									
CONNECT 26400	138									
CONNECT 28800	140									
CONNECT 31200	142									
CONNECT 33600	144									

V1	V0	X0	X1 X2 X3 X4	-M0	-M1	W0	W1	W2	W8	Type of Connection
CONNECT 300/REL CONNECT 1200/REL CONNECT 2400/REL CONNECT 4800/REL CONNECT 7200/REL CONNECT 9600/REL CONNECT 12000/REL CONNECT 14400/REL CONNECT 16800/REL CONNECT 19200/REL CONNECT 21600/REL CONNECT 24000/REL CONNECT 26400/REL CONNECT 28800/REL CONNECT 31200/REL CONNECT 33600/REL	20 22 23 31 35 33 37 39 131 133 135 137 139 141 142 144									Transfer rate 300 bps duplex with MNP or Transfer rate 1200..33,600 bps duplex with MNP or V.42(bis)
CONNECT 300/REL - MNP CONNECT 1200/REL - MNP CONNECT 2400/REL - MNP CONNECT 4800/REL - MNP CONNECT 7200/REL - MNP CONNECT 9600/REL - MNP CONNECT 12000/REL - MNP CONNECT 14400/REL - MNP CONNECT 16800/REL - MNP CONNECT 19200/REL - MNP CONNECT 21600/REL - MNP CONNECT 24000/REL - MNP CONNECT 26400/REL - MNP CONNECT 28800/REL - MNP CONNECT 31200/REL - MNP CONNECT 33600/REL - MNP	20 22 23 31 35 33 37 39 131 133 135 137 139 141 142 144									Transfer rate 300..33,600 bps duplex with MNP
CONNECT 1200/REL - LAPM CONNECT 2400/REL - LAPM CONNECT 4800/REL - LAPM CONNECT 7200/REL - LAPM CONNECT 9600/REL - LAPM CONNECT 12000/REL - LAPM CONNECT 14400/REL - LAPM CONNECT 16800/REL - LAPM CONNECT 19200/REL - LAPM CONNECT 21600/REL - LAPM CONNECT 24000/REL - LAPM CONNECT 26400/REL - LAPM CONNECT 28800/REL - LAPM CONNECT 31200/REL - LAPM CONNECT 33600/REL - LAPM	22 23 31 35 33 37 39 131 133 135 137 139 141 142 144									Transfer rate 300..33,600 bps duplex with V.42(bis)

V1	V0	X0	X1 X2 X3 X4	-M0	-M1	W0	W1	W2	W8	Type of Connection
CONNECT 300/MNP	21									Transfer rate 300..33,600 bps duplex with MNP class 1..4
CONNECT 1200/MNP	22									
CONNECT 2400/MNP	23									
CONNECT 4800/MNP	24									
CONNECT 7200/MNP	25									
CONNECT 9600/MNP	26									
CONNECT 12000/MNP	27		■	■					■	
CONNECT 14400/MNP	28									
CONNECT 16800/MNP	120									
CONNECT 19200/MNP	121									
CONNECT 21600/MNP	122									
CONNECT 24000/MNP	123									
CONNECT 26400/MNP	124									
CONNECT 28800/MNP	125									
CONNECT 31200/MNP	126									
CONNECT 33600/MNP	127									
CONNECT 300/MNP5	71									Transfer rate 300..33,600 bps duplex with MNP class 5
CONNECT 1200/MNP5	72									
CONNECT 2400/MNP5	73									
CONNECT 4800/MNP5	74									
CONNECT 7200/MNP5	75									
CONNECT 9600/MNP5	76									
CONNECT 12000/MNP5	77									
CONNECT 14400/MNP5	78		■	■					■	
CONNECT 16800/MNP5	170									
CONNECT 19200/MNP5	171									
CONNECT 21600/MNP5	172									
CONNECT 24000/MNP5	173									
CONNECT 26400/MNP5	174									
CONNECT 28800/MNP5	175									
CONNECT 31200/MNP5	176									
CONNECT 33600/MNP5	177									
CONNECT 1200/LAPM	82									Transfer rate 300..33,600 bps duplex with V.42
CONNECT 2400/LAPM	83									
CONNECT 4800/LAPM	84									
CONNECT 7200/LAPM	85									
CONNECT 9600/LAPM	86									
CONNECT 12000/LAPM	87									
CONNECT 14000/LAPM	88		■	■					■	
CONNECT 16800/LAPM	180									
CONNECT 19200/LAPM	181									
CONNECT 21600/LAPM	182									
CONNECT 24000/LAPM	183									
CONNECT 26400/LAPM	184									
CONNECT 28800/LAPM	185									
CONNECT 31200/LAPM	186									
CONNECT 33600/LAPM	187									

V1	V0	X0	X1 X2 X3 X4	-M0	-M1	W0	W1	W2	W8	Type of Connection
CONNECT 1200/LAPM/V42BIS	92									Transfer rate 300..33,600 bps duplex with V.42bis
CONNECT 2400/LAPM/V42BIS	93									
CONNECT 4800/LAPM/V42BIS	94									
CONNECT 7200/LAPM/V42BIS	95									
CONNECT 9600/LAPM/V42BIS	96									
CONNECT 12000/LAPM/V42BIS	97									
CONNECT 14400/LAPM/V42BIS	98		■	■					■	
CONNECT 16800/LAPM/V42BIS	190									
CONNECT 19200/LAPM/V42BIS	191									
CONNECT 21600/LAPM/V42BIS	192									
CONNECT 24000/LAPM/V42BIS	193									
CONNECT 26400/LAPM/V42BIS	194									
CONNECT 28800/LAPM/V42BIS	195									
CONNECT 31200/LAPM/V42BIS	196									
CONNECT 33600/LAPM/V42BIS	197									
CONNECT	*)		■		■	■	■	■	■	Any transfer rate, without MNP or V.42 with MNP class 1..4 with MNP class 5 with V.42 with V.42bis
CONNECT MNP	*)		■		■	■	■	■	■	
CONNECT MNP5	*)		■		■	■	■	■	■	
CONNECT LAPM	*)		■		■	■	■	■	■	
CONNECT LAPM/V42BIS	*)		■		■	■	■	■	■	

*) The command **AT-M1** has no effect on the abbreviated result codes. They are the same as with **AT-M0**.

Appendices

A AT Commands in Brief

Command	Meaning
A/	Repeat last command entered
A	Accept incoming call
B16	Outgoing digital call, Incoming digital call
B17	Outgoing digital call, Incoming analog call
B18	Outgoing digital call, Incoming analog + digital call
B20	Outgoing analog call, Incoming digital call
B21	Outgoing analog call, Incoming analog call
B22	Outgoing analog call, Incoming analog + digital call
B24	Outgoing analog + digital call, Incoming digital call
B25	Outgoing analog + digital call, Incoming analog call
B26	Outgoing analog + digital call, Incoming analog + digital call
%B300	V.110 line bit rate 300 bps (Modem mode only)
%B1200	V.110 line bit rate 1200 bps
%B2400	V.110 line bit rate 2400 bps
%B4800	V.110 line bit rate 4800 bps
%B7200	V.110 line bit rate 7200 bps (Modem mode only)
%B9600	V.110 line bit rate 9600 bps
%B12000	V.110 line bit rate 12,000 bps (Modem mode only)
%B14400	V.110 line bit rate 14,400 bps (Modem mode only)
%B16800	V.110 line bit rate 16,800 bps (Modem mode only)
%B19200	V.110 line bit rate 19,200 bps
%B21600	V.110 line bit rate 21,600 bps (Modem mode only)
%B24000	V.110 line bit rate 24,000 bps (Modem mode only)
%B26400	V.110 line bit rate 26,400 bps (Modem mode only)
%B28800	V.110 line bit rate 28,800 bps (Modem mode only)
%B31200	V.110 line bit rate 31,200 bps (Modem mode only)
%B33600	V.110 line bit rate 33,600 bps (Modem mode only)
%B38400	V.110 line bit rate 38,400 bps (ISDN mode only)
%C0	No data compression
%C1	V.42bis and MNP5 data compression in modem mode
%C2	V.42bis data compression
%C3	V.42bis and MNP5 data compression in modem mode
&C0	DCD always active
&C1	DCD indicates an existing connection
&C2	DCD dropped only during disconnection
Dn	Establishing connection
\$D0	Disable DTR dialing
\$D1	Enable DTR dialing
&D0	Ignore DTR status change
&D1	Change to Command mode if DTR → OFF
&D2	Disconnect if DTR → OFF
&D3	Disconnect and reinitialize if DTR → OFF

Command	Meaning
\D0	DSR and CTS always on
\D1	DSR indicates B channel switched through, CTS always on
\D2	DSR always on and CTS follows DCD
\D3	DSR indicates B channel switched through and CTS follows DCD
E0	Disable command echo
E1	Enable command echo
%E0	Automatic retrain off
%E1	Automatic retrain on
&F	Load factory configuration
\F	Display stored numbers
%G0	Line bit rate determined by port bit rate
%G1	Line bit rate set with AT%B
&G0	Calling tone on, no guard tone
&G1	Calling tone on, guard tone 550 Hz
&G2	Calling tone on, guard tone 1800 Hz
&G4	Calling tone off, no guard tone
&G5	Calling tone off, guard tone 550 Hz
&G6	Calling tone off, guard tone 1800 Hz
H	Terminate connection (hang up)
-H0	Normal mode
-H1	Dumb Mode
I0	Display product code in format nnn
I1	Display check sum
I2	Display result of check sum
I3	Display firmware version and date
I4	Display current configuration
I5	Display serial number
I6	Display product name and hardware release
+ICLDn	Store numbers for closed user groups
+ICLIn	Set/display subscriber number
+IDNn	Setting and display of Directory Number (DN)
+IDPn	Set/display D channel protocol
+IEAZn	Set/display EAZ digit
+IMSNn	Set/display accepted MSNs
+SPIDn	Set/display Service Profile ID (SPID)
\J0	DTE rate independent of connection bit rate
\J1	Connection bit rate defined by DTE.
L0	Load speaker volume low
L1	Load speaker volume low
L2	Loud speaker volume medium
L3	Load speaker volume high

Command	Meaning
%L0	V.110 line bit rate adaption in ISDN mode
%L1	Partial line bit rate adaption in modem mode V.110 line bit rate adaption in ISDN mode V.100 line bit rate adaption in modem mode
%L2	No line bit rate adaption, connection will be broken in ISDN mode No fallback in modem mode
%L3	V.110 line bit rate adaption in ISDN mode V.100 line bit rate adaption in modem mode
M0	Loud speaker off
M1	Loud speaker on while dialing and waiting for answer tone
M2	Loud speaker always on
M3	Loud speaker on while waiting for answer tone
%M0	V.8 bit rate adaption on
%M1	V.8 bit rate adaption off
-M0	Word CONNECT result codes depend on ATV
-M1	Word CONNECT result codes independent of ATV
&N	Channel bundling
\N	Set operating mode
0	Change to Online state
%P0	No Asynchronous/Synchronous conversion
%P1	Asynchronous/Synchronous conversion for point-to-point protocol on
\Pmn	Store numbers (m = 0..9, n= up to 36 digits)
Q0	Enable result codes
Q1	Disable result codes
Q2	Disable result codes in answer mode
*Q0	Enable CONNECT result code after invalid escape sequence
*Q1	Disable CONNECT result code after invalid escape sequence
\Q0	No Handshake
\Q1	XON/XOFF handshake bi-directional
\Q2	CTS handshake unidirectional
\Q3	RTS/CTS handshake bi-directional
\Q4	XON/XOFF handshake unidirectional
\Q5	as \Q2, but CTS OFF until connection established
\Q6	as \Q3, but CTS OFF until connection established
%R0	Display register contents, two registers per line
%R1	Display register contents, one register per line/ continuous display
Sn=x	Set register n to value x
Sn?	Read value for register n
Sn	Set register n as the default register
?	Read the value of the register last in use
=x	Sets the value of the last used register to x
%S0	ISDN bit rate 64,000 bps
%S1	ISDN bit rate 56,000 bps
&S0	DSR always active
&S1	DSR indicates B channel active
\Tn	Inactivity timer (n = 0..255; Standard value = 0)

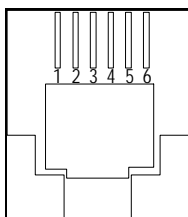
Command	Meaning
V0	Enable numeric result codes
V1	Enable word result codes
%V	Display firmware version
&V0	Display configuration profiles
\V0	No modified CONNECT result codes
\V1	Identify error-corrected connections
\V2	Identify error-corrected connections and method
\V8	Comprehensive CONNECT result codes
&W0	Save configuration profile 0
&W1	Save configuration profile 1
*W0	Save extended configuration profile 0
*W1	Save extended configuration profile 1
X0	Busy line reported with NO CARRIER, CONNECT or '1' respectively
X1	Busy line reported with NO CARRIER
X2	Busy line reported with NO CARRIER
X3	Busy line reported with BUSY
X4	Busy line reported with BUSY
\X0	XON/XOFF are not passed to the remote unit
\X1	XON/XOFF are passed to the remote unit
&Y0	Select profile 0 for startup configuration
&Y1	Select profile 1 for startup configuration
Z0	Load configuration profile 0
Z1	Load configuration profile 1
&Zm=n	Store numbers (m= 0 to 19)

B Technical Specifications

Power supply		9 V _{AC} , max. 900 mA
Power consumption		8 W
Design and dimensions		Desktop device with metal housing 108 x 36 x 200 mm (W x H x D)
Environment	Temperature	5..40°C
	Humidity	0..80%, non-condensing
ISDN Interface	S ₀ -Bus	Basic rate interface (S ₀ -bus, I.430) and ISDN-PBX-device with S ₀ -bus
Transmission modes	D channel protocol	Euro-ISDN/DSS1, 1TR6 (incl. SPV), National ISDN-1, AT&T 5ESS (also point-to-point) point to multipoint
ISDN mode	Transfer protocols	V.110 (I.463) (asynchronous 1200..38,400bps), V.120 (56,000bps, 64,000bps), X.75 with 64,000bps and 56,000bps X.75/T.70NL with 64,000bps and 56,000 bps X.75-T-Online (VT-100) X.75-T-Online (CEPT/KIT) HDLC synchronous, 56,000/64,000 bps PPP after RFC 1662
	Data compression	V.42bis (data throughput up to 23 Kbytes/s over one B channel)
	Channel bundling	Static and dynamic (data throughput up to 15 Kbytes/s without compression)
	Max. data throughput	230,400 bps asynchronous at the ED interface
	Error correction	When using ITU-T V.120 and X.75
	Protocol recognition	Automatic switching between V.110, V.120 and X.75
	Bit rate recognition	Automatic in V.110 mode (asynchronous) and automatic switching between 64,000/56,000 bps
Modem mode	Transfer rates	33,600..300 bps asynchronous V.34, V.Fast Class, V.32bis, V.32, V.22bis, V.21, V.23, also Bell 212A and Bell 103
	Data compression	V.42bis and MNP Class 5
	Error correction	V.42 and MNP Class 4
	Bit rate adaption	V.8 and V.100 (can be disabled)

Fax mode	Transfer rates	14,400..2,400 bps with V.17, V.33, V.29, V.27ter
	Command set	TR-29.2 Class 2 (SP-2388), Class 2.0 (TIA/EIA-592) and Class 1 (TIA/EIA-578)
	Operating modes	Send- and Receive Fax, Fax-Polling
Voice mode	Tone in- and output	via PC soundcard
	Command set	Voice command set as PN-2986 and Rockwell
Command set		Extended AT command set including EAZ- and MSN support, caller identification and charge unit counting, connection status
Computer interface		RS232/V.24/V.28, 25 pin D subminiature connector 1200..230,400 bps, asynchronous; Data format: 8 data bits, no parity, 1 stop bit (8,n,1)
System monitoring		Automatic hang-up with an unused line, (can be disabled), charge unit counting and limitation
Status display		Colored LEDs to check ISDN interface and connection, V.24 display; loud speaker to monitor analog connections
Additional options		Control of closed user-groups by checking the caller number
FCC conformance		Yes, see over
CE conformance		Yes; conforms to EN 50082/Part 1, EN 55022, Class B
Approvals	EU (except for France)	CE 0188 X
	Germany	BZT A116180E
	Switzerland	BAKOM 96.0026.I.N
	USA	See FCC label on the housing

RJ-11 Socket Pin Assignment



Line	IAE	S ₀ Socket
-	-	1
T+	2a	2
R+	1a	3
R-	1b	4
T-	2b	5
-	-	6

FCC Conformance Certificate

C RS-232/V.24 Interface

The interface between your *MicroLink ISDN/TL V.34* and computer consists of several data, control, and signal lines. The front panel LEDs show the status of most of these interface lines. The following table lists the pin assignment of the RS-232/V.24 interface for 9-pin and 25-pin connectors.

9-pin	25-pin	ITU-T	DIN	USA	Description	Signal direction
U*	1	101	E1	GND	Protective Ground	-
5	7	102	E2	GND	Signal Ground	-
3	2	103	D1	TxD	Transmit Data	→ ISDN modem
2	3	104	D2	RxD	Receive Data	← ISDN modem
6	6	107	M1	DSR	Data Set Ready	← ISDN modem
8	5	106	M2	CTS	Clear to Send	← ISDN modem
9	22	125	M3	RI	Ring Indicator	← ISDN modem
1	8	109	M5	DCD	Data Carrier Detect	← ISDN modem
4	20	108	S1	DTR	Data Terminal Ready	→ ISDN modem
7	4	105	S2	RTS	Request to Send	→ ISDN modem

* U = housing/shield

The interface lines have the following meanings:

■ DTR (Data Terminal Ready)

This control line indicates that the computer and *MicroLink ISDN/TL V.34* are ready for operation. This control line on the *MicroLink ISDN/TL V.34* is determined by the **AT&D** command (refer to page 36).

■ RTS (Request To Send)

This control line indicates that your computer is ready to send data. This interface line is used for data flow control (hardware handshake).

■ Data Set Ready (DSR)

This control line indicates that your *MicroLink ISDN/TL V.34* is ready for operation. This signal line is usually always active (ON), but is controlled by the commands **AT\D** and **AT&S** (refer to pages 36 and 52).

■ Clear To Send (CTS)

This control line indicates that your *MicroLink ISDN/TL V.34* is ready to send data. This output signal from your *MicroLink ISDN/TL V.34* is normally always active (ON), but is controlled by the **AT\D** and **AT\Q** commands (refer to pages 36 and 50).

■ Ring Indicator (RI)

This control line indicates when an incoming call is being detected. This output is active (ON) when the *MicroLink ISDN/TL V.34* detects an incoming call. Incoming calls are only detected if the DTR control line is active (ON) or the **AT&D0** is in effect. (Refer to the **ATA** command on page 32.)

■ Data Carrier Detect (DCD)

This output from the *MicroLink ISDN/TL V.34* normally becomes active (ON) when a successful connection has been established. It is controlled by the **AT&C** command (refer to page 34).

D Error Codes

When an error occurs, a value corresponding to the cause of the error gets written to Registers **S154** and **S155**. These values can help you identify the problem.

To read the values of these registers, place your *MicroLink ISDN/TL V.34* in Command Mode, then type **ATS154?** <CR> and **ATS155?** <CR>.

Error codes S154/S155	Meaning	Reason and possible solution
AT command interface errors		
001/001	Connection establishment aborted by entering a character during connection establishment	Entering characters during connection establishment is normally not allowed. To allow it, set bit 6 of register S14 to 1 (allow polling during connection establishment).
001/002	Connection establishment aborted, the bit rate set with AT%B or in S37 cannot be used.	The AT%B command is only effective in V.110 mode. The bit rate set with AT%B must not be higher than 38,400 bps.
001/003	Call is no longer waiting on the line (after ATA or ATO)	Remote side has withdrawn the call, or other terminal device has accepted the call.
001/004	T-Online protocol error on the serial interface (Germany only)	Try to call again.
001/005	Disconnection with ATZ	Entering ATZ in the command state in an existing connection terminates the connection.
001/006	Inactivity time elapsed (disconnection)	The time in which no more data were sent has exceeded the value set in register S30 or with the AT\Tn command.
001/007	Disconnection by DTR → OFF	The DTR signal line was dropped, possibly by the communications program.
001/008	Cost limit set in register S167 exceeded	Check the values of the registers S167 to S170 . Switching the ISDN terminal adapter off and on will reset the registers.
Local errors		
051/001	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 terminal adapter directly at the NT (Network Terminator).
051/002	D channel layer 2 establishment error	
051/003	B channel layer 1 establishment error	Check the B channel protocol of the remote side.
051/004	B channel layer 2 establishment error	
051/005	D channel layer 1 disconnection	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).
051/006	D channel layer 2 disconnection	
051/007	D channel layer 3 disconnection	Check the selected D channel protocol (AT+IDP?).
051/008	B channel layer 1 disconnection	Disconnected by the remote side or connection error.
051/009	B channel layer 2 disconnection	
051/010	B channel layer 3 disconnection	Re-establish the connection.
051/011	B channel layer 2 disconnection	Connection error caused connection restart -

Error codes S154/S155	Meaning	Reason and possible solution
051/012	B channel layer 3 disconnection	data loss possible.
051/128	V.110 transfer frame of the remote side not recognized	In V.110 mode with automatic bit rate adaptation in answer mode (AT%L1), the bit rate of the caller must be \leq your own bit rate.
051/129	V.110 transfer frame of the remote side aborted	Re-establish the connection.
051/133	Invalid V.110 bit rate (E bits)	A connection could not be established, because the V.110 bit rate used by the remote side is not supported. Contact the remote side and agree on a bit rate supported by both sides.
051/134	V.110 bit rate (E bits) not supported	
051/136	V.110 connection establishment error	Error messages during the connection establishment have no effect.
051/144	V.42bis error (compressed data cannot be decoded)	The remote side is not V.42bis compatible. Restart the transfer without data compression.
Error messages from ISDN (valid for 1TR6 protocols)		
052/000	Disconnection by the network, no reason specified or reason not translatable	Try to call again.
052/128	Normal disconnection	Both sides have terminated the connection properly.
052/131	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).
052/138	Own line busy	Your line is occupied by other terminal devices. Terminate other connections first.
052/144	Semi-permanent connections not supported by the network	Apply to your network operator for semi-permanent connections.
052/145	Requested service not available	Apply to your network operator for this service
052/160	Outgoing calls locked	Ask your network operator to unlock your line for outgoing calls.
052/161	Remote side busy	Try to call again later.
052/165	Semi-permanent connection not allowed between these stations	Apply to your network operator for semi-permanent connections.
052/181	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).
052/184	Remote number has changed	Ask for the new number of the remote side.
052/185	Remote terminal device not ready	Check whether the remote side is ready for operation.
052/186	No remote device has answered the call	Check whether the remote side is ready for operation and the remote EAZ or MSN used.
052/187	Remote terminal device busy	Try to call again later.
052/189	Incoming calls locked on the remote side	Ask the remote side to accept incoming calls.
052/190	Call refused by remote side	Contact the remote side.
052/217	Network busy	Try to call again later.

Error codes S154/S155	Meaning	Reason and possible solution
052/218	Call refused or disconnected by the remote side	Try to call again later or contact the remote side.
052/240	Local protocol error	Try to call again.
052/241	Remote protocol error	
Error messages from the ISDN (valid for DSS1, and US protocols)		
052/000	Disconnection by the network, no reason specified or reason not translatable	Try to call again.
052/128	Normal disconnection	Both sides have terminated the connection properly.
052/131	Data transfer service not available	Check the remote number and the availability of the desired services (this applies also to private branch exchanges).
052/138	B channel not available	Wait and try to reconnect
052/145	Possibly SPID wrong or used by another terminal	Check the SPID number.
052/181	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).
052/184	Remote number has changed	Ask for the new number of the remote side.
052/185	Remote terminal device not ready	Check whether the remote side is ready for operation.
052/186	No remote device has answered the call	Check whether the remote side is ready for operation and check the MSN or EAZ used.
052/187	Remote terminal device busy	Try to call again later.
052/190	Call refused by remote side	Contact the remote side.
052/217	Network busy	Try to call again later.
052/241	Remote error	Try to call again.
052/255	Unknown error message in the network	
MLP errors (channel bundling)		
065/001	MLP block error	The remote side is not ELSA MLP compliant. Re-establish the connection without channel bundling.
065/002	MLP disconnection (primary connection aborted)	The primary connection was aborted before the secondary connection. Possibly wrong behavior of the remote side.

Additional to the registers S154/S155, error codes indicating the source of problems with DSS1 (Euro-ISDN) connections can be read using the register S165. This register offers a detailed insight into the cause of errors.

S165 Error Code	Meaning
Error Code from the ISDN (for DSS1 Protocol only)	
001	Number not assigned
002	No path to requested transfer network
003	No path to target available
006	Channel not accepted
017	Remote station busy
018	Remote station does not respond
019	Remote station does not answer
021	Call cancelled
022	Number has changed
027	Remote station not ready
028	Incorrect number
029	Service feature rejected
034	No channel available
038	ISDN network not ready
041	Temporary error
042	ISDN network overloaded
044	Channel or service not available
047	Service not available
049	Service not available
050	Requested service is not ordered
057	Bearer capability not authorized
058	Bearer capability not presently available
063	Service or option not available
065	Service not available
066	Channel type not implemented
069	Requested property not available
070	Only service data transfer is available
079	Service or Option not available
088	Remote station does not support requested service
091	Invalid transfer network choice
127	Unknown ISDN error

E Answers to Frequently Asked Questions

General Issues

How can I send AT commands to the *MicroLink ISDN/TL V.34* ?

To use AT commands to communicate with a *MicroLink ISDN/TL V.34*, you need a suitable communications or terminal program such as Telix. After starting Telix, you can enter AT commands in the terminal screen. The commands you type are sent to the *MicroLink ISDN/TL V.34* via your PC's serial interface. See your Telix documentation for detailed information on how to use this program.

What must I do to configure my *MicroLink ISDN/TL V.34* for the correct D channel protocol (Euro-ISDN/DSS1, 1TR6, NI-1 or AT&T 5ESS) ?

European version:

All European ELSA *MicroLink ISDN/TL V.34* ISDN terminal adapters are preconfigured for Euro-ISDN (DSS1). You only need to enter the desired your ISDN line's MSN (Multiple Subscriber Number, up to eight digits). With the **AT+IMSN** command, you can assign up to two different MSNs (named 0 and 1) to your *MicroLink ISDN/TL V.34*. If, for example, you want to assign the number 12345678, type **AT+IMSN0=12345678** and press <CR>. To display the MSNs currently assigned to the *MicroLink ISDN/TL V.34*, type **AT+IMSN?** and press <CR>.

To operate your *MicroLink ISDN/TL V.34* on a 1TR6 ISDN line (an early German ISDN standard), use the command **AT+IDP=1TR6** to set the *MicroLink ISDN/TL V.34*'s D channel protocol. If you want to know which D channel protocol is currently active, type **AT+IDP?** and press <CR>. The EAZ (terminal selection digit) is preset to 0. If, for example, you want to use 7 as EAZ digit, type **AT+IEAZ=7** and press <CR>. To find out which EAZ digit is currently assigned to the *MicroLink ISDN/TL V.34*, type **AT+IEAZ?** and press <CR>.

The **AT&F** command (factory reset) always resets the assigned EAZ digit to 0. This command does not, however, reset the D channel protocol. Thus if the 1TR6 protocol was selected with **AT+IDP** command, it will still be available.

US version:

All US *MicroLink ISDN/TL V.34* ISDN terminal adapters are pre-configured for the National ISDN-1 protocol (NI-1). To operate your *MicroLink ISDN/TL V.34* on a 5ESS line (a preliminary AT&T ISDN standard), use the command **AT+IDP=AT&T**. To find out which *MicroLink ISDN/TL V.34* D channel protocol is currently active, type **AT+IDP?** and press <CR>.

Note that you must store a Service Profile ID (SPID number) in nonvolatile memory before you can establish your first connection (refer to the command **AT+ISPID** on pages 16 and 43).

What is the best initialization string for calling a BBS?

All ELSA *MicroLink ISDN/TL V.34* ISDN terminal adapters come pre-configured to maximize BBS operations. To save your changes to the configuration in the nonvolatile memory, use the command **AT*W**. You can restore the factory default settings with the **AT&F** command.

How can I accelerate data communications programs such as CompuServe Information Manager under Windows?

If your computer has a buffered UART interface chip (type 16550), make sure the [386Enh] section in the SYSTEM.INI file of your Windows directory has the following entry:

COMxFIFO=1

For the variable **x**, enter the number of the interface you chose (for example, COM2FIFO=1; '2' stands for COM port 2). You can use the supplied diagnostic program, MODEMTST.EXE, to check which UART type is used on the selected interface.

If your computer does not have a 16550 UART, we recommend that you upgrade or replace your serial interface board.

My *MicroLink ISDN/TL V.34* does not accept any AT commands.

If your typed AT commands do not appear on your computer screen and/or are not executed by your *MicroLink ISDN/TL V.34*:

- Verify that your communication software is configured to address the same COM port to which your *MicroLink ISDN/TL V.34* is connected.
- Make sure your communication software is addressing the appropriate interrupt line (IRQ) for the selected COM port. You can use the supplied diagnostic program ,MODEMTST.EXE, to determine the IRQ for your serial interface
- If you have changed the *MicroLink ISDN/TL V.34* configuration, use the **AT&F** command to restore the factory default settings (even if this command does not appear on the screen). You should now be able to enter an **AT**, which the *MicroLink ISDN/TL V.34* answers with **OK**.

The *MicroLink ISDN/TL V.34* always reports NO CARRIER after a dial attempt. Why can't I establish a connection?

The reason for a failed connection establishment can be determined by reading the values of Registers **S154** and **S155**. Use the commands **ATS154?** and **ATS155?** to read these register values. Then locate the error code in the table on page 99 to find the reason for the failure.

US version: Make sure you stored a valid Service Profile ID (SPID number) using the command **AT+ISPID** (refer to page 43). The *MicroLink ISDN/TL V.34* must have a unique SPID to establish a connection. In addition, your ISDN line must provide a data communications service. Ask your network provider for details.

In V.110 operation, I get a NO CARRIER result code after each dial attempt. The Registers S154/S155 contain the error code 051/128: V.110 transfer frame of the remote side not recognized. This problem does not appear in X.75 mode. Why?

Unlike X.75 or V.120 operation, where a constant line bit rate of 64,000 or 56,000 bps is used on the ISDN side, the ISDN line bit rate in V.110 mode can be set to values between 38,400 and 1200 bps. There are two ways to set the transfer speed in V.110 mode (**AT\N0**):

- If the *MicroLink ISDN/TL V.34* is configured to **AT%G0** (default setting), the ISDN line bit rate is set according to the bit rate used on the serial port. In this case set the serial port rate of your communications program to the speed you wish to use on the ISDN side.
- If the *MicroLink ISDN/TL V.34* is set to **AT%G1**, you can set a fixed ISDN line bit rate independently of the serial port rate using the command **AT%Bxxxxx**.

Please note that the line bit rate set by the caller must not be greater than the line bit rate set on the called side.

For example, assume you want to call the CompuServe ISDN node in Munich or ISDN Datex-P nodes, which can only be dialed via V.110. Also assume that you are using a fixed bit rate of 9600 bps. To work with these conditions, your *MicroLink ISDN/TL V.34* must be configured with the commands **AT\N0&G1%B9600**. If you try to call with a higher speed, no connection can be established and you receive a **NO CARRIER** result code (see error codes 051/128 in Registers **S154** and **S155** on page 72). In this case, the V.110 transfer frame of the caller does not match the transfer frame of the remote station.

Can I call a remote station using a different D channel protocol than my own ISDN line (DSS1, 1TR6, NI-1 or AT&T 5ESS) ?

The different D channel protocols are not relevant, since they only affect the connection between your local system and the nearest public ISDN exchange. Therefore, a connection can be established between two stations using different D channel protocols.

How can I disable the online data compression to transfer files which have already been compressed (e.g. ZIP or ARC files) ?

The data compression is controlled by the **AT%C** command. The default setting, **AT%C3**, selects V.42bis data compression. Since no increase in performance is realized by compressing already-compressed files during the transfer, the V.42bis compression protocol is able to recognize compressed files and disable the compression during the file transfer. Thus it is not necessary to disable the data compression manually.

What can I test with the program MODEMTST?

Your ELSA *MicroLink ISDN/TL V.34* ISDN terminal adapter is shipped with a diagnostic program named MODEMTST.EXE. You will always find the latest version in the *ELSA ONLINE* Support BBS (refer to page 91) and in the ELSA forum in CompuServe for download.

MODEMTST offers the following functions:

- Test the serial ports (for example, to determine the IRQ and the UART chip used)
- Display the configuration of the *MicroLink ISDN/TL V.34*
- Display the parameter settings of the *MicroLink ISDN/TL V.34*
- Establish a test connection (with the *ELSA ONLINE* BBS)

I frequently get CRC errors when uploading or downloading files to/from a BBS; sometimes even the connection is lost. What can be the reason?

You may be using an improper or missing handshake method. To take advantage of data compression protocols, the serial port bit rate (defined in the communications software) should normally be set higher than the ISDN line bit rate (for example, 115,200 bps instead of 64,000 bps). However, this rate requires either a hardware handshake (RTS/CTS) or software handshake (XON/XOFF) flow control method.

The same handshake method must be set in both your *MicroLink ISDN/TL V.34* and communication software. Otherwise, CRC errors are likely to occur in data transfers. If you use RTS/CTS handshake, you may have an improperly configured serial interface cable. If you use an RS-232/V.24 adapter from 25-pin to 9-pin (also called "mouse adapter"), the RTS and CTS lines (pins 4 and 5) may not be connected. Make sure you use an RS-232/V.24 adapter with all lines connected.

Another possible error source is the serial interface of your computer. At bit rates of 19,200 bps and higher under DOS, and generally under Windows or OS/2, you should use a high-speed 16550 UART chip. This UART is equipped with a 16-byte FIFO buffer, allowing considerably higher transfer rates than 8250 and 16450 UARTs, which are reliable up to 9600 bps. At rates of 19,200 bps and higher, these UARTs may lose characters and will thus cause CRC errors.

OS/2 Issues

When using Telix for DOS or the communications program ZOC in a DOS box under OS/2, I frequently get CRC errors. When I run Telix directly under DOS, no errors occur. I am using a 16550 UART, so the UART type cannot be the cause of the problem.

The standard communications drivers shipped with OS/2 may cause problems when transferring data across the serial interface of your PC at high rates. In this case, the optimized communications drivers SIO.SYS and VSIO.SYS programmed by Ray Gwinn will help. They must be entered as devices in the CONFIG.SYS file instead of the standard OS/2 drivers, COM.SYS and VCOM.SYS.

You can download these shareware drivers from the ISDN forum on the *ELSA ONLINE* Support BBS. The compressed file contains detailed installation instructions.

Telix

I get several CRC errors when transferring files with Telix for DOS. What can be the reason?

Make sure your *MicroLink ISDN/TL V.34* and Telix are using the same handshaking method. All ELSA modems are preset to RTS/CTS handshake (**ATIN3**). In Telix for DOS v3.22, XON/XOFF handshake is the default setting. Make the following changes in the Telix configuration (<Alt> <O>) under "Terminal options":

```
J - XON/XOFF Software Flow Control   Off
K - CTS/RTS Hardware Handshaking     On
```

When exiting the configuration, select "Write setup to disk" to activate the changes each time Telix starts.

How must Telix for Windows be configured for the *MicroLink ISDN/TL V.34*?

Under Telix for Windows or other terminal programs, an external *MicroLink ISDN/TL V.34* can be accessed with AT commands, just like a conventional analog modem. The following configuration settings are important for the operation with a *MicroLink ISDN/TL V.34*:

- Select the COM port to which your *MicroLink ISDN/TL V.34* is connected.
- The serial port rate can be set to 115,200 bps. If you get frequent CRC errors at this speed, reduce it to 57,600 bps or install an optimized Windows communications driver, such as RHSICOMM.DRV, in your WIN.INI file.
- Set the data flow control to CTS/RTS hardware handshake.
- The dial prefixes should **not** contain any analog modem dialing parameters like **P** (for pulse dialing), **T** (for tone/frequency dialing) or **W** (wait for dialtone).

In Telix for Windows, you may for example copy the connect device "ELSA *MicroLink* 28800TL" from the list of devices which can be installed in the connect device manager ("Connect Devices" in the "Configuration" menu) and rename it (for example, to "ELSA *MicroLink ISDN/TL*pro"). In this new device, you can then make the configuration changes for *MicroLink ISDN/TL V.34* as described above.

If you have Telix for Windows v1.10 or later, your *MicroLink ISDN/TL V.34* should be detected and installed automatically if you scan the ports.

Btx / T-Online

I want to call the German Btx / T-Online online service with 64,000 bps. What must I do?

Include the **&FN9** command in the initialization string of your Btx or KIT decoder program. This setting lets you establish error-corrected connections to German Btx/T-Online nodes (ISDN number 01910 in Germany). **ATIN9** selects the CEPT or KIT access, where you can read all CEPT and KIT graphics pages. **ATIN8**, on the other hand, selects VT-100 access, where you can read VT-100 compatible pages only.

F Product Support

You need help? If you encounter any problems during the installation or operation of your ISDN terminal adapter, please consult this manual first.

If you have further questions, you can contact our Support team. In this case, please always provide the following information:

◇ IMPORTANT ◇

- Precise model name and firmware version of the ISDN terminal adapter (the firmware version can be displayed with the **ATi3** command, and the model name can be displayed with **ATi6**).

- The configuration of the terminal adapter.
The current parameter settings can be displayed with the command **ATi4**, the register values are displayed with **AT%R**. Special ISDN settings are displayed with **AT+I<...>?** commands. For example, the **AT+IMSN?** command displays the MSNs selected for the ISDN terminal adapter.

- 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 exactly describe the steps you took to deliberately trigger the error.

If you get an unexpected NO CARRIER message, you can determine the reason for the disconnection by means of the registers S154/S155 (see page).

Who to contact? First you should contact the dealer or firm where you bought your ISDN adapter board. If there are still questions remaining, contact one of the following:

- The *ELSA ONLINE* Support BBS in Germany:

ISDN

+49/0-241-9177-7800

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

+49/0-241-9177-981

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
- The **ELSA** Internet WWW Homepage :
<http://www.elsa.de>
- Or write to:
ELSA GmbH
Data Communications Support
Sonnenweg 11
52070 Aachen
Germany
Fax +49-241-9177-113
- In very urgent cases, call the **ELSA Hotline** in Germany:
Phone +49-241-9177-110
Monday to Thursday from 9 am to 4:30 p.m. (CET)
Friday from 9 am to 12 p.m. (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
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Configuration problems?

In the *ELSA ONLINE* Support BBS (forum ISDN, file area CONFIG) and in ELSA's CompuServe forum you will find information about the configuration of many applications for the use with ELSA *MicroLink*® ISDN terminal adapters.

Please first make sure that you are using the latest software and driver versions. The latest versions are always available for download in the *ELSA ONLINE* Support BBS and in ELSA's CompuServe forum. Here you will find lots of information and answers to frequently asked questions (FAQs).

Support BBS

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

The Support BBS is divided into product-specific forums, which are structured similar to file directories. In these forums, you can exchange experiences with other users and ask questions to the ELSA Support team. Furthermore, the Support BBS always holds latest product information, examples and application software.

◇ ATTENTION ◇

Please pay attention to the forum structure of *ELSA ONLINE*. If you have a question, please always choose the appropriate forum, for example the ISDN forum if you have questions about an ISDN product. This facilitates our support work and guarantees that your question is answered as soon as possible.

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

Login screen of
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: +49/0-241-9177981      (33600.. 300 bps)
ISDN  : +49/0-241-91777800   (64000..1200 bps)

          Durchgehend geoeffnet

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

Vor- und Nachname:

```

Enter your first and last name at the prompt "Vor- und Nachname". If you are a new user, you can now select the language for the BBS menus and texts.

◇ NOTE ◇

If you feel lost the first time you visit our BBS, don't be discouraged! There is no way to damage your or our computer system by making wrong entries. The BBS software is designed to give you any possible help to find your way. Most problems will disappear if you read the login bulletin and other provided help and information texts carefully.

Registration

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

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

The registration is performed via the menu option "REGISTER" and is at no additional cost for you (except for the costs for the call). To register, you must tell the system your address, phone number and, if available, your fax number. Your registration will be processed within one working day. After that, you are a registered user entitled to access the product information forums and to put questions to our Support team.

◇ NOTE ◇

When trying to access a software Support forum (such as TELIX or TELIXWIN) for the first time, you will be asked for the serial number of your software. You will find the Telix serial number on the original Telix disk label. After

entering a valid serial number, you are entitled to access the forum and write E-mails 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. Please always choose the appropriate mail area for your questions, for example "ELSA ISDN Adapters" or "ISDN Software" for questions about your ISDN product. This facilitates our support work and guarantees that your question is 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 that your ISDN terminal adapter is defective and that it may be the configuration that is at fault, please call the ELSA Hotline before sending us the ISDN terminal adapter for repair.

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

You can help us to do the repair as fast as possible by including a detailed error description with the device, to help us track down the error source. Please send your ELSA product directly to our Service department.

G Glossary

1TR6	<i>1TR6</i> is a specification by the German Telekom for ISDN terminal devices with 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.
5ESS	<i>5ESS</i> is a US standard for the ISDN $\rightarrow D$ channel protocol developed by AT&T. It is a preliminary standard to the National ISDN-1 standard ($\rightarrow NI-1$).
Asynchronous transmission	In serial data transmission a method is needed to synchronize transmitter and receiver in order to enable the receiver to detect the beginning and end of a transmitted character. In <i>asynchronous transmission</i> this structuring is achieved by marking each byte to be sent with one start bit and one or two stop bits. Especially in the microcomputer sector, this start/stop method is one of the most commonly used transmission methods, since, unlike \rightarrow synchronous transmission, it is comparatively easy to perform.
AT command set	The extended <i>AT command set</i> (AT = command prefix <i>Attention</i>) has become a world-wide standard for the syntax of \rightarrow modem control commands. To give data communications users the possibility to maintain their familiar command interface when changing over to ISDN, ELSA <i>MicroLink</i> ® ISDN products can be controlled with AT commands as well.
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	<i>Baud</i> (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.
CAPI	<i>Common ISDN API (API = Application Programming Interface)</i> . This is a software interface developed by German ISDN adapter manufacturers in cooperation with the German FTZ, which is used for communication between ISDN adapters and ISDN application software.
CCITT	\rightarrow ITU-T
Communications software	In order to access <i>MicroLink ISDN/TL V.34</i> from a personal computer, for example to choose transmission parameters or to start a data transfer (\rightarrow Download, \rightarrow Upload), a suitable <i>communications software</i> , also called <i>terminal program</i> , is needed. Such a program emulates an "intelligent terminal" on the PC, i.e. a simple input/output device equipped with additional features for saving received data and transmitting stored data. All ELSA

MicroLink® products supporting the →AT command set are shipped with the communications program **Telix**.

Control channel	ISDN signaling channel (also called <i>D channel</i>) for the transmission of control data (e.g. message about incoming call etc.) between the ISDN interface and the public exchange. In Europe the bit rate of a D channel is normally 16,000 bps, while the →data channels use 64,000 bps (in the US also 56,000 bps).
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 (in the US also 56,000 bps).
Data format	To allow a data exchange between two stations in an →asynchronous transmission, the parties must agree on the length and structure of the bytes to be transferred. This specification is called <i>data format</i> . The most common data formats for asynchronous transmission are: 8N1 (1 start bit, 8 data bits, no parity bit and 1 stop bit = 10 bits per byte) and 7E1 (1 start bit, 7 data bits, 1 parity bit (even parity) and 1 stop bit = 10 bits per byte).
DN	The <i>Directory Number</i> (valid for US point-to-multipoint protocols only): Each B-channel requires an extension number, under which it can be reached by other ISDN devices. See also SPID.
DSS1	A European standard developed by the →ETSI for the →D channel protocol (also called <i>Euro-ISDN</i>). In Germany, this standard has been 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 transmitted utilizable data per 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> means the totality of control software integrated with the hardware of a device, 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).
I.430	This →ITU-T standard describes layer 1 of the user/network interface of an ISDN →Basic Rate Interface.
I.463	→V.110
I.465	→V.120
ISDN	Abbreviation of <i>Integrated Services Digital Network</i> .
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 numbers to be assigned to one ISDN line by the responsible exchange. 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 actual number, an MSN can be up to eight digits long.
Multiple Subscriber Number	→MSN
National ISDN-1	→NI-1
NI-1	The <i>National ISDN-1</i> standard is a common specification in the US for the ISDN →D channel protocol.
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.
Parity bit	The parity bit is a control bit that is sent in addition to a number of data bits in a data transmission. The data bits set to "1" are supplemented by the parity bit to an even or odd bit sum. The parity check is a simple method of error detection. However, this method is not very reliable, as for example double bit errors are not recognized. Therefore in data communications normally "no parity" is selected, which besides results in an increase of the transmission speed, since no additional parity bit has to be sent.

PPP	<i>Point-to-Point Protocol</i> . This is a transmission protocol for carrying network packets (such as Internet etc.) to the end user.
S₀ bus	Link between →Basic Rate Interface and terminal device. Up to eight ISDN terminal devices can be operated simultaneously on one S ₀ bus, and up to 12 connection sockets can be connected to the bus.
SPID	<i>Service Profile ID</i> (valid for US point-to-multipoint protocols only) is an identifier for each B-channel. The SPID must match to the Directory Number (see DN) for a connection to be established.
S/T Interface	→S ₀ bus
Synchronous transmission	<i>Synchronous transmission</i> is, like →asynchronous transmission, a method to synchronize transmitter and receiver. Unlike asynchronous transmission, in this method of data transmission the synchronization is not achieved by start and stop bits for an entire character, but by clock pulses for each single bit. Due to the elimination of the additional start and stop bits, synchronous transmission is faster, but also requires a considerably greater technical effort.
T.70NL	T.70NL is a data packet header used in the transmission standard →X.75. The T.70NL header must be enabled or disabled on both ends of the transmission.
TA	→Terminal adapter
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. <i>MicroLink TL V.34</i> has a green LED that indicates whether a TEI has been assigned to the terminal adapter.
Terminal Endpoint Identifier	→TEI
Terminal adapter	<i>Terminal adapters (TA)</i> are used to connect non-ISDN devices to the ISDN. An a/b terminal adapter, for example, can be used to connect devices designed for analog telephone networks, such as analog telephones, class 2 and 3 fax devices, modems etc. <i>MicroLink ISDN/TL V.34</i> is an external RS-232/V.24 terminal adapter, allowing the access of the ISDN through the serial RS-232/V.24 interface of a computer.
Transmission protocol	To transmit data files from one computer to another, a range of <i>transmission protocols</i> exists in order to provide a trouble-free file transfer. Over the years, protocols of different efficiency and convenience have been developed. In principle, they all work as follows: Data are usually transmitted as data blocks and are checked for errors and incompleteness on the receiving side. If an error has been detected, the defective block is requested once more and transmitted again. The →communications software Telix (supplied with every ELSA <i>MicroLink</i> ® product that uses the

AT command set), supports many common transmission protocols, such as →Xmodem, Xmodem-1k, Ymodem and →Zmodem.

U interface

This is the link between the public exchange and your local NT (uses 2-wire).

V.110

V.110 (also referred to as I.463) is an →ITU-T standard for the adaptation of asynchronous or synchronous serial data streams to the ISDN line bit rate of 64,000 bps for the transmission over an ISDN →B channel.

V.120

V.120 (also referred to as I.465) is an →ITU-T standard for the packing of asynchronous or synchronous data in (error-corrected) HDLC frames on an ISDN →B channel. Unlike →X.75, V.120 also supports a line bit of 56,000 bps as commonly used in the USA.

V.42bis

The →ITU-T standard V.42bis describes a data compression method which can increase the →effective transfer rate of (previously uncompressed) data by a factor up to four. *MicroLink ISDN/TL V.34* supports V.42bis. Thus effective line transfer rates of (theoretically) up to 256,000 bps can be achieved, if the serial interface supports these high rates.

V.Fast Class

This modulation process, which was developed by Rockwell in anticipation of the V.34 (V.Fast) standard, operates with at variable bit rates between 16,800 and 33,600 bps in steps of 2400 bps.

X.75

Similar to →V.120, X.75 is an →ITU-T standard for the error-corrected transmission of data with HDLC frames on an ISDN →B channel (64,000 bps).

H 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.

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