MicroLink 33.6TQV
MicroLink 28.8TQV
MicroLink 14.4TQ

User's Manual

ELSA
Data Communications
Computer Graphics

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Contents

1 Introduction

About this manual

This manual describes the installation, the features and the operation of the following ELSA high-speed modems:

MicroLink 33.6TQV
MicroLink 28.8TQV
MicroLink 14.4TQ

Symbols and conventions

For faster orientation, symbols and icons are used next to sections of text which are of special interest:

→ **NOTE** → denotes important information.

A bullet symbol indicates a list of items:

- ...

Procedures consist of numbered steps:

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.

Changes to this manual

ELSA *MicroLink*® modems are subject to continual further development. It is therefore possible that the printed documentation does not correspond to the latest release. However, you will always find the latest information in the *ELSA ONLINE* Support BBS (see page 99 for phone numbers).

Package contents

Before you start installing your ELSA *MicroLink*® modem, please make sure that your package is complete:

- ELSA *MicroLink*® modem
- External power supply (AC adapter)
- Telephone line connection cable
- Modem connection cable (RS-232C) with 9/25 pin adapter
- *ELSAsuite* CD and/or software floppy disks
- Printed manuals

→ **NOTE** → If any parts are missing, please contact your dealer.

ELSA reserves the right to make changes to the package contents without prior notice.

Notes:

2 Brief Description

Design

MicroLink 33.6TQV, *MicroLink 28.8TQV* and *MicroLink 14.4TQ* are desktop modems in a flat, robust metal housing. This housing has minimal dimensions, meaning that your modem will easily fit on any desk top.

Transmission types

MicroLink 33.6TQV, *MicroLink 28.8TQV* and *MicroLink 14.4TQ* support the following transmission types and bit rates:

	Bell 103	**300 bps duplex**	(not in the United Kingdom)
	V.21	**300 bps duplex**	
	Bell 212A	**1200 bps duplex**	(not in the United Kingdom)
	V.22bis	**1200 bps duplex** **2400 bps duplex**	
	V.23	**1200/75 bps duplex** **75/1200 bps duplex** **1200 bps half-duplex**	
	V.32	**4800 bps duplex** **9600 bps duplex**	
	V.32bis	**4800 bps duplex** **7200 bps duplex** **9600 bps duplex** **12,000 bps duplex** **14,400 bps duplex**	
MicroLink 33.6TQV, MicroLink 28.8TQV only:	**V.Fast Class**	**16,800 bps duplex** **19,200 bps duplex** **21,600 bps duplex** **24,000 bps duplex** **26,400 bps duplex** **28,800 bps duplex**	
MicroLink 33.6TQV, MicroLink 28.8TQV only:	**V.34**	**2400 bps duplex** **4800 bps duplex** **7200 bps duplex** **9600 bps duplex** **12,000 bps duplex** **14,400 bps duplex** **16,800 bps duplex** **19,200 bps duplex** **21,600 bps duplex** **24,000 bps duplex** **26,400 bps duplex** **28,800 bps duplex**	
MicroLink 33.6TQV,	**V.34**	**31,200 bps duplex** **33,600 bps duplex**	

Fax mode	In addition to the modem modes, the ELSA *MicroLink*® modems described here are equipped with both the SendFax and the ReceiveFax function (see also section 5.9, page 82). Using the supplied fax software, it is possible to conveniently send and receive text and image documents at rates between 14,400 and 2400 bps. The support of fax command sets Class 1 and Class 2 make it possible to use any standard fax software (e.g. Delrina WINFAX) and also the E-mail functions within Windows 95 and Windows for Workgroups.
Polling operation	ELSA *MicroLink* modems support the fax polling mode which, together with suitable fax software, allows the polling of fax documents and the operation of a polling system.
Bit rate adaptation	The ITU-T V.100 and ITU-T V.8 procedures are used for determining the bit rate used by the remote modem. This means that *MicroLink* modems adapt to the highest possible bit rate common to both devices. The bit rate adaptation can be disabled.
MNP4 and V.42	The error correction protocols implemented in the *MicroLink* modems (MNP4 and V.42) allow 100% error-corrected data transmission even with poor quality telephone connections. ELSA *MicroLink*® modems with MNP4 or V.42 can establish reliable, error-corrected connections with other similarly equipped modems.
MNP5 and V.42bis	*MicroLink 33.6TQV, MicroLink 28.8TQV* and *MicroLink 14.4TQ* also use the data compression methods MNP5 and V.42bis. Using MNP5, the transfer rates can be doubled, or even quadrupled in the case of V.42bis. Therefore *MicroLink 33.6TQV, MicroLink 28.8TQV* and *MicroLink 14.4TQ* can achieve effective transfer rates up to 115,200 bps or 57,600 bps, respectively!
AT command set	The "AT command set" is used for communication with *MicroLink* modems. This language has become the de-facto standard for dial modems.
Voice function	*MicroLink 33.6TQV* and *MicroLink 28.8TQV* are equipped with a voice function, allowing you to use your modem as an answering machine in connection with the supplied voice software (see section 5.10, page 84).
Password protection	The password protection serves to protect your modem from being used or configured by unauthorized persons. By means of a password (the so-called supervisor password) certain modem functions can be locked. Up to five access flags can be used to define which functions are locked.
Automatic callback	This feature can used to make your modem call back automatically when it is called by another modem. Up to 19 callback numbers with corresponding passwords can be stored using the **AT$P** command.
Remote configuration	The remote configuration allows you to configure your modem from any location you can call from. This feature can be used directly or in combination with the automatic callback function. Up to 19 different user passwords can be stored using the **AT$P** command.

2.1.1 CE Approval

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

MicroLink 33.6TQV, MicroLink 28.8TQV and *MicroLink 14.4TQ* have been CE-approved and thus guarantee:

- Immunity to interference according to EN 50082,
  Electromagnetic compatibility; Generic immunity standard; Part 1: Residential, commercial and light industry
- Low radio emission according to EN 55022,
  Electromagnetic compatibility of information technology and telecommunications equipment
- Electrical safety according to EN 60950,
  Safety of information technology equipment including electrical business equipment

Notes

3 National Regulations

National regulations

This chapter contains information concerning national regulations for various countries. **Please read the section on your country carefully!** Slight differences in command parameters, register values etc. are indicated in their respective chapters later in this manual, and are not covered here. The following countries are considered here:

United Kingdom

The Netherlands

USA

National Information Sheet

If your country is not listed here, you will find a National Information Sheet included with this manual containing all necessary information for your country.

3.1 BABT Approval (United Kingdom)

This section applies only to the BABT approved British versions of the ELSA *MicroLink* ® modem.

This apparatus has been approved by the BABT for the use of the following facilities:

- Modem facility
- Fax facility
- Auto calling
- Auto Answer
- Hands-free telephone facility

→ **ATTENTION** →

Any other usage will invalidate the approval of the apparatus if as a result it then ceases to comply with the standards against which approval was gained.

In addition, as the owner and/or operator of this apparatus you should regard the following points:

- If you want to connect your modem to the British Telecom PSTN, you are required to fill in the form found on the last page of this manual and send it to your local BT agency in order to have the appropriate connection socket installed. Please don't forget to enter the approval Number of your modem. You will find the Approval Number printed on the label placed on the modem housing.
- The modem can only be connected to direct exchange lines. It cannot be operated in shared service or 1 + 1 carrier systems. Further, the modem cannot be used as an extension to a payphone.
- This modem has a Ringer Equivalence Number (REN) of 1, which is the same as the REN of a standard BT telephone. The REN is used to determine how many devices can be connected to

your telephone line. The sum of the RENs of all devices on any line must not exceed four (4.0). Attaching too many devices may mean that they do not ring properly. The REN of your modem can also be found on the label placed on the modem housing.

- Before operating the modem, make sure that it is properly connected to the power supply and switched on. Refer to chapter 4 "Setting up the Modem" for installation instructions.
- The telephone line the modem is connected to must provide loop disconnect signaling (pulse dialing) or DTMF signaling (tone dialing). The modem supports both dialing methods. Selecting the appropriate method is described in section 5.5 of this manual, "Description of AT Commands".

→ **NOTE** → Although this equipment can use either loop disconnect signaling (pulse dialing) or DTMF signaling (tone dialing), only the performance of the DTMF signaling is subject to regulatory requirements for correct operation. It is therefore strongly recommended that the equipment is set to use DTMF signaling for access to public or private emergency services. DTMF signaling also provides a faster dialing process.

- Within private branch exchange (PABX), dialling an external number may require the user to insert a PSTN access digit, e.g. a digit 9 (external access code). See section 5.5 of this manual for details about connection establishment.
- This modem is capable of storing several phone numbers which can be dialed automatically. Check that all stored numbers are correctly programmed before using the auto-dialing function.

→ **NOTE** → The V.24/RS-232C interface on the rear side of the modem housing is a connector to a SELV circuit (Safety Extra-Low Voltage), complying with EN 41003 Clause 4.1.3. Any part of this connector can be touched without the risk of electric shock.

3.2 HDTP Approval (the Netherlands)

This section applies only to the Netherlands versions of the ELSA *MicroLink* ® modem approved by the Hoofddirectie Telecommunicatie en Post (HDTP). This modem model may not yet be HDTP approved at this time.

- The Connection Factor (aansluitfactor), which can be found on the HDTP approval label on the housing of your modem, provides a guide as to the maximum number of pieces of equipment (both in the idle state and for call detection) that can be connected in parallel to a single telephone line. The sum of the connection factors for all the devices connected to the telephone line must be less than five (5.0).
- Some telephone exchanges in the Netherlands still provide a dial tone in the frequency range between 100 and 200 Hz which will not be recognized by *MicroLink*. It is therefore possible that the modem will not function properly at all public telephone exchanges. Dial tones in the frequency range between 340 and 550 Hz are properly recognized. Information concerning the different types of exchanges can be obtained from the PTT-Netwerkbedrijf.

3.2.1 Voor Uw Veiligheid

Met betrekking tot uw veiligheid, het goede functioneren van uw nieuwe ELSA *MicroLink* ® modem en uw computer, dient u de volgende regels in acht te nemen.

- Om kontakt met gevaarlijke spanning van de telefoonlijn en/of schade aan het modem te vermijden, dient het telefoonsnoer en de voedingskabel van het modem te worden verwijderd voordat u de behuizing van het modem opent. Normaliter dient de modem behuizing overigens niet geopend te worden.
- Een telefoon verbinding maakt gebruik van gelijk- en wisselstromen om bel-signalen te kunnen genereren. Het telefoonlijn circuit (TNV) kan onder gevaarlijke spanning staan. Elk lichamelijk kontakt dient hiermee te worden vermeden.
- Om veiligheidsredenen dient uitsluitend de originele externe voeding, welke bij uw modem wordt geleverd, te worden gebruikt. Een geopende voeding of een mechanisch beschadigde voeding mag niet langer gebruikt worden want als de primaire wisselspanning (230 volt) met de hand of metalen delen wordt aangeraakt kan dit leiden tot een electrische schok welke dodelijk kan zijn.
- De V.24/RS-232C verbinding op de achterzijde van uw ELSA *MicroLink*® modem, is de verbinding met een z.g. VELV circuit (Veligheids Extra Lage Spanning) welke overeenkomt met de norm EN 41003, clausule 4.1.3. Elk gedeelte van deze connector kan worden aangeraakt zonder risico van een electrische schok.
- Raak de pennen van de modem connector niet aan, want de kleinste hoeveelheid vuil of electrostatische ontlading, kan leiden tot slecht functioneren of zelfs defect raken van uw modem.

3.3 Consumer Information and FCC Requirements (USA)

This section applies only to the US versions of the ELSA *MicroLink*® modem bearing an FCC registration. This model may not yet be FCC approved at this time.

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 and Part 68. As an owner and/or operator of a registered modem like this modem, you must comply with these rules:

- Before installing your modem, you must notify your telephone company that you are going to install an FCC registered device. When you contact them, you must provide the FCC registration number and Ringer Equivalence Number (REN) for your modem; these numbers are found on the FCC label on the modem housing.
- You cannot connect your modem to a party line or to a coin telephone line.
- You must only connect your modem to a standard modular telephone jack, type RJ11.
- If your modem needs repairs, you must arrange for ELSA to make them if you are to keep the FCC registration of your modem valid.
- You must use a shielded RS-232C cable to connect your external modem to your terminal or computer.

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 with your radio and television reception.

If you believe that this equipment is causing interference with your radio or television reception, try turning the equipment off and on. If the interference problems stop when the equipment is switched off, then the equipment is probably causing the interference. You may be able to correct the problem by doing one or more of the following:

- Adjust the position of the radio or TV antenna.
- Move the modem away from the radio or TV.
- Plug the modem 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 telephone network. This device should be disconnected until the source of the problem can be determined and until repair has been made. If this is not done, the telephone company may temporarily disconnect service.

The telephone company may make changes in its technical operations and procedures. If such changes affect the compatibility or use of this device, the telephone company is required to give adequate notice of the changes.

If the telephone company requests information on what equipment is connected to their lines, inform them of:

- the telephone number of the line that the modem is connected to,
- the Ringer Equivalence Number (REN),
- the USOC jack required, and
- the FCC registration number.

The Ringer Equivalence Number (REN) is used to determine how many devices can be connected to your telephone line. In most areas the sum of the RENs of all devices on any line should not exceed five (5.0). If too many devices are attached, they may not ring properly.

→ **ATTENTION** → **Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.**

Notes:

4 Setting up the Modem

4.1 For Your Safety

In the interests of your safety and the correct operation of your new ELSA *MicroLink*® modem with your computer system, please observe the guidelines listed below.

→ **IMPORTANT** → **See chapter 3 ("National Regulations") for specific safety instructions!**

- In order to avoid contact with hazardous voltage of the telephone line circuit or damage of the modem, be sure that you have unplugged both the power supply and the telephone line from the modem before opening the housing! It is not normally necessary to open your modem at all.
- A telephone line uses direct current and alternating current for ring signals. The telephone line circuit (TNV) can have hazardous voltage and must not be touched.
- For reasons of safety, use only the original external power supply shipped with your modem.

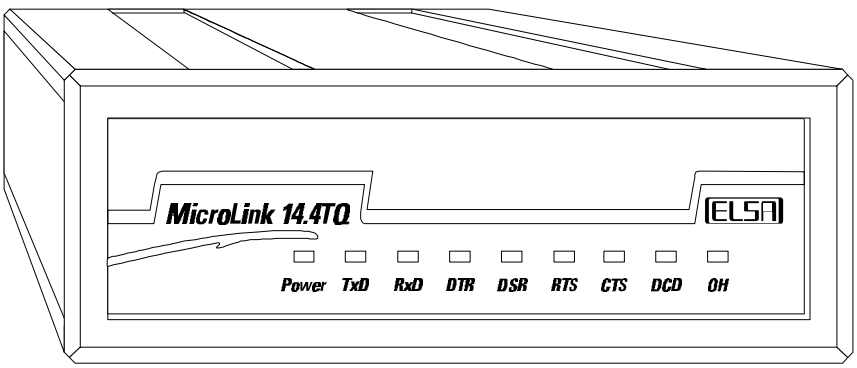
  A power supply that has been opened or mechanically damaged should no longer be operated; touching the primary voltage (Europe: 230 V, USA: 120 V) with the hand or with metal parts results in an electric shock which can be deadly.
- The 9 V_{AC} power input of the modem is a low voltage circuit; touching this circuit with the hand or with metal parts does not normally cause an electric shock.

  The V.24/RS-232C interface on the rear side of the modem housing is a connector to a SELV circuit (Safety Extra-Low Voltage), complying with EN 41003 Clause 4.1.3. Any part of this connector can be touched without the risk of electric shock.
- Please do not touch the metal pins of the modem connectors. Even slight dirt or electrostatic discharge may cause malfunctions or, in extreme cases, damage to the modem.

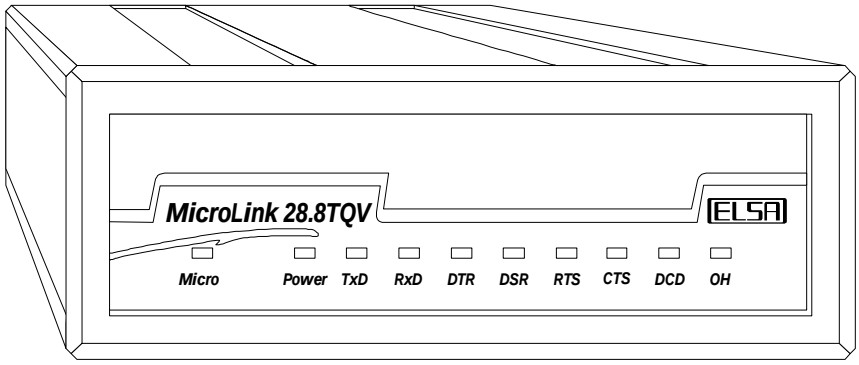
4.2 Setting up your ELSA *MicroLink*

The following illustrations show the front and rear panels of the *MicroLink 33.6TQV*, *MicroLink 28.8TQV* and *MicroLink 14.4TQ* modems:

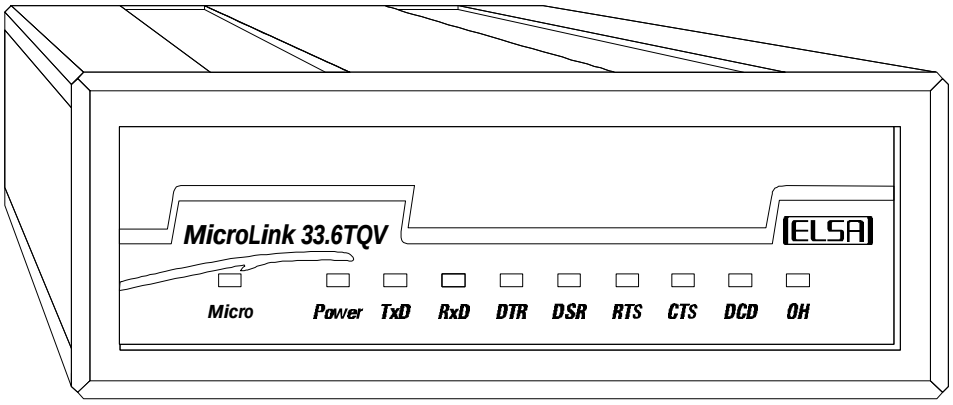
Front panel of the *MicroLink 14.4TQ*



Front panel of the *MicroLink 28.8TQV*

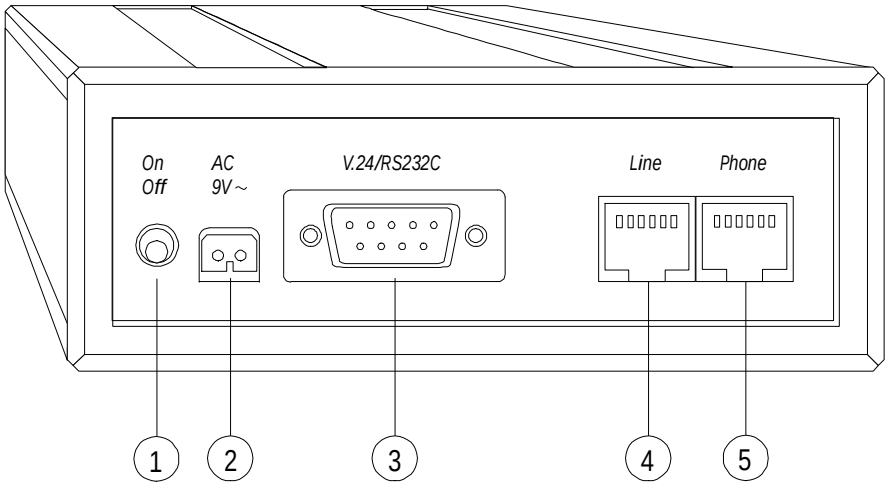


Front panel of the *MicroLink 33.6TQV*



The LEDs provide a status display and indicate the status of the interface lines (see also page 93). "Micro" indicates the location of the microphone with which your can record messages to be used with the voice function.

Rear panel



No.	Description
1	On/Off switch
2	Power input
3	V.24/RS-232C interface
4	Line connector
(5)	Telephone connector (not available in some countries)

4.3 Hardware Installation

The installation of your modem is performed as follows:

1. Power connection Make sure that the voltage of the power line matches the voltage of the supplied AC adapter. Then connect the modem to the power line using the AC adapter.

→ **ATTENTION** → For your safety, use only the original power supply shipped with your modem!

2. Connecting to the computer Select the appropriate serial asynchronous communication interface (COM port) by referring to the operating instructions of your computer or terminal and connect the modem to this interface using the supplied RS-232C cable and adapter if required.

It is highly recommended that the selected serial port should be equipped with a UART chip (Universal Asynchronous Receiver/Transmitter) with a FIFO buffer (type 16550). Without such a UART, error-free transmission across the serial interface at rates over 9600 bps cannot be guaranteed.

The supplied diagnostic program MODEMTST.EXE can be used to check which UART type is used on the selected interface. If it is not a 16550 UART, we recommend you to upgrade or replace your serial interface board.

→ **ELSA TIP** → For example, ELSA offers the *COMFAST* ® serial interface board, featuring two freely configurable serial ports, each equipped with a 16550 UART.

When selecting the serial interface, be aware of the corresponding IRQ settings, especially for COM3 and COM4. Make sure that each IRQ is only used by one device, otherwise hardware conflicts and PC malfunctions may occur. For example, it is common for COM3 to share IRQ4 with COM1, and COM4 to share IRQ3 with COM2, which could lead to a conflict.

Changing an interrupt is normally performed by changing a DIP switch or a jumper on the serial interface board. Please refer to the manual for your serial interface board for instructions.

→ **NOTE** → If your computer only has a 9-pin connection socket, you will need an appropriate adapter, which has all nine lines connected. If some of the lines are not connected, malfunctions (e.g. transmission errors) may occur.

3. Connection to telephone network Connect your modem to the telephone network by connecting one end of the supplied connection cable (RJ11 plug) to the line connector on the rear panel of the modem (see illustration on page 18) and the other end to the appropriate connection socket installed by the respective national telecommunications service.

4. Switching the modem on Switch the modem on using the switch on the rear panel of the modem. After being switched on, the modem performs a short self-test.

You need a suitable communications software (e.g.Telix) which provides a user interface for operating your modem.

5. Starting the communications program

Start your communications program and set up the COM port to which your modem is connected. With your communications program in terminal mode, type **AT** at the keyboard and press Return. If this series of characters is echoed by the modem (i.e. displayed on the monitor) and answered with **OK**, the modem is ready for operation.

4.4 Installing the *MicroLink 33.6TQV/28.8TQV* under Windows 95

Depending on the version which you are using, Windows 95 presents with one of two possible procedures for the installation. Exactly which version you have will become clear after your computer has been restarted and the modem has been detected.

Procedure 1:

Start Windows 95

After connecting your modem to it, the computer must be restarted. Windows 95 displays the "New Hardware Found" window and recognizes the modem as ELSA *MicroLink 33.6TQV*, for example. Select the **Driver from disk provided by hardware manufacturer** option and click on **OK**.

The window "Install from Disk" is displayed.

Install software

Insert the supplied *ELSAsuite* CD into the CD-ROM drive and click on **Browse**. The "Open" window will be displayed.

Select the CD-ROM drive (e.g. d:) and click on **OK**. In the following "Install from Disk" window click on **OK**. The files required files will now be copied onto hard disk.

Select modem

In the "Select Device" window, select the ELSA *MicroLink 33.6TQV* and click on **OK**. Your ELSA *MicroLink 33.6TQV* is now installed under Windows 95.

Check

In the "Properties for Modems" window you should see that the correct name for your modem has been entered. You can also check the entries under **Control Panel**, **System** by selecting the "Device Manager". The modem has been correctly installed if the appropriate symbol is displayed.

Procedure 2 (Windows 95 service release 2):

Start Windows 95

After connecting your modem to it, the computer must be restarted. Windows 95 displays the "New Hardware Found" window followed by the "Update Device Driver Wizard". Insert the supplied *ELSAsuite* into the CD-ROM drive and click on **Continue**. Click on **Other Locations...**. The "Select other location" window will be displayed.

Install software

Click on **Browse**, select the CD-ROM drive (e.g. d) and then click on **OK**.

End Installation In the " Update Device Driver Wizard " your modem will be recognized as the ELSA *MicroLink 33.6TQV*. Confirm the installation with **Continue**. Your ELSA *MicroLink 33.6TQV* is now installed under Windows 95.

Check In the "Properties for Modems" window you should see that the correct name for your modem has been entered. You can also check the entries under **Control Panel**, **System** by selecting the "Device Manager". The modem has been correctly installed if the appropriate symbol is displayed.

4.5 Establishing a Connection

Main line or extension In order to establish a connection with another modem you must know whether your modem is connected to a main line or to an extension in a private telephone system (private automatic branch exchange, PABX) .

Dial tone Private telephone exchanges use different methods of getting a dial tone:

Pressing the **Flash key**
or dialing an escape digit (e.g. **0** or **9**)

Pulse or tone dialing In addition, you must know whether your telephone uses pulse or tone dialing. This can normally be determined by listening to the dialing sound. If you hear a rattling sound after each dialed number, you have pulse dialing. If you hear the touch-tone beeps when dialing, then you have tone dialing.

1. Dialing on the main line If you wish to call the telephone number 123456 on the main line, enter:

ATD**P**123456	for **P**ulse dialing or
ATD**T**123456	for **T**one dialing

2. Dialing on an extension The dial command from an extension of a private telephone exchange is as follows:

for pulse dialing:

ATDP**0W**123456	for dial tone via escape digit 0

for tone dialing:

ATDT**&W**123456	for dial tone via flash button
ATDT**0W**123456	for dial tone via escape digit 0

3. Dialing from extension to extension Note that when setting up a connection from extension to extension, a dial tone is not heard. The command to dial the extension number 123 is:

AT**X3**DP123	for pulse dialing or
AT**X3**DT123	for tone dialing.

(see also the **ATX** command, page 47)

→ **NOTE** → This does not apply to the **Netherlands**, where a dial tone is always provided and the **ATX3** command has no effect.

Special dialing characters Details concerning special dialing characters which can be included in the dialing string (e.g. for the dial tone), are found in the description of the **ATD** dial command, page 30).

5 Operation

5.1 General Information

AT command set

The **AT command set** has established itself as the world-wide standard for the syntax of modem control commands (AT = command **AT**tention prefix; see section 5.3, page 25).

To send AT commands from a PC to a modem requires a suitable communications software, known as a "terminal program". All ELSA *MicroLink*® modems are shipped with the famous communications program **Telix**.

Two operating states

The two general operating states of a modem are the **command state** and the **online state** (transmission state).

Command input, execution

After being switched on, the modem is in the **command state**. Commands can be accepted, interpreted and executed in this state only. After a successful connection with the other party, the modem changes from the command state to the online state. Returning to the command state and changing back again is possible even with an existing connection (see Escape command, section 5.2, page 24, and **ATO** command, page 40).

Data transmission

Online state signifies that a telephone connection to another party exists: The modem is "online". This is the case with both a successful connection (outgoing call) and with the acceptance of an incoming call. In this state data exchange (data transmission) can take place between two connected data stations.

5.2 The Escape Command

Changing to the command state

The Escape command can only be recognized in the online state. It permits you to change to the command state and thus allows a temporary escape from the online data transmission without disconnecting the line.

In order to make sure that this command can be distinguished from the normal data flow, the following rules are in effect:

Escape sequence

The Escape command consists of a sequence of three **Escape characters** (default setting: **+ + +**) and a **valid command line**.

After the three Escape characters have been entered, the modem is in the command state. However, data transmission is interrupted only after the recognition of a valid command line.

→ NOTE →

The **Escape character** should not be confused with the character <ESC> of the ASCII character set. The Escape character can be redefined via the register S2 (see page 50).

Valid command line

A valid command line begins with an **AT** or **at** and must be terminated with a Carriage Return (<CR>, see also section 5.5, page 27). The command ***A/*** or ***a/*** is not valid after the three Escape characters. Also, a valid command line in an Escape sequence is restricted to a maximum of 40 characters.

Valid Escape sequence

Upon the entry of the Escape sequence, the data transmission is interrupted and the command line is processed. If no further character follows the three Escape characters within one second (= Escape Prompt Delay = EPD), the modem replies with **OK** in advance and awaits a valid command line.

Return to online state

The **ATO** command (see page 40) returns you to the online data transmission (unless the line was disconnected).

Invalid Escape sequence

If characters not representing a valid command line follow the OK after the EPD, the modem changes back to the online state with a CONNECT message. The CONNECT message can be suppressed with the **AT*Q1** command (see page 40).

Escape Prompt Delay

The delay of one second can be altered in the register S12 (see page 52).

5.3 The AT Command Prefix

Automatic recognition of bit rate and data format

All commands to be given to the modem in the AT command language must begin with an **AT** (**At**tention) command prefix, except for the **A/** command, see page 27. The modem determines the data format to be used and the transmission bit rate between modem and computer by means of the **AT** prefix.

DTE and DCE rate

The bit rate your computer or terminal uses to communicate with the modem is called the DTE rate (DTE = **D**ata **T**erminal **E**quipment), or serial port bit rate, whereas the speed the modem uses for the transmission of data across the telephone line is called the DCE rate (DCE = **D**ata **C**ommunications **E**quipment) or DCE line speed.

The DTE rate is set either by the **AT** transmission or is set to match the DEC rate from the telephone line, unless an independent DCE rate has been set manually (see **AT%G1** command, page 34).

If, for example, the modem receives an **AT** command at a DTE rate of 19,200 bps (bits per second) from the computer, the modem sets a DCE rate of 19,200 bps (*MicroLink 33.6TQV, MicroLink 28.8TQV*) full duplex on the telephone side as well.

If you have set your terminal program to a bit rate which is not supported by your modem on the telephone side (e.g. 115,200 bps), an attempt is made to establish a connection at the next lowest transmission speed of which the modem is capable. This process is bit rate adaptation.

Bit rate adaptation

ELSA *MicroLink* modems are equipped with an adaptive transmission bit rate in accordance with the ITU-T standard V.100 and, with the *MicroLink 33.6TQV* and *MicroLink 28.8TQV*, ITU-T V.8. This means that the modem automatically switches to the highest bit rate common to both the local and the remote modems.

Supported bit rates

MicroLink 33.6TQV and *MicroLink 28.8TQV* support DTE rates up to 115,200 bps, and *MicroLink 14.4TQ* supports DTE rates up to 57,600 bps (see also register S93, page 65). Default values for the data format are 8 data bits, no parity, 1 stop bit (**8N1**). The following data formats are recognized automatically:

1 start bit, 7 data bits, no parity, 2 stop bits
1 start bit, 7 data bits, even parity, 1 or 2 stop bits *)
1 start bit, 7 data bits, uneven parity, 1 or 2 stop bits *)
1 start bit, 8 data bits, no parity, 1 or 2 stop bits *)

*) The modem automatically uses '1 stop bit'.

5.4 The Command Line Buffer

AT command buffer

The modem contains a command line buffer which can store up to 80 characters (including blanks) of a command line with exception of the **AT** prefix and the terminating <CR> (Carriage Return). Line feed characters <LF> are always ignored in the command state.

If the modem is to be given several commands (e.g. speaker control, volume regulation, selection of verbose result codes in the case of error-corrected connections, and reading of the value of register S0), these can be entered individually with one **AT** command prefix **each** and one terminating <CR> **each**:

Command input in several command lines

```
atm1
OK
atl3
OK
at\v8
OK
ats0?
000

OK
```

However, it is also possible to enter these commands successively after a **single** introductory **AT** in a single command line and to terminate with a **single** <CR>:

Command input in one command line

```
at m1 l3 \v8 s0?
000

OK
```

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

Upon reaching the end of the command line buffer no further commands can be entered. The command line can only be edited with backspace <BS> or executed with <CR>.

Exceptions

The following commands must be located in the last position of a command line (i.e. subsequent commands are not executed):

ATD (dial command),
ATA (call acceptance),
ATZ (initialization command),
ATO (return to online state),
ATH (disconnect) if this command was entered online,
AT\P and **AT&Z** (store telephone numbers),
AT&T (testing loopbacks).

5.5 Description of AT Commands

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 (e.g. 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. **ATL** = **ATL0**).
Identification of the default configuration	Parameter settings that apply to the default modem configuration, as set at the factory, are marked by the symbol *****.

A Accept incoming call

ATA

This command accepts an incoming call. An incoming call is indicated by the line RI = ON and, unless the modem result codes are disabled, reported by the message RING (verbose form) or 2 (abbreviated form).

→ **ATTENTION** → If the automatic call acceptance function is enabled, a call cannot be accepted manually (i.e. with the **ATA** command) as the line is disconnected upon the entry of any character except for line feed (see register S0, page 49). However, the line is not disconnected if bit 6 of register S14 is set to 1 (default value = 0). With this setting it is possible for the computer to transmit characters to the modem while the connection is being established (see also page 52).

Furthermore, this command allows an existing telephone connection (voice) to be taken over by the modem (data). This requires that modem and telephone are connected to the same line (see also **ATD** command, page 30). The bit rate adaptation according to ITU-T V.100 is disabled in this case.

Example: A telephone connection is established. The parties agree on a transmission format, transmission protocol etc. The change to the online state takes place by entry of **ATA** <CR> by the one party and subsequent entry of **ATD** <CR> by the other party. The parties must also agree on which command is to be given on which side.

%A Fallback character in the negotiation phase

AT%An (n = 0..62, 64..125, 127; default = 0)

This command defines the character which is regarded as fallback command during call acceptance. This command requires the settings **AT\N3** (see page 38) and **AT\C2** (see page 29).

If the modem receives this character in the negotiation phase while trying to establish an error-corrected connection (setting **AT\N3**), it falls back to normal mode immediately. The fallback character is not passed to the serial port. As soon as the modem receives a SYN character (22 decimal), the fallback character recognition is switched off. The default setting 0 disables the fallback character recognition entirely.

→ **NOTE** → The values n = 63 and n = 126 cannot be used, because these characters are needed in the V.42 negotiation phase and would therefore cause conflicts.

B ITU-T or Bell transmission modes

* **ATB0 : Modem complies with ITU-T standards V.21/V.22bis**
ATB1 : Modem complies with Bell standards 103/212A (not available in the **UK**)

This command determines whether your modem transmits at 300 or 1200 bps in compliance with the ITU-T standards V.21 or V.22bis or according to the Bell standards 103 or 212A.

%B DCE rate

AT%B300 : 300 bps
AT%B1200 : 1200 bps
AT%B1200/75 : 1200/75 bps
AT%B75/1200 : 75/1200 bps
AT%B2400 : 2400 bps
AT%B4800 : 4800 bps
AT%B7200 : 7200 bps
AT%B9600 : 9600 bps
AT%B12000 : 12,000 bps
* **AT%B14400 : 14,400 bps** (default setting for *MicroLink 14.4TQ*)
AT%B16800 : 16,800 bps (*MicroLink 33.6TQV, MicroLink 28.8TQV* only)
AT%B19200 : 19,200 bps (*MicroLink 33.6TQV, MicroLink 28.8TQV* only)
AT%B21600 : 21,600 bps (*MicroLink 33.6TQV, MicroLink 28.8TQV* only)
AT%B24000 : 24,000 bps (*MicroLink 33.6TQV, MicroLink 28.8TQV* only)
AT%B26400 : 26,400 bps (*MicroLink 33.6TQV, MicroLink 28.8TQV* only)
• **AT%B28800 : 28,800 bps** (default setting for *MicroLink 28.8TQV*)
AT%B31200 : 31,200 bps (*MicroLink 33.6TQV* only)
* **AT%B33600 : 33,600 bps** (default setting for *MicroLink 33.6TQV*)

The **AT%B** command sets the desired transmission bit rate on the telephone side (the DCE rate), as long as the bit rate is not determined by the DTE rate (see **AT%G0** command, page 34).

%C Data compression

AT%C0 : No data compression
AT%C1 : Data compression according to MNP5 only
AT%C2 : Data compression according to V.42bis only
*** AT%C3 : Data compression according to V.42bis or MNP5**

This command determines which data compression method is employed for an error-corrected connection. It is to be regarded in correlation with the commands **AT\N** (see page 38) and **AT-J** (see page 36). An overview of the interdependencies of these commands can be found in the appendix, page 90 Error Correction and Data Compression.

The default setting is **AT%C3**, so the modem automatically recognizes which compression method (depending on the capabilities or setting of the remote modem) to use.

\C Data buffering in the negotiation phase

*** AT\C0 : No data buffering in the negotiation phase**
AT\C1 : Data buffering in the negotiation phase
AT\C2 : No data buffering, fallback character recognition (AT%A)

During a call acceptance with the setting **AT\N3** (see page 38), the **AT\C** command determines how the modem treats characters which are neither an MNP nor an LAPM request.

If no MNP or LAPM request is recognized within three seconds, the modem falls back to normal mode. In the setting **AT\C0**, no buffering and no early fallback takes place.

In the setting **AT\C1**, up to 200 characters ca be buffered, which are sent to the port after the fallback to normal mode. If 200 characters are received before the three seconds have elapsed, the modem falls back immediately.

In the setting **AT\C2**, the fallback to normal mode can be triggered by the character defined with the **AT%A** command. No buffering takes place. This can be used to shorten the negotiation phase when the calling modem does not support error correction.

&C DCD option

AT&C0 : DCD is always active
*** AT&C1 : DCD follows the state of the carrier**
AT&C2 : DCD is dropped during hang up only

Communications programs normally evaluate the DCD (Data Carrier Detect) interface line in order to determine whether a connection (i.e. a carrier signal) is present. The modem supports this function with the setting **AT&C1**.

D Dial command

ATDn

Upon an **ATD** command, the modem attempts to establish a connection and dials the telephone number **n**. **n** can consist of the digits **0**..**9** and, in the case of tone dialing, may also contain the characters **A**..**D**, ***** and **#**.

The maximum allowed length of the entire dial string is 64 characters. The following special characters may be included:

Special characters	Meaning
	Dialing method
P	Select pulse dialing
T	Select tone dialing
	Getting dial tone
! , **&** or **[**	Press flash button (only for tone dialing)
	Dial tone
W or **:**	Wait for (second) dial tone
@	Wait for silence: Depending on the time defined in register S7, the modem waits for at least one RING, followed by five seconds of silence, or hangs up with NO ANSWER
	Dial pause
,	Dial pause as defined in register S8
<	Dial pause 1 second
=	Dial pause 3 seconds
	Changing the operating mode only for the following connection
M	V.42 mode (AT\N4)
Q	V.42 mode and fallback to normal mode (AT\N5)
V	V.42 mode and fallback to MNP mode (AT\N6)
X	V.42 or MNP and fallback to normal mode (AT\N3)
Y	MNP mode (AT\N2)
Z	Normal mode (AT\N0)
	Dialing stored telephone numbers
L	Redial the last number
Sm	Dial a number stored in the directory (**m** = 0 to 19, see **AT&Z**)
/m	Dial a number stored in the directory (**m** = 0 to 9), see **AT\P**)
;	Return to the command state after the dial string (for appending additional dial commands if the maximum length of a dial string is exceeded)

→ NOTE → In general, special characters can be inserted at any point of the dial string and are effective beyond that point. The special characters for dialing stored numbers are an exception (see the **AT\P** and **AT&Z** commands, pages 40 and 48). These special characters must be entered directly after **AT**(...)**D**. The **;** character for appending additional dial commands must be located at the end of a dial string.

The connection establishment can be aborted at any time during dialing by entering any character, except for Line Feed, XON and XOFF (additional details about establishing a connection can be found in section 4.5; page 21).

In addition, entry of **ATD** without parameters allows an existing telephone connection (voice) to be taken over by the modem (data). This requires that modem and telephone are connected to the same line.

Example: A modem is called up by telephone. As soon as the remote modem sends an answer tone, a modem connected to the same line as the telephone can take over the line with the **ATD** <CR> command (see also **ATA** command, page 27).

$D Automatic dialing with DTR

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

If DTR dialing is enabled and the state of the DTR interface line changes from OFF to ON, the modem automatically dials the number stored in position 0 (see commands **AT\P**, page 40, and **AT&Z**, page 48).

%D Delay before forced hang up

AT%Dn : (n = 0..255 seconds; default = 0)

The **AT%Dn** command can be used to define a maximum delay, during which the modem tries to empty its sending and receiving buffers, before it terminates the connection. If a connection is terminated because the carrier is lost, only the characters still in the receiving buffer can be read. If the buffer is empty or the modem is set to **AT%D0**, the connection is terminated immediately without delay.

&D DTR control

AT&D0 : Ignore DTR
AT&D1 : Change to command state if DTR → OFF
* **AT&D2 : Hang up if DTR → OFF**
AT&D3 : Reinitialize modem if DTR → OFF

These commands determine how the modem reacts to a transition of the DTR interface line from ON to OFF.

When set to **AT&D0**, the modem ignores the state of the DTR line.

With **AT&D1** the modem changes to the command state upon a transition of DTR from ON to OFF.

AT&D2 causes the modem to hang up when DTR changes from ON to OFF, and to change to the command state. Call acceptance is not possible again before DTR returns from OFF to ON.

AT&D3 causes a reinitialization of the modem when DTR changes from ON to OFF (any existing connection is aborted, and values from the non-volatile memory are read), and the modem switches to the command state. Call acceptance is not possible again before DTR returns from OFF to ON.

The modem does not report a RING with **AT&D2** and **AT&D3** if DTR is set to OFF.

:D Manual dialing

* **AT:D0 : Modem does not go online if DTR OFF→ON**
AT:D1 : Modem goes online if DTR OFF→ON

After a connection has been established manually (by telephone), the modem goes online with the setting **AT:D1** when the DTR interface line changes from OFF to ON. It does not do so with the standard setting **AT:D0**.

\D DSR/CTS control

* **AT\D0 : DSR and CTS always on**
AT\D1 : DSR follows answer tone, CTS always on
AT\D2 : DSR always on, CTS follows DCD
AT\D3 : DSR follows answer tone, CTS follows DCD

This command affects the meaning of the DSR and CTS interface lines. If a hardware data flow control is employed (see also **AT\Q** command, page 41), the setting of the **AT\D** command is meaningless for the CTS interface line.

The following table provides an overview of the interdependencies of the **AT\D**, **AT&C** and **AT&S** commands (default settings are marked in **bold**):

&C	\D	&S	Effect		
0	0	0	DSR always ON	CTS always ON	DCD always ON
0	0	1	DSR follows answer tone	CTS always ON	DCD always ON
0	1	0	DSR follows answer tone	CTS always ON	DCD always ON
0	1	1	DSR follows answer tone	CTS always ON	DCD always ON
0	2	0	DSR always ON	CTS always ON	DCD always ON
0	2	1	DSR follows answer tone	CTS always ON	DCD always ON
0	3	0	DSR follows answer tone	CTS always ON	DCD always ON
0	3	1	DSR follows answer tone	CTS always ON	DCD always ON

&C	\D	&S	Effect		
1	**0**	**0**	**DSR always ON**	**CTS always ON**	**DCD follows carrier**
1	0	1	DSR follows answer tone	CTS always ON	DCD follows carrier
1	1	0	DSR follows answer tone	CTS always ON	DCD follows carrier
1	1	1	DSR follows answer tone	CTS always ON	DCD follows carrier
1	2	0	DSR always ON	CTS follows DCD	DCD follows carrier
1	2	1	DSR follows answer tone	CTS follows DCD	DCD follows carrier
1	3	0	DSR follows answer tone	CTS follows DCD	DCD follows carrier
1	3	1	DSR follows answer tone	CTS follows DCD	DCD follows carrier
2	0	0	DSR always ON	CTS always ON	DCD OFF at hangup
2	0	1	DSR follows answer tone	CTS always ON	DCD OFF at hangup
2	1	0	DSR follows answer tone	CTS always ON	DCD OFF at hangup
2	1	1	DSR follows answer tone	CTS always ON	DCD OFF at hangup
2	2	0	DSR always ON	CTS always ON	DCD OFF at hangup
2	2	1	DSR follows answer tone	CTS always ON	DCD OFF at hangup
2	3	0	DSR follows answer tone	CTS always ON	DCD OFF at hangup
2	3	1	DSR follows answer tone	CTS always ON	DCD OFF at hangup

E Command echo

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

This command selects whether your modem echoes entered commands on the local screen or not. If the echo is switched on and all characters appear twice on your monitor, your communications program is in half-duplex mode, and you should switch to full duplex mode.

%E Automatic retrain

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

If the modem is set to **AT%E0** no retrain is performed even if the line quality is poor. With the default setting **AT%E1**, the modem automatically tries to adapt itself to changes of the line quality.

If the automatic retrain is disabled with **AT%E0**, a retrain can nevertheless be triggered manually by changing to the command state in an existing connection and entering **ATO1** (see page 40).

&F Restore factory configuration

AT&F

This command loads the factory default settings of the modem firmware. The modem is reset to the delivery state. If a connection exists, this command is not executed.

\F Display stored telephone numbers

AT\F

This command displays the telephone numbers stored with the **AT\P** or **AT&Z** command (see pages 40 and 48) from position 0 to 19.

%G DCE rate control

*** AT%G0 : DCE rate determined by DTE rate**
AT%G1 : DCE rate set with AT%B

Normally, the DCE rate (the transmission speed on the telephone side) is always set to the same bit rate the serial interface of the computer is using (DTE rate). That means that after each **AT** entered with a new DTE rate, the DCE rate is changed as well. If the selected DTE rate is not supported on the telephone side (e.g. 115,200 bps), an attempt is made to establish the next connection with the next lower bit rate the modem supports (e.g. 28,800 bps) (see also section 5.3, page 25).

With **AT%G1**, the DCE rate is independent of the DTE rate and can only be changed by **AT%B** (see page 28).

&G Set calling tone and guard tone

*****	**AT&G0 : Calling tone on, no guard tone**	(not in the **UK**)
	AT&G1 : Calling tone on, guard tone 550 Hz	
	AT&G2 : Calling tone on, guard tone 1800 Hz	(default for the **UK**)
	AT&G4 : Calling tone off, no guard tone	(not in the **UK**, default for **USA**)
	AT&G5 : Calling tone off, guard tone 550 Hz	
	AT&G6 : Calling tone off, guard tone 1800 Hz	

The guard tone is an additional signal that can be sent over the telephone line in V.22bis mode. This tone is meaningless in those countries in which *MicroLink* modems are approved by the national telecommunications service.

The calling tone is a periodic tone which is transmitted in the time period between dialing and connection. As this tone can lead to disturbances in some foreign modems, it is possible to suppress the transmission of the calling tone.

→ **NOTE** → In the **United Kingdom**, the guard tone cannot be switched off, and default is 1800 Hz. In the **USA**, the calling tone is off by default to avoid confusion with a 300-bps carrier (Bell 103).

H Hang up command

ATH0 : Go on-hook
ATH1 : Go off-hook

If the modem is in the command state after an Escape command (see section 5.2, page 24) or a change of DTR from ON to OFF with a preceding **AT&D1** (see page 31), the **ATH** (or **ATH0**) command can be used to hang up and thus terminate an existing connection.

If the modem is offline, it can be told to go off-hook (pick up the phone) with the **ATH1** command.

-H Dumb mode

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

With the **AT-H1** command the modem can be set to a "dumb" mode. This means that an incoming call will always be accepted as soon as the DTR line is active. The only commands accepted in this operating mode are **ATD** (dialing) and **AT-H**. In dumb mode, all echoes and result codes (e.g. OK, RING, CONNECT) are suppressed. (Polling is possible during connection establishment, see also page 52.)

→ **NOTE** → To set the modem back to normal operation, the **AT-H0** <CR> and **AT&F** <CR> commands must be entered in two separate command lines.

I Display product information

ATI0 : Display product code in nnn format
ATI1 : Display checksum
ATI2 : Display checksum result
ATI3 : Display firmware version and date
ATI4 : Display current configuration profile
ATI5 : Display serial number
ATI6 : Display product name
ATI7 : Display result of self-test
ATI9 : Display Plug and Play information

A three digit ASCII string type number (modem product code) is displayed with **ATI0**.

ATI1 displays the least significant byte of a 16 bit checksum of the firmware ROM as a three digit ASCII number.

ATI2 calculates the checksum of the ROM and compares it with the checksum stored in the ROM. If both values are identical, an OK is displayed. If they are not, ERROR is replied.

ATI3 displays the firmware version number and the firmware date. This command corresponds to the **AT%V** command (see page 45).

ATI4 displays the current modem configuration.

ATI5 displays the internal factory serial number of the modem.

ATI6 displays the product name of the modem.

ATI7 displays the result of the self-test the modem automatically performs after being switched on.

ATI9 displays a string containing Plug and Play information (e.g. for Windows 95).

-J Detect phase

AT-J0 : Disable detect phase
*** AT-J1 : Enable detect phase**

This command determines whether the calling modem, when establishing a V.42 connection, sends a control sequence (detect phase) to the remote modem or not.

Some remote modems may not be able to recognize a detect phase. In case of difficulties in establishing V.42 connections with such modems, the detect phase can be suppressed with **AT-J0**.

Exception: If the modem is set to **AT\N3** without detect phase it only attempts to establish an MNP connection before falling back to a physical connection. In order to establish a V.42 connection, **AT-J1** must be set. An overview of the effects of **AT-J** and **AT\N3** can be found in the description of the **AT\N** command, page 38.

\J Constant DTE rate

*** AT\J0 : DTE rate independent of CONNECT bit rate**
AT\J1 : DTE rate depends on DCE rate

With the **AT\J0** setting a constant bit rate is maintained between computer and modem. This prevents the DTE rate from being adapted to the DCE rate.

The **AT\J1** command makes the computer connection bit rate (DTE rate) adjust to the CONNECT (DCE) bit rate. This applies to all transfer modes up to V.32bis.

\K Break control

AT\Kn (n = 0..5)

This command affects the handling of break signals received by the modem. The following tables indicate the effects of the parameter **n**. The modem is able to buffer up to four breaks (received and to be sent).

During an error-corrected connection or a connection in normal mode, the breaks sent by the computer are handled in the following manner:

n	Effect
0, 2, 4	Modem changes to command state, no break is sent to remote system
1	Modem clears sending buffer, a break is sent to remote system
3	Modem sends break immediately to remote system; no loss of data
5	**Modem inserts break into data stream; no loss of data**

During a connection in normal mode, the breaks received from the remote system are handled as follows:

n	Effect
0, 1	Modem clears sending buffer, transmits break to computer
2, 3	Modem immediately transmits break to computer
4, 5	Modem inserts break into data stream; no loss of data

L Speaker volume

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

This command controls the volume of the modem speaker.

%L V.100 bit rate adaptation

AT%L0 : Partial bit rate adaptation
*** AT%L1 : V.100 bit rate adaptation**
AT%L2 : No fallback
AT%L3 : V.100 bit rate adaptation

This command controls the bit rate adaptation (automatic speed matching) during the establishment of a connection.

With **AT%L1** (default setting) and with **AT%L3**, the *MicroLink 33.6TQV, MicroLink 28.8TQV* and *MicroLink 14.4TQ* operate in accordance with the ITU-T standard V.100. Modems complying with this standard automatically adapt themselves to the transmission bit rate of the other party.

If a connection is established to a modem that does not operate in accordance with ITU-T V.100, the **AT%L0** command should be used to allow only partial bit rate adaptation, in which a fallback to a lower bit rate is possible only within one transmission mode (e.g. V.32bis from 14,400 to 12,000, 9600, 7200 and 4800 bps). If a connection cannot be established with this setting as well, the modem should be configured to **AT%L2**. A connection is then established only with the bit rate determined by the **AT%B** command (see page 28).

M Speaker control

ATM0 : Speaker always off
*** ATM1 : Speaker on during dialing/waiting for answer tone**
ATM2 : Speaker always on
ATM3 : Speaker on during waiting for answer tone

The speaker can be permanently on or off, or it can be switched on during the connection establishment phase (dialing and waiting for an answer tone), or it can be switched on only during the transition into the online state.

-M Verbose CONNECT messages

*** AT-M0 : Verbose CONNECT messages dependent on AT\V**
AT-M1 : Verbose CONNECT messages independent of AT\V

This command influences the verbose CONNECT messages for error-corrected connections (connections with MNP, V.42, or V.42bis).

With **AT-M0** (default setting) the output of CONNECT messages depends on the setting of the **AT\V** command (see page 45).

With **AT-M1** the following result codes are displayed upon successful connection, regardless of the setting of the **AT\V** command and the transmission bit rate:

MNP1..4 connection:	**CONNECT MNP**
MNP5 connection:	**CONNECT MNP5**
V.42 connection:	**CONNECT LAPM**
V.42bis connection:	**CONNECT LAPM/V42BIS**

%M V.8 bit rate adaptation (*MicroLink 33.6TQV* and *MicroLink 28.8TQV* only)

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

This command controls the bit rate adaptation during the establishment of a connection.

With **AT%M0** (default setting) *MicroLink 33.6TQV* and *MicroLink 28.8TQV* 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, the modem automatically tries to adapt its bit rate according to ITU-T V.100.

\N Operating mode

	\N0	**\N1**	**\N2**	**\N3***	**\N4**	**\N5**	**\N6**
V.42				(↓)	■	↓	↓
MNP			■	↓			■

normal	■			■		■	
direct		■					

This command determines whether error correction is employed and which method is used. This command is connected with the **AT%C** (data compression, see page 29) and **AT-J** (detect phase, see page 36) commands. An overview of the interdependencies of these commands can be found in appendix B, Error Correction and Data Compression. If the error correction has been disabled with **AT\N0** or **AT\N1**, data compression is not possible.

When set to **AT\N0**, the modem operates in normal mode and establishes physical connections without an error correction method.

With **AT\N1** the modem establishes connections in direct mode. No buffering or data flow control takes place in these physical connections. This operating mode is not possible with V.34 and V.Fast Class. With V.34 and V.Fast Class the modem operates in normal mode.

When set to **AT\N2**, the modem attempts to establish an error-corrected connection with MNP. If the other party does not support MNP, the connection is aborted.

With **AT\N3** (default setting) the modem attempts to establish an error-corrected connection. If this is not possible, a connection in normal mode is re-established. The **AT-J** command determines whether the modem only tries to establish a connection with MNP, or also with V.42 (see page 36).

When set to **AT\N4**, the modem attempts to establish an error-corrected connection with V.42. If this is not possible, the connection is aborted.

With the settings **AT\N5** and **AT\N6** the modem first attempts to establish an error-corrected connection with V.42. If the other party does not support V.42, **AT\N5** causes an automatic fallback to a physical connection, while with **AT\N6** the modem attempts to establish an error-corrected connection with MNP. If that protocol is not supported as well, the connection is aborted.

The following table shows which types of connections can be established between two modems dependent on the setting of **AT\N** (and, in the case of the calling modem, also dependent on **AT-J**):

	Originate						
Answer	**AT\N0**	**AT\N1**	**AT\N2**	**AT\N3**		**AT\N4**	**AT\N5**	**AT\N6**
				-J0	**-J1**			
AT\N0	normal	direct/normal	none	normal		none	normal	none
AT\N1	normal/direct	direct/normal	none	normal		none	normal/direct	none
AT\N2	none	none	MNP	MNP		none	none	MNP
AT\N3	normal	direct/normal	MNP	MNP	V.42	V.42	V.42	V.42
AT\N4	none	none	none	none	V.42	V.42	V.42	V.42
AT\N5	normal	direct/normal	none	normal	V.42	V.42	V.42	V.42
AT\N6	none	none	MNP	MNP	V.42	V.42	V.42	V.42

→ **NOTE** → The direct mode is not possible with V.34 and V.Fast Class. With V.34 and V.Fast Class, the modem operates in normal mode.

O Return to online state

ATO0 : Return to online state without retrain
ATO1 : Return to online state with retrain

If the modem is in the command state after an Escape command (see section 5.2, page 24) or a transition of DTR from ON to OFF with a preceding **AT&D1** (see page 31), the **ATO0** command can be used for changing back to the online state and resuming the online data transmission.

P Set pulse dialing

ATP

This command selects the pulse dialing (loop disconnect signaling) method.

\P Store telephone numbers

AT\Pmn

Up to ten telephone numbers can be stored in the non-volatile memory of the modem with this command. The **ATD/m** command (see page 30) dials the telephone number **n** (max. 36 digits) stored in the **m**-th position (**m** = **0**..**9**). The numbers are kept in the memory even when the modem is switched off. A number stored in position **m** can be deleted with the **AT\Pm** command. The rules applying to **n** are the same as explained on page 30.

→ **ATTENTION** → The numbers stored with **AT\P** can be overwritten with the **AT&Z** command (see page 48).

Q Enable/disable modem result codes

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

This command can be used to suppress the messages sent by the modem to the connected computer (see section 5.8, page 77) always (**ATQ1**) or only in answer mode (**ATQ2**).

*Q Message after invalid Escape sequence

* **AT*Q0 : Enable CONNECT message after invalid Escape sequence**

AT*Q1 : Disable CONNECT message after invalid Escape sequence

This command can be used to suppress the CONNECT message when returning to the online state after an invalid Escape command (see section 5.2, page 24).

\Q Flow control

AT\Q0 : Disable flow control
AT\Q1 : XON/XOFF bidirectional handshake
AT\Q2 : CTS unidirectional handshake
*** AT\Q3 : RTS/CTS bidirectional handshake**
AT\Q4 : XON/XOFF unidirectional handshake

With this command various handshake methods for the data flow control at the serial interface can be selected.

Data flow control is especially important if the transmission bit rate to the computer is not equal to the DCE rate. That is the case e.g. when error correction and data compression methods are used. Without a handshake procedure there is an inevitable risk of buffer overflow.

When using a hardware handshake via the **AT\Q2** or **AT\Q3** command, the data flow is controlled by the RTS (Request To Send) and CTS (Clear To Send) interface lines. If the RTS control line is set to OFF, data output to the computer is stopped. Switching to ON resumes the output of the received data. If the modem continues to receive data from the telephone line, the data are temporarily stored in a receiving buffer. If the sending buffer is full, the modem sets the message line CTS (Clear To Send) to OFF to stop the data output from the computer.

The **AT\Q1** and **AT\Q4** commands select a software handshake with the XON/XOFF characters. When the modem receives the character <DC3> (= Ctrl-S = XOFF) from the computer, data output is stopped until a <DC1> (= Ctrl-Q = XON) is sent. On the other hand, the modem sends a <DC3> or <DC1> to the computer when its buffer is full or ready to be refilled. The **AT\X** command (see page 47) determines whether the XON and XOFF characters are also sent to the remote modem or not. By default, they are not sent.

With unidirectional handshake methods, the handshake signals coming from the computer are ignored.

%R Display register contents

AT%R

This command displays the current contents of the S registers (0..99) in two columns, decimally and hexadecimally.

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

The register number **n** (0..239) and the register value **x** (0..255) are entered and displayed as numerical ASCII strings. The valid values for **x** may be restricted (for example, see register S0, page 49). The S registers are described individually in section 5.6.

Command lines with **ATS** (**ATSn**, **ATSn=x**, **ATSn?**) make the referenced register the default register for subsequent **AT?** and **AT=x** commands. If a register is set to an invalid value, the command is ignored and answered with ERROR. If invalid settings are made in a bit-mapped register, only the invalid bits are ignored; all other bits are accepted.

&S DSR control

* **AT&S0 : DSR is always active**
AT&S1 : DSR is active between answer tone and hang up

This command influences the meaning of the DSR signal line (see also page 93). This interface line is normally always active. When set to **AT&S1**, DSR is active only in the time between the end of the answer tone and the termination of the connection.

\S Verbose display of the current configuration

AT\S0 : Display the entire list
AT\S1 : Display the entire list
AT\S2 : Display from part 2
AT\S3 : Display from part 3
AT\S4 : Display from part 4
AT\S5 : Display from part 5

The **AT\S** command displays the current configuration profile of the modem in verbose form, as follows:

Example:

```
1.  CONNECTION / HANG UP
LAST DIAL
DIAL MODE                   TONE        T/P
DIAL LOCK                   000         MIN
DIAL/BUSY TONE              003         X3
DTR DIALING                 OFF         $D0
PAUSE LENGTH                002         S8=2
AUTO ANSWER                 001         S0=1
GUARD/CALLING TONE          000         &G0
DISCONNECT DELAY            000         %D0
INACTIVITY TIMER            000         \T0

Press any key to continue...

2.  LINE INTERFACE
MODEM = SERIAL BPS          OFF         %G1

MODEM BPS                   33600       %B33600
```

MicroLink 33.6TQV and MicroLink 28.8TQV only:

```
V.8                         OFF         %M1
BPS ADJUST                  OFF         \J0
SPEED MATCH                 V100        %L1
BELL                        OFF         B0
AUTO RETRAIN                ON          %E1
ALLOW RD LOOPBACK           OFF         &T4

Press any key to continue...

3.  PROTOCOLS
MODEM MODE                  NORMAL      \N0
COMPRESSION                 ALL         %C3
DETECT PHASE                ON          -J1
BREAK CONTROL               005         \K5
FALLBACK CHARACTER          000         %A0
FALLBACK MODE               FB 200      \C1

Press any key to continue...

4.  HOST INTERFACE
SERIAL BPS                  115200      AT
DATA FORMAT/PARITY          8N1         AT
TRANSMIT XON/XOFF           OFF         \X0
DATA FLOW CONTROL           RTS/CTS     \Q3
DSR/CTS CONTROL             000         \D0
CARRIER DETECTION           001         &C1
ESCAPE CHARACTER             +          S2=43
EFFECT OF DTR               002         &D2
MEANING OF DSR              000         &S0

Press any key to continue...

5.  ON-SCREEN-MESSAGES AND SPEAKER
MODEM MESSAGES              ON          Q0
COMMAND ECHO                ON          E1
FORM OF MESSAGES            LONG        V1
MESSAGES DEP ON \V          ON          -M0
CONNECT MESSAGES            008         \V8
TIES CONNECT                ON          *Q0
SPEAKER CONTROL             001         M1
SPEAKER VOLUME              002         L2
```

T Set tone dialing

ATT

This command selects the touch-tone dialing (multi-frequency dialing, DTMF signaling) method.

&T Diagnostic testing

AT&T0 : Normal operation
AT&T1 : Local analog loopback
AT&T3 : Local digital loopback [1)]
*** AT&T4 : Remote digital loopback accepted** [1)]
AT&T5 : Remote digital loopback accepted [1)]
AT&T6 : Remote digital loopback

This command sets several testing loopbacks and can be used as a function test.

AT&T1 is effective in the command state only and places the modem into a local analog loopback. Each character sent from the host to the modem is echoed.

The **AT&T3** and **AT&T6** commands are effective in the online state only. Upon receiving this command, the modem enables a local or remote digital loopback when entering the next online state.

The **AT&T3** command places the modem into a local digital loopback. The loopback is initiated by the remote modem. In this state, the characters sent by the remote modem are not transmitted to the host, but instead returned directly to the remote modem.

The **AT&T6** command enables a remote digital loopback (if the remote modem is set to **AT&T4**). In this mode, the remote modem does not pass the received characters to its host computer, but instead returns them directly to the local modem.

When the modem is set to **AT&T4**, it is possible for a remote modem to establish a remote digital loopback. This can be suppressed by the **AT&T5** setting.

The testing modes can be terminated by changing to the command state and entering **AT&T0**.

1) These commands are only valid if no error correction method is active.

\T Disconnect inactivity timer

AT\Tn (n = 0..255 × 10 seconds; default = 0)

This command controls the time after which the modem automatically terminates a connection, if no data have been sent or received within this period (see also register S30, page 56). The value of **AT\T** is a multiple of 10 seconds. Valid values for **n** are **0**..**255**. The default value **0** disables the inactivity timer.

V Form of result codes

ATV0 : Enable short form result codes (digits)
*** ATV1 : Enable long form (verbose) result codes**

This command allows you to choose whether the messages sent by the modem to the connected computer are displayed as digits or words. The result codes in short form and verbose form are listed in section 5.8, page 77.

%V Display firmware version

AT%V

This command displays the modem firmware version on the monitor and corresponds to the **ATI3** command (see page 35).

&V Display configuration profiles

AT&V

This command displays the current configuration and the two stored configuration profiles 0 and 1 (see also the **AT&W** and **AT*W** commands, page 46) of the modem on the monitor.

\V CONNECT messages for error-corrected connections

AT\V0 : No modified CONNECT messages
AT\V1 : Identification of error-corrected connections
AT\V2 : Identification of MNP and V.42(bis) connections
*** AT\V8 : Identification of MNP, V.42 and V.42bis connections**

This command controls the CONNECT messages for error-corrected connections (connections with MNP, V.42 or V.42bis).

With **AT\V0** modified CONNECT messages are always suppressed. The CONNECT messages for error-corrected connections are identical to the CONNECT messages for physical connections.

With **AT\V1** the type of error-corrected connection is not differentiated (**xxxx** = transmission bit rate):

CONNECT xxxx/REL (REL = reliable)

With **AT\V2** error-corrected connections are differentiated into MNP and V.42 (bis) connections:

CONNECT xxxx/REL - MNP (MNP connection)
CONNECT xxxx/REL - LAPM (V.42(bis) connection)

All of the settings listed have the disadvantage of not including complete information concerning the type of connection. The **AT\V8** command (default setting) allows a complete evaluation:

CONNECT xxxx/MNP (MNP1..4 connection)
CONNECT xxxx/MNP5 (MNP5 connection)
CONNECT xxxx/LAPM (V.42 connection)
CONNECT xxxx/LAPM/V42BIS (V.42bis connection)

Furthermore, the **AT\V8** setting can be used to display "Extended CONNECT messages", which provide additional information about the transmission standard used (e.g. **CONNECT xxxx/V32BIS/LAPM/V42BIS**). For extended CONNECT messages, bit 6 of register S96 (see page 66) must be set to 1 (**ATS96=72**). Possible values for the transmission mode string are:

V23, V21, V22BIS, V32, V32BIS, VFC, V34, B103*, B212A* (*= not in the **UK**)

An overview of all possible CONNECT messages can be found in section 5.8, page 77.

&W Save current configuration profile

AT&W0 : Save configuration profile 0
AT&W1 : Save configuration profile 1

This command can be used to save the current modem configuration in the non-volatile memory of the modem. Two different configuration profiles (0 and 1) can be stored.

The current values of the following commands and registers are saved:

%A	**%D**	**-J**	**\N**	**&T4**	**S14**	**S26**	**S34**	**S47**
B	**\D**	**\J**	**P**	**&T5**	**S15**	**S27**	**S36**	**S48**
%B	**E**	**\K**	**Q**	**\T**	**S18**	**S28**	**S37**	**S51**
%C	**%E**	**L**	**\Q**	**V \V**	**S21**	**S30**	**S38**	**S52**
&C	**%G**	**%L**	**&S**	**X**	**S22**	**S31**	**S39**	**S64**
\C	**&G**	**M**	**\S**	**\X**	**S23**	**S32**	**S42**	**S93**
&D	**-H**	**-M**	**T**	**S0**	**S25**	**S33**	**S46**	**S95**

→ **ATTENTION** → Registers whose current value cannot be stored with the **AT&W** command are saved with their default values. Thus the **AT&W** command may overwrite those register values stored with **AT*W** (see below).

The values are retained when the modem is switched off and are automatically recalled the next time the modem is turned on.

*W Save extended configuration profile

AT*W0 : Save extended configuration profile 0
AT*W1 : Save extended configuration profile 1

In addition to the parameters and registers stored with **AT&W**, this command also saves the values of the following registers in the non-volatile memory of the modem:

S2..S12, S29, S33..S34, S40, S42..S43, S60, S63..S64, S94, S96, S99, S101..S103; S130, S229

The values are retained when the modem is switched off and are automatically recalled the next time the modem is turned on.

X Handling of dial tones / busy tones

ATX0 : Ignore dial tone / busy tone *)
ATX1 : Ignore dial tone / busy tone *)
ATX2 : Wait for dial tone / ignore busy tone
ATX3 : Ignore dial tone / evaluate busy tone *)
*** ATX4 : Wait for dial tone / evaluate busy tone**

This command is used to determine the dialing behavior. With **ATX2** or **ATX4** the modem waits for a dial tone before dialing. With **ATX0**, **ATX1** or **ATX3** the modem does not wait for the dial tone, so that "blind dialing" is possible, e.g. while establishing a connection between two extensions.*)

In addition, this command selects whether your modem recognizes a busy tone and replies with BUSY or ignores the busy tone and aborts the dialing attempt with NO CARRIER.

→ **NOTE** → With the **ATX0** setting only the message CONNECT (or "1" in short form) is displayed, regardless of the transmission bit rate and the type of connection.

\X Handling of XON/XOFF characters

*** AT\X0 : XON/XOFF characters are not passed to the remote side**
AT\X1 : XON/XOFF characters are passed to the remote side

This command influences the handling of the characters XON and XOFF which serve for data flow control if an XON/XOFF software handshake has been selected (see also **AT\Q**).

The **AT\X0** setting causes the XON/XOFF characters to be used only for the data flow control between the local modem and computer and are **not** transmitted to the remote modem.

With the **AT\X1** setting these characters likewise control the data flow between the local modem and computer. However, the characters are **also** sent 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

This command determines which of the two stored configuration profiles (0 or 1) is loaded and used when the modem is turned on.

Z Load configuration profile

ATZ0 : Load configuration profile 0
ATZ1 : Load configuration profile 1

This command loads a configuration profile (0 or 1) from non-volatile memory. Any existing connection will be broken. This command is independent of the **&Y** command.

&Z Store telephone numbers

AT&Zm=n : Store telephone number n in position m

Up to twenty telephone numbers can be stored in the non-volatile memory of the modem with this command. The **ATDSm** command (see page 30) dials the telephone number **n** (max. 36 digits) stored in the **m**-th position (**m** = **0**..**19**). The numbers are kept in the memory even when the modem is switched off. A number stored in position **m** can be deleted with the **AT&Zm=** command. The rules applying to **n** are the same as explained on page 30.

→ **ATTENTION** → The numbers stored with **AT&Z** can be overwritten with the **AT\P** command (see page 40).

5.6 Registers

MicroLink 33.6TQV, MicroLink 28.8TQV and *MicroLink 14.4TQ* have internal registers you can use to modify the configuration of the modem (see **ATSn** command, page 42). On the following pages, the functions of each register are described. Please note that changing the value of a bit-mapped register can affect several functions at once!

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 modem status. To change the configuration of your modem, you should use the more convenient and safe 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 = 138).
- Add the decimal value of bit 6 = 1 (decimal value = 2^6 = 64) to the current register value (new register value = 138 + 64 = 202).
- Set register S14 to the new value (202) with the **ATS14=202** 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 modem is switched off, the active configuration profile must be saved with the **AT*W** command.

S0 Number of rings to auto-answer

Valid values	:	0..5 rings (in the **Netherlands**: 0..8)
Default value	:	0
Storage in non-volatile memory	:	AT&W or AT*W

The number of rings after which the modem automatically answers an incoming call is set in register S0. A value of 0 disables auto-answer, i.e. incoming calls are not accepted.

If you enter an invalid value, the modem automatically uses the nearest allowed value (minimum or maximum) as the number of rings to be waited for.

With S0 > 0 the connection establishment can be aborted by any character (except for <LF>). However, the connection is not terminated if bit 6 of register S14 is set to 1 (default value = 0). With this setting the connected computer can still send signals to the modem during the establishment of a connection (see page 52).

S1 Ring counter

Valid values	:	0..255 ring pulses
Default value	:	0
Storage in non-volatile memory	:	no

Register S1 contains the number of rings of an incoming call. The value of S1 is reset to zero if no further pulses from the telephone network are registered after a period of time (default: 5 seconds) that has been set in register S99 (see page 67). No new calls can be distinguished within this period of time, and no numbers can be dialed.

S2 Escape character

Valid values	:	0..255 (decimal)
Default value	:	43 (+)
Storage in non-volatile memory	:	AT*W

The Escape command '+++' (see also section 5.2, page 24), which is used to change from the online state to the command state in an existing connection , can be redefined in register S2.

→ **NOTE** → Changing to the command state is locked by the value 0 or values ≥ 128.

S3 Carriage Return character

Valid values	:	0..127 (decimal)
Default value	:	13 (Carriage Return)
Storage in non-volatile memory	:	AT*W

The character for <CR> (Carriage Return, Enter) can be redefined in register S3.

S4 Line Feed character

Valid values	:	0..127 (decimal)
Default value	:	10 (Line Feed)
Storage in non-volatile memory	:	AT*W

The character for <LF> (Line Feed) can be redefined in register S4.

S5 Backspace character

Valid values	:	0..32, 127 (decimal)
Default value	:	8 (Backspace)
Storage in non-volatile memory	:	AT*W

The character for <BS> can be redefined in register S5.

S6 Waiting before blind dialing

Valid values	:	3..6 seconds (in the **UK**: 4..5 seconds)
Default value	:	3 seconds (in the **UK**: 4 seconds)
Storage in non-volatile memory	:	AT*W

The time to elapse before the modem performs blind dialing (see also **ATX**, **ATX1** or **ATX3**, page 47) can be set in register S6.

S7 Waiting for carrier

Valid values	:	10..100 seconds (in the **UK**: 10..59)
Default value	:	90 seconds (in the **UK**: 59 seconds)
Storage in non-volatile memory	:	AT*W

The amount of time that the modem waits for the carrier after dialing is set in register S7.

S8 Pause length of ','

Valid values	:	0..8 seconds
Default value	:	2 seconds
Storage in non-volatile memory	:	AT*W

The length of a dialing pause caused by the dialing character **,** (see page 30) is determined in register S8.

S10 Delay for hang up after carrier loss

Valid values	:	1..255 1/10 seconds
Default value	:	3 (0.3 seconds)
Storage in non-volatile memory	:	AT*W

Register S10 determines the period of time after which the modem terminates the connection if no carrier signal is detected.

S11 Tone duration for tone dialing

Country	Valid values	Default value
United Kingdom	85..95 1/1000 seconds	90 1/1000 seconds
The Netherlands	70..95 1/1000 seconds	70 1/1000 seconds
USA	40..95 1/1000 seconds	40 1/1000 seconds

Storage in non-volatile memory : AT*W

The speed of the tone dialing process (i.e. the duration of each dialing tone) can be changed in register S11.

S12 Escape Prompt Delay

Valid values : 0..255 (1/50 seconds)
Default value : 50 (1 second)
Storage in non-volatile memory : AT*W

The length of the Escape Prompt Delay is set in register S12 (see also section 5.2, page 24).

S14 Bit-mapped options

The contents of register S14 can be stored in the non-volatile memory using the **AT&W** or **AT*W** command. The individual bits have the following meaning:

Bit	Dec.	Meaning	
0	0	none	
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 = short form result codes (digits)	ATV0
	8	**1 = long form (verbose) result codes**	**ATV1**
4	**0**	**0 = normal operation**	**AT-H0**
	16	1 = dumb mode	AT-H1
5	**0**	**0 = tone dialing**	**ATT**
	32	1 = pulse dialing	ATP
6	**0**	**0 = polling not allowed during connection establishment**	
	64	1 = polling allowed during connection establishment	
7	0	0 = modem in answer mode	
	128	**1 = modem in originate mode**	

S16 Bit-mapped options

This register can be read only. It contains information about the status of an active loopback:

Bit	Dec.	Meaning	
0	0	0 = local analog loopback inactive	
	1	1 = local analog loopback active	AT&T1
1	0	none	
2	0	0 = local digital loopback inactive	
	4	1 = local digital loopback active	AT&T3
3	0	0 = no initiated remote digital loopback	
	8	1 = initiated remote digital loopback active	
4	0	0 = remote digital loopback inactive	
	16	1 = remote digital loopback active	AT&T6
5..6	0	reserved	
7	0	none	

S21 Bit-mapped options

The contents of register S21 can be stored in the non-volatile memory using the **AT&W** or **AT*W** command. The individual bits have the following meaning:

Bit	Dec.	Meaning	
0..2	0	none	
3..4	0	0 = ignore DTR status change	AT&D0
	8	1 = change to command state if DTR → OFF	AT&D1
	16	**2 = hang up if DTR → OFF**	**AT&D2**
	24	3 = reinitialization if DTR → OFF	AT&D3
5	0	0 = DCD signal is always active (ON)	AT&C0
	32	**1 = DCD signal indicates existence of carrier**	**AT&C1**
6..7	0	none	

S22 Bit-mapped options

The contents of register S22 can be stored in the non-volatile memory using the **AT&W** or **AT*W** command. The individual bits have the following meaning:

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	0 = ignore dial tone / busy tone	ATX0
	64	4 = ignore dial tone / busy tone	ATX1
	80	5 = wait for dial tone / ignore busy tone	ATX2
	96	6 = ignore dial tone / evaluate busy tone	ATX3
	112	**7 = wait for dial tone / evaluate busy tone**	**ATX4**
7	0	none	

S23 Bit-mapped options

The contents of register S23 can be stored in the non-volatile memory using the **AT&W** or **AT*W** command. The individual bits have the following meaning:

Bit	Dec.	Meaning	
0	0	0 = initiated remote digital loopback not allowed	AT&T5
	1	**1 = initiated remote digital loopback allowed**	**AT&T4**
1..3[1)]	0	0 = DTE rate 300 bps	
	2	1 = DTE rate 600 bps	
	4	2 = DTE rate 1200 bps	
	6	3 = DTE rate 2400 bps	
	8	4 = DTE rate 4800 bps	
	10	5 = DTE rate 9600 bps	
	12	6 = DTE rate 19,200 bps	
	14	**7 = DTE rate ≥ 38,400 bps**	
4..5[1)]	0	0 = 7E1	
	16	**1 = 8N1**	
	32	2 = 7O1	
	48	3 = 7N2	
6..7	**0**	**0 = guard tone off** (not in the United Kingdom)	**AT&G0** / AT&G4
	64	1 = guard tone 550 Hz	AT&G1 / AT&G5
	128	2 = guard tone 1800 Hz (**default for the United Kingdom**)	AT&G2 / AT&G6

1) The value of S23 is overwritten after every AT (see section 5.3, page 25).

S25 DTR delay

Valid values	:	0..255 (1/100 seconds)
Default value	:	5 (0.05 seconds)
Storage in non-volatile memory	:	AT&W or AT*W

Register S25 can be used to set the minimum duration of a DTR change to have any effect. This affects those features that are set with the **AT&Dn** and **AT$Dn** commands.

S27 Bit-mapped options

The contents of register S27 can be stored in the non-volatile memory using the **AT&W** or **AT*W** command. The individual bits have the following meaning:

Bit	Dec.	Meaning	
0..5	0	reserved	
6	**0**	**0 = ITU-T V.21/V.22bis**	**ATB0**
	64	1 = Bell 103/212A (not available in the United Kingdom)	ATB1
7	**0**	**0 = duplex**	
	128	1 = half-duplex	

S28 Bit-mapped options

The contents of register S28 can be stored in the non-volatile memory using the **AT&W** or **AT*W** command. The individual bits have the following meaning:

Bit	Dec.	Meaning	
0..1	0	0 = word length in asynchronous direct mode (AT\N1): 8 bits/character	
	1	1 = word length in asynchronous direct mode (AT\N1): 9 bits/character	
	2	**2 = word length in asynchronous direct mode (AT\N1): 10 bits/character**	
	3	3 = word length in asynchronous direct mode (AT\N1): 11 bits/character	
2..3	0	0 = partial bit rate adaptation	AT%L0
	4	**1 = V.100 bit rate adaptation on**	**AT%L1**
	8	2 = no fallback	AT%L2
	12	3 = V.100 bit rate adaptation on	AT%L3
4	0	reserved	
5	**0**	**0 = bit rate tolerance: -2,5% + 1,0%**	
	32	1 = bit rate tolerance: - 2,5% + 2,3%	
6	0	0 = Disable automatic retrain	AT%E0
	64	**1 = Enable automatic retrain**	**AT%E1**
7	**0**	**0 = RING message and call acceptance not possible if DTR = OFF**	
	128	1 = RING message and call acceptance possible if DTR = OFF	

→ **NOTE** → Direct mode is not possible with V.34 and V.Fast Class. With V.34 and V.Fast Class, the modem operates in normal mode.

S29 Bit-mapped options

The contents of register S29 can be stored in the non-volatile memory using the **AT*W** command. The individual bits have the following meaning:

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	(*MicroLink 33.6TQV, MicroLink 28.8TQV* only)
	2	**1 = Enable asymmetric bit rates**	(*MicroLink 33.6TQV, MicroLink 28.8TQV* only)
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**	(*ML 33.6TQV, ML 28.8TQV* only)
	16	1 = Disable V.34/V.Fast Class rate renegotiation	(*ML 33.6TQV, M 28.8TQV* only)
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**	(*MicroLink 33.6TQV, MicroLink 28.8TQV* only)
	128	1 = V.8 answer tone without V.Fast Class ID	(*MicroLink 33.6TQV, MicroLink 28.8TQV* only)

S30 Disconnect inactivity timer

Valid values	:	0..255 × 10 seconds
Default value	:	0 (timer off)
Storage in non-volatile memory	:	AT&W or AT*W

The period of time after which the modem automatically terminates the connection (if no further data have been received or sent) can be set in register S30 (see also **AT\T** command, page 44). A value of zero disables the inactivity timer.

S31 Bit-mapped options

The contents of register S31 can be stored in the non-volatile memory using the **AT&W** or **AT*W** command. The individual bits have the following meaning:

Bit	Dec.	Meaning	
0..2	**0**	**0 = no guard tone, calling tone on** (not in the United Kingdom)	**AT&G0**
	1	1 = guard tone 550 Hz, calling tone on	AT&G1
	2	2 = guard tone 1800 Hz, calling tone on (**default for the United Kingdom**)	AT&G2
	4	4 = no guard tone, calling tone off (not in the United Kingdom, **default for USA**)	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 according to ITU-T V.25**	
	8	1 = calling tone according to ITU-T V.8 (*MicroLink 33.6TQV, MicroLink 28.8TQV* only)	
4	**0**	**0 = manual dialing off**	**AT:D0**
	16	1 = manual dialing on	AT:D1
5	**0**	**0 = DTR dialing off**	**AT$D0**
	32	1 = DTR dialing on	AT$D1
6..7	0	reserved	

S33 Bit-mapped options

Register S33 stores the settings of the **AT$B** and **AT$T** commands (see pages 72 and 72). The individual bits have the following meaning:

Bit	Dec.	Meaning	
0..1	**0**	**0 = no callback**	**AT$B0**
	1	1 = callback variant 1	AT$B1
	2	2 = callback variant 2	AT$B2
2	**0**	**0 = callback log off**	**AT$T0**
	4	1 = callback log on	AT$T1
3	**0**	**0 = remote configuration off**	**AT*E0**
	8	1 = remote configuration on	AT*E1
4..7	0	reserved	

S34 Configuration command

Valid values	:	0..127 (decimal)
Default value	:	42 (*)
Storage in non-volatile memory	:	**AT*W**

Register S34 can be used to change the configuration command ********, which is used to change from the online state to the remote configuration state.

S35 Number of Callback Attempts

Valid values	:	1..99
Default value	:	3
Storage in non-volatile memory	:	**AT*W**

In Register S35, the number of times your modem attempts to call back can be defined.

S36 Error correction

In Register S36 you can select which type of error correction (if any) is to be used.

The "selective rejects" from the V.42 error correction protocol are also supported. This facility enables erroneous data packets to be re-transmitted, without losing other data packets sent subsequently. Up to six selective rejects can be defined and processed simultaneously.

Settings for register S36 can be stored to non-volatile memory with the commands **AT&W** or **AT*W.**

The individual bits have the following meanings:

Bit	Dec.	Meaning

Bit	Dec.	Meaning	
0..2	0	0 = Normal mode	AT\N0
	1	1 = Direct mode	AT\N1
	2	2 = MNP	AT\N2
	3	**3 = V.42/MNP with fallback to normal mode**	**AT\N3**
	4	4 = V.42	AT\N4
	5	5 = V.42 with fallback to normal mode	AT\N5
	6	6 = V.42 with fallback to MNP	AT\N6
3..6	0	reserved	
7	**0**	**0 = Selective Reject (SREJ) on**	
	128	1 = Selective Reject (SREJ) off	

S37 Bit-mapped options

The contents of register S37 can be stored in the non-volatile memory using the **AT&W** or **AT*W** command. The individual bits have the following meaning:

Bit	Dec.	Meaning	
0..5	1	1 = DCE rate 75/1200 bps	AT%B75/1200
	2	2 = DCE rate 1200/75 bps	AT%B1200/75
	3	3 = DCE rate 300 bps	AT%B300
	5	5 = DCE rate 1200 bps	AT%B1200
	6	6 = DCE rate 2400 bps	AT%B2400
	7	7 = DCE rate 4800 bps	AT%B4800
	8	8 = DCE rate 7200 bps	AT%B7200
	9	9 = DCE rate 9600 bps	AT%B9600
	10	10 = DCE rate 12,000 bps	AT%B12000
	11	**11 = DCE rate 14,400 bps**	**AT%B14400**
	12	12 = DCE rate 16,800 bps[1]	AT%B16800
	13	13 = DCE rate 19,200 bps[1]	AT%B19200
	14	14 = DCE rate 21,600 bps[1]	AT%B21600
	15	15 = DCE rate 24,000 bps[1]	AT%B24000
	16	16 = DCE rate 26,400 bps[1]	AT%B26400
	17	**17 = DCE rate 28,800 bps**[1]	**AT%B28800**
	18	18 = DCE rate 31,200 bps[2]	AT%B31200
	19	**19 = DCE rate 33,600 bps**[2]	**AT%B33600**
6	**0**	**0 = DCE rate determined by DTE rate**	**AT%G0**
	64	1 = DCE rate set by AT%B	AT%G1
7	**0**	**0 = DTE rate determined by CONNECT bit rate**	**AT\J0**
	128	1 = same effect as AT\J0	AT\J1

[1] *MicroLink 33.6TQV* and *MicroLink 28.8TQV* only

[2] *MicroLink 33.6TQV* only

S38 Delay before forced hang up

Valid values	:	0..255 seconds
Default value	:	0 seconds
Storage in non-volatile memory	:	AT&W or AT*W

Register S38 can be used to define a maximum delay during which the modem tries to empty its sending and receiving buffers before it terminates the connection. If a connection is terminated because the carrier is lost, only the characters still in the receiving buffer can be read. If the buffer is empty or S38 = 0, the connection is terminated immediately without delay.

S39 RTS/CTS delay in half-duplex mode

Valid values	:	0..255 1/100 seconds
Default value	:	3 (0.03 seconds)
Storage in non-volatile memory	:	AT&W or AT*W

In half-duplex mode, CTS follows the state of RTS. When RTS changes from OFF to ON, the modem waits for the time defined in register S39, before CTS is set to ON as well.

S42 Waiting for user password

Valid values	:	20..120 seconds
Default value	:	30 seconds
Storage in non-volatile memory	:	AT*W

Register S42 defines the period of time the modem waits for the user password to be entered after a successful connection establishment.

S43 Callback delay

Valid values	:	0..2 minutes
Default value	:	1 minute
Storage in non-volatile memory	:	AT*W

Register S43 defines the delay after which an automatic callback is performed.

S46 Data compression

Valid values	:	0..3 (decimal)
Default value	:	3 (V.42bis or MNP5)
Storage in non-volatile memory	:	AT&W or AT*W

Register S46 determines whether a data compression method is used, and which one is used.

Dec.	Meaning	
0	No data compression	AT%C0
1	MNP5 data compression only	AT%C1
2	V.42bis data compression only	AT%C2
3	**V.42bis or MNP5 data compression**	**AT%C3**

S47 Fallback character

Valid values	:	0..62, 64..125, 127 (decimal)
Default value	:	0
Storage in non-volatile memory	:	AT&W or AT*W

Register S47 defines the ASCII character (n = 1..127), which is regarded as fallback command during call acceptance. (see also **AT%A** command, page 28). This command requires the settings **AT\N3** (see page 38) and **AT\C2** (see page 29) The default value 0 disables the fallback character recognition entirely.

→ **NOTE** → The values 63 and 126 cannot be used, because these characters are needed in the V.42 negotiation phase and would therefore cause conflicts.

S48 Bit-mapped options

The contents of register S48 can be stored in the non-volatile memory using the **AT&W** or **AT*W** command. The individual bits have the following meaning:

Bit	Dec.	Meaning	
0..1	0	reserved	
2	0	0 = Detect phase off	AT-J0
	4	**1 = Detect phase on**	**AT-J1**
3..4	**0**	**0 = no data buffering in the negotiation phase**	**AT\C0**
	8	1 = data buffering in the negotiation phase	AT\C1
	16	2 = no data buffering, fallback character detection (AT%A)	AT\C2
5..7	0	0 = Break control	AT\K0
	32	1 = Break control	AT\K1
	64	2 = Break control	AT\K2
	96	3 = Break control	AT\K3
	128	4 = Break control	AT\K4
	160	**5 = Break control**	**AT\K5**

S51 Bit-mapped options

The contents of register S51 can be stored in the non-volatile memory using the **AT&W** or **AT*W** command. The individual bits have the following meaning:

Bit	Dec.	Meaning

Bit	Dec.	Meaning	
0..3	0	0 = no handshake	AT\Q0
	1	1 = XON/XOFF bidirectional	AT\Q1
	2	2 = RTS/CTS unidirectional	AT\Q2
	3	**3 = RTS/CTS bidirectional**	**AT\Q3**
	4	4 = XON/XOFF unidirectional	AT\Q4
4	**0**	**0 = XON/XOFF characters are not passed to remote station**	**AT\X0**
	16	1 = XON/XOFF characters are passed to remote station	AT\X1
5..6	0	none	
7	0	reserved	

S52 Bit-mapped options

The contents of register S52 can be stored in the non-volatile memory using the **AT&W** or **AT*W** command. The individual bits have the following meaning:

Bit	Dec.	Meaning	
0..1	**0**	**0 = DSR always active, CTS always active**	**AT\D0&S0**
	1	1 = DSR follows answer tone, CTS always active	AT\D1&S1
	2	2 = DSR always active, CTS follows DCD	AT\D2
	3	3 = DSR follows answer tone, CTS follows DCD	AT\D3
2..3	0	0 = DCD is always active (ON)	AT&C0
	4	**1 = DCD indicates presence of carrier**	**AT&C1**
	8	2 = DCD dropped only during hang-up	AT&C2
4..7	0	reserved	

S53 Bit-mapped options

Register S53 sets the data format between computer and modem. (This setting is independent of the data format on the telephone side, which is always 8N1). The settings for this register can be stored to non-volatile memory with the commands **AT&W** or **AT*W**. The individual data bits have the following meanings:

Bit	Dec.	Meaning
0..1	**0**	**Online data format 8N1, 7E1, 7O1 or 7N2**
	1	Online data format 8E1
	2	Online data format 801
	3	Online data format 8N2
1..7	0	none

S54 Bit-mapped options

Register S54 controls the modem's option to emit an acoustic signal as notification of an incoming call. By default, this ringing is disabled (bit 0 = 0), and can be enabled by setting bit 0 = 1 with S54.

This register is independent of the command **AT&F**. The settings for this register can be stored to non-volatile memory with the command **AT*W**.

S65 Received signal level

Register S65 can be read only. It contains the received signal level in -dBm (for example, a value of 35 means a signal level of -35 dBm). Levels down to -43 dBm should be properly detected.

S66 Bit-mapped options

The register S66 decides the symbol rate in V.34- and V.Fast class operation. With this option, certain symbol rates can be suppressed. The settings for this register can be stored to non-volatile memory with the commands **AT&W** or **AT*W**. The individual data bits have the following meanings:

Bit	Dec.	Meaning
0	0	0 = Symbol rate 2400 bps off (max. 21,600 bps)
	1	**1 = Symbol rate 2400 bps on**
1	0	reserved
2	0	0 = Symbol rate 2800 bps off (max. 24,000 bps)
	4	**1 = Symbol rate 2800 bps on**
3	0	0 = Symbol rate 3000 bps off (max. 26,400 bps)
	8	**1 = Symbol rate 3000 bps on**
4	0	0 = Symbol rate 3200 bps off (max. 33,600 bps)
	16	**1 = Symbol rate 3200 bps on**
5	0	0 = Symbol rate 3429 bps off (max. 33,600 bps)
	32	**1 = Symbol rate 3429 bps on**
6..7	0	reserved

S84 Bit-mapped options

Register S84 displays the symbol rate established during a V.34 or V.Fast class connection. The symbol rate is displayed as a value from 0 to 5 according to the table below. This register is read-only. The individual bits have the following meanings:

Bit	Dec.	Meaning
0..2	0	0 = 2400 bps
	1	1 = reserved
	2	2 = 2800 bps
	3	3 = 3000 bps
	4	4 = 3200 bps
	5	5 = 3429 bps

S86 Call failure reason code

Register S86 can be read only. The value of S86 indicates the reason for the last connection failure:

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 re-transmissions
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)
32	AT&T0 (in analog loopback)
33	Termination via keystroke
34	Termination via DTR
60	V.32/V32bis handshake signal missing: (AA, CC, AC or CA)
61	V.32/V.32bis handshake signal missing: (R1, R2 or R3)
62	V.32/V.32bis handshake signal missing: (S)
63	V.32/V.32bis handshake signal missing: (transition from S to \S)
64	V.32/V.32bis handshake signal missing: (E)
68	No answer to automatic retrain

S87 Bit-mapped options

Register S87 can be read only. It contains information about the current connection:

Bit	Dec.	Meaning
0..4	1	1 = DCE line transmit bit rate 75 bps (V.23)
	2	2 = DCE line transmit bit rate 1200 bps (V.23)
	3	3 = DCE line transmit bit rate 300 bps
	4	4 = reserved
	5	5 = DCE line transmit bit rate 1200 bps
	6	6 = DCE line transmit bit rate 2400 bps
	7	7 = DCE line transmit bit rate 4800 bps
	8	8 = DCE line transmit bit rate 7200 bps
	9	9 = DCE line transmit bit rate 9600 bps
	10	10 = DCE line transmit bit rate 12,000 bps
	11	11 = DCE line transmit bit rate 14,400 bps
	12	12 = DCE line transmit bit rate 16,800 bps[1]
	13	13 = DCE line transmit bit rate 19,200 bps[1]
	14	14 = DCE line transmit bit rate 21,600 bps[1]
	15	15 = DCE line transmit bit rate 24,000 bps[1]
	16	16 = DCE line transmit bit rate 26,400 bps[1]
	17	17 = DCE line transmit bit rate 28,800 bps[1]
	18	18 = DCE line transmit bit rate 31,200 bps[2]
	19	19 = DCE line transmit bit rate 33,600 bps[2]
5	0	reserved
6	0	0 = no fax connection
	64	1 = fax connection established
7	0	0 = ITU-T
	128	1 = Bell (not available in the UK)

1) *MicroLink 33.6TQV* and *MicroLink 28.8TQV* only

2) *MicroLink 33.6TQV* only

S88 Bit-mapped options

Register S88 can be read only. It contains information about the current connection:

Bit	Dec.	Meaning
0	0	0 = no connection with MNP1..4
	1	1 = connection with MNP1..4
1	0	0 = no connection with MNP5
	2	1 = connection with MNP5
2	0	0 = no connection with V.42
	4	1 = connection with V.42
3	0	0 = no connection with V.42bis
	8	1 = connection with V.42bis

4..7	0	none

S89 Bit-mapped options

Register S89 can be read only. It contains information about the current connection:

Bit	Dec.	Meaning
0..4	1	1 = DCE line receive bit rate 75 bps (V.23)
	2	2 = DCE line receive bit rate 1200 bps (V.23)
	3	3 = DCE line receive bit rate 300 bps
	4	4 = reserved
	5	5 = DCE line receive bit rate 1200 bps
	6	6 = DCE line receive bit rate 2400 bps
	7	7 = DCE line receive bit rate 4800 bps
	8	8 = DCE line receive bit rate 7200 bps
	9	9 = DCE line receive bit rate 9600 bps
	10	10 = DCE line receive bit rate 12,000 bps
	11	11 = DCE line receive bit rate 14,400 bps
	12	12 = DCE line receive bit rate 16,800 bps[1]
	13	13 = DCE line receive bit rate 19,200 bps[1]
	14	14 = DCE line receive bit rate 21,600 bps[1]
	15	15 = DCE line receive bit rate 24,000 bps[1]
	16	16 = DCE line receive bit rate 26,400 bps[1]
	17	17 = DCE line receive bit rate 28,800 bps[1]
	18	18 = DCE line receive bit rate 31,200 bps[2]
	19	19 = DCE line receive bit rate 33,600 bps[2]
5..7	0	0 = modulation type V.23
	32	1 = modulation type V.21
	64	2 = modulation type V.22bis
	96	3 = modulation type V.32
	128	4 = modulation type V.32 bis
	160	5 = modulation type V.Fast Class
	192	6 = modulation type V.34, symmetric bit rates
	224	7 = modulation type V.34, asymmetric bit rates

1) *MicroLink 33.6TQV* and *MicroLink 28.8TQV* only

2) *MicroLink 33.6TQV* only

S93 DTE rate

Valid values	:	0..16 (decimal)
Default value	:	-
Storage in non-volatile memory	:	AT&W or AT*W

The contents of register S93 can be stored in the non-volatile memory using the **AT&W** or **AT*W** command. The possible values have the following meaning:

Bit	Dec.	Meaning

Bit	Dec.	Meaning
0..4	0	DTE rate 300 bps
	1	DTE rate 300 bps
	2	DTE rate 300 bps
	3	DTE rate 300 bps
	4	DTE rate 600 bps
	5	DTE rate 1200 bps
	6	DTE rate 2400 bps
	7	DTE rate 4800 bps
	8	DTE rate 7200 bps
	9	DTE rate 9600 bps
	10	DTE rate 12,000 bps
	11	DTE rate 14,400 bps
	12	DTE rate 19,200 bps
	13	DTE rate 38,400 bps
	14	DTE rate 57,600 bps
	15	reserved
	16	DTE rate 115,200 bps (*MicroLink 33.6TQV/28.8TQV* only)
5..7		reserved

→ **NOTE** → The **AT&F** command (see page 33) will set the current DTE rate in register S93. The value of S93 is overwritten after every AT command.

S95 Bit-mapped options

The contents of register S95 can be stored in the non-volatile memory using the **AT&W** or **AT*W** command. The individual bits have the following meaning:

Bit	Dec.	Meaning	
0..3	0	0 = no modified CONNECT messages	AT\V0
	1	1 = indication of error-corrected connections	AT\V1
	2	2 = differentiation MNP - V.42	AT\V2
	8	**8 = differentiation MNP - V.42 - V.42bis**	**AT\V8**
4	**0**	**0 = CONNECT messages dependent on AT\V**	**AT-M0**
	16	1 = CONNECT messages independent of AT\V	AT-M1
5	**0**	**0 = CONNECT message after invalid Escape sequence**	**AT*Q0**
	32	1 = no CONNECT message after invalid Escape sequence	AT*Q1
6..7	**0**	**0 = modem result codes enabled**	**ATQ0**
	64	1 = modem result codes disabled	ATQ1
	128	2 = modem result codes disabled in answer mode	ATQ2

S96 Bit-mapped options

The contents of register S96 can be stored in the non-volatile memory using the **AT*W** command. The individual bits have the following meaning:

Bit	Dec.	Meaning
0..1	**0**	**0 = decimal display of S register values**
	1	1 = hexadecimal display of S register values
	2	2 = binary display of S register values
2	**0**	**0 = message 'Press any key to continue' enabled**
	4	1 = message 'Press any key to continue' disabled
3	0	0 = Verbose modem configuration in German
	8	**8 = Verbose modem configuration in English**
4	0	reserved
5	**0**	**0 = Display send bit rate**
	64	1 = Display send and receive bit rate
6	**0**	**0 = Identification of MNP, V.42 and V.42bis connections with AT\V8**
	64	1 = Extended CONNECT messages with AT\V8
7	0	reserved

S99 Delay between rings

Valid values	:	10..255 (1/10 seconds)
Default value	:	50 (5 seconds)
Storage in non-volatile memory	:	AT&W or AT*W

The maximum allowed delay between received ring tones is set in register S99. Usually the standard value of 5 seconds need not be changed. If, however, ring pulses are sent at longer intervals in a telecommunications service network, increasing the maximum delay in register S99 prevents the ring counter (see register S1) from being reset to zero after each ring.

S130 Bit-mapped fax options

Register S130 controls settings for fax operation (see also section 5.9, page 82). The contents of register S130 can be stored in the non-volatile memory using the **AT*W** command. The individual bits have the following meaning:

Bit	Dec.	Meaning
0..1	0	reserved
2	0	0 = reversed bit order for T.4 data (Class 2 '89, receive)
	4	**1 = normal bit order for T.4 data (Class 2 '89, receive)**
3	**0**	**0 = operation with conventional fax software**
	8	1 = Special settings for fax operation with ELSA Transfax
3	0	reserved
4	**0**	**0 = fillbits are removed from T.4 data**
	16	1 = fillbits are not removed from T.4 data
5	0	reserved

Bit	Dec.	Meaning
6	**0**	**0 = CTS and XON/XOFF handshake if no AT\Q command (Class 1/Class 2 only)**
	64	1 = CTS and XON/XOFF handshake after AT\Q command (Class 1/Class 2 only)
7	**0**	**0 = fax operation according to V.33, V.17, V.29 and V.27ter possible**
	128	1 = fax operation according to V.33, V.29 and V27ter possible

5.7 Password Protection, Automatic Callback and Remote Configuration

Password protection — The password protection serves to protect your modem from being used or configured by unauthorized persons. By means of a password, the so-called supervisor password, certain modem functions can be locked. Five access flags can be used to define which modem functions are locked.

Automatic callback — This feature allows the modem to call back automatically after it has been called. Up to 19 callback phone numbers and corresponding passwords can be stored with the **AT$P** command.

Remote configuration — The remote configuration allows you to configure your modem from any location you are calling from and can be combined with the automatic callback function. Up to 19 different user passwords can be stored with the **AT$P** command.

5.7.1 Password Protection

If your modem is used by several persons, you can use the password protection to restrict the access to your modem. Five so-called access flags can be used to define which modem functions may be used (see page 70).

An authorized modem user must identify himself by entering the supervisor password to access the modem functions. The factory default supervisor password is **ELSA**. It can be changed with the **AT$Y** command (see page 69).

The password must have at least four, but no more than eight characters. Valid characters are digits, upper case letters and special characters. Lower case letters are treated as upper case letters internally.

Entered characters are always echoed with ***** and may be edited with Backspace and DEL. Every entered line must be terminated with Enter.

$Y Change supervisor password

AT$Y

The **AT$Y** command is used to change the supervisor password.

After entering **AT$Y**, the new password must be entered twice, each time confirming with Enter. The second entry is necessary to make sure that no wrong password is saved in case of typing errors.

If both entered passwords are identical and valid, the new password is saved as supervisor password in the non-volatile memory, and the **AT$Y** command is acknowledged with an OK from the modem.

If the two entered passwords are not identical, the command is aborted with an ERROR message. The **AT$Y** command must then be entered again to change the password.

Example:

```
at$y
PASSWORD       : ****
NEW PASSWORD   : ******
NEW PASSWORD   : ******
OK
```

5.7.2 Modem Access Flags

The **AT$S** command is used to set the access flags to define which modem functions can be used. Changes of the access flags always apply to the entire modem (not only to one of the configuration profiles) and are saved in the non-volatile memory.

$S Set access flags

AT$S

The **AT$S** command is used to change access flags. After entering the command and the correct password, the current setting of the access flags (CONFIG) is displayed. After entering the new setting in the SET line, the new configuration (CONFIG) is displayed. Flags which have not been set are displayed as '**-**'.

Example:

```
at$s
PASSWORD  : ****
CONFIG    : A-IOP
SET       : AIO
CONFIG    : A-IO-
OK
```

Access flags can only be changed by authorized users who enter the correct supervisor password. Any combination of the following access flags can be used:

Flag	Meaning
A	All commands which do not change the non-volatile memory may be used ('All').
W	The commands **AT$P, AT\P, AT&W, AT*W, AT&Y** and **AT&Z** may be used ('Write').
I	Incoming calls can be accepted. If this flag is not set, calls can neither be accepted with ATA nor with **ATS0 = 1**. The RING message is suppressed, only the RI interface line indicates an incoming call ('Indial').
O	Outgoing calls are allowed ('Outdial').
P	The password list may be displayed and changed ('Password').

→ **NOTE** → Locked commands are answered with ERROR.

$S? Display access flags

AT$S?

The **AT$S?** command can be used to check the current setting of the access flags. After entering the command, a list of the currently set flags is displayed on the screen.

Example:

```
at$s?
CONFIG  : AW---
OK
```

5.7.3 Automatic Callback and Remote Configuration

The automatic callback is activated with the **AT$B** command (see page 72) and the remote configuration with the **AT*E** command (see page 75). Both functions can be used individually or in combination.

The **AT$P** command is used to save user passwords and corresponding parameters.

$P Save user password and callback number

AT$P0;prefix
AT$Pposition;mode;password;number

The **AT$P** command can be used to save up to 19 different user passwords in a list. The following parameters, separated by semicolons, can be used:

prefix A separate dialing prefix for the callback numbers is saved in position 0 of the non-volatile memory. When using special dialing characters (see **ATD** command), make sure that they follow immediately after the semicolon (e.g. **at$p0;t0w**).

position This parameter, followed by at least one more parameter, defines the position (1..19) in the non-volatile memory, where the respective entry is to be stored. If, for example, an entry is to be stored in the fourth position, the number 4 must be entered (e.g. **at$p4;1;kirk;1701**).

Existing entries can be modified by entering the respective parameter, thus overwriting the old setting. For example, if you want to change only the user password of an entry, enter only the position and the new password for the respective entry.

Example: To replace the password 'KIRK' in the entry **AT$P4;1;KIRK;1701** by 'SPOCK' (**AT$P4;1;SPOCK;1701**), enter the following:

at$p4;;spock

→ **NOTE** → If the **AT$Pposition** command is used without additional parameters, the respective entry (0..19) is entirely deleted from the list (e.g. **at&p4** deletes the entry in position four).

mode This parameter can be used to set different security levels (see the following table).

The value of <mode> is calculated by adding the decimal values of the respective bits. The individual bits have the following meaning:

Bit	Dec.	Meaning
0	0	entry locked
	1	entry active
1..2	0	only password required for identification
	2	password and phone number required for identification
	4	prompt for password, then callback of the stored phone number
	6	prompt for password and phone number, then callback of the entered number
3	0	reserved
4..5	0	remote configuration locked
	16	remote configuration, display mode
	32	remote configuration, modification mode
6..7	0	reserved

password This parameter defines the user password for the respective entry.

number This parameter can be used to save a phone number of up to 32 characters along with the user password in the list.

$R Display user password and parameters

AT$R

The **AT$R** command displays the stored user passwords, callback numbers and all other parameters on the screen.

Example:

```
at$r
00 - T0W
01 - 05;VERA       ;38317
02 - 05;JOERG      ;38317
03 -
04 - 01;BARNU      ;
05 -
06 - 33;SCOTTY     ;1701
07 - 35;ESTHER     ;1234567
08 - 37;MCCOY      ;1701
09 -
10 -
11 -
12 -
```

→ **NOTE** → If the **AT$P** or **AT$R** command is used and the "P" access flag (see page 70) is inactive, the user is prompted to enter the supervisor password. If a wrong password is entered, the commands are not executed, but answered with ERROR.

Automatic callback The automatic callback feature with password protection enables your modem to call back another modem automatically after it has been called.

$B Enable automatic callback

*** AT$B0 : No callback**
AT$B1 : Method 1, RING and CONNECT are displayed before access procedure
AT$B2 : Method 2, RING and CONNECT are displayed after access procedure

The **AT$B** command is used to enable or disable the automatic callback function.

The **AT$B0** command disables the callback function.

The **AT$B1** command determines that the RING and CONNECT messages are displayed before the access procedure.

The **AT$B2** command determines that the RING and CONNECT messages are displayed after the access procedure. If a proper connection has been established, the input of an ATD command is followed by a CONNECT message.

After establishing the connection, the modem does not immediately enter the transparent mode, but activates its callback routine. This routine prompts the user at the remote modem to identify himself by entering his user password and (if configured accordingly) his phone number.

Example:

```
ELSA MICROLINK

PASSWORD      :     ********
PHONE NUMBER  :     ************
PASSWORD OK
```

If the entries are correct, the message PASSWORD OK is displayed, and the called modem immediately terminates the connection. After the time set in register S43 (see page 59), the phone number stored along with the user password is called automatically. The modem will not enter the transparent mode before the remote user has entered his user password and (if configured accordingly) his phone number again. If the user does not enter a valid identification within the time defined in register S42, the called modem terminates the connection.

If the callback function is disabled, the modem immediately establishes a transparent connection.

$T Trace mode

*** AT$T0 : Trace mode off**
AT$T1 : Trace mode on

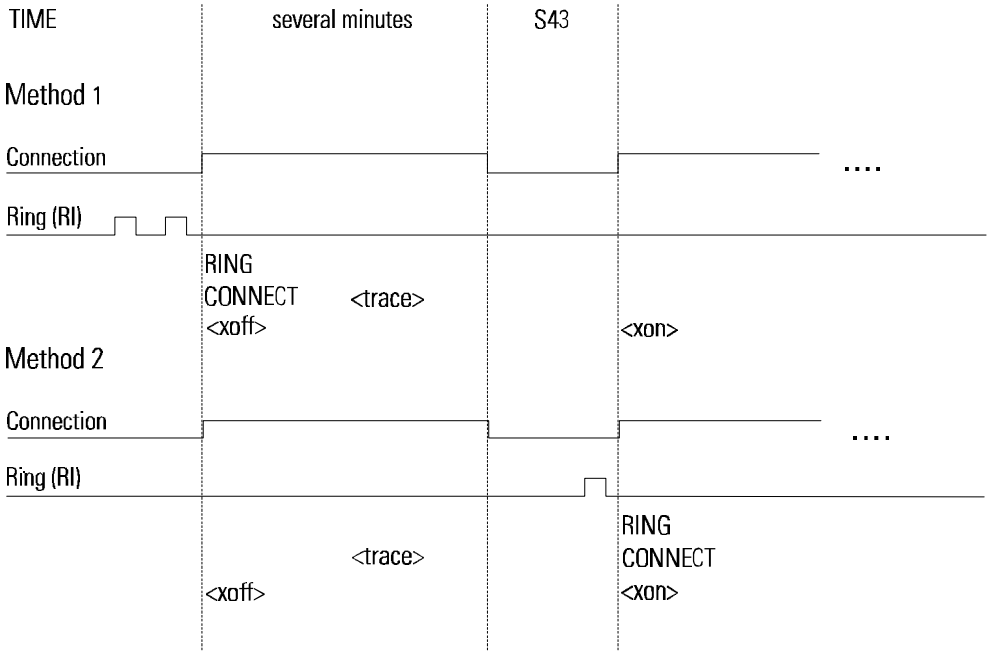
The **AT$T** command enables or disables the trace mode. The trace mode can be used to monitor unsuccessful access attempts.

The **AT$T0** command disables the trace mode, and messages are not displayed.

The **AT$T1** command enables the trace mode, and all messages will be preceded by '**+R**'. Trace messages cannot be displayed in abbreviated form.

The current setting of the **AT$B** and **AT$T** commands can be displayed with the **ATI4** command.

The following illustration shows the methods 1 (**AT$B1**) and 2 (**AT$B2**) with enabled trace mode (**AT$T1**):



If method 1 is used, after a RING the modem first displays the password and phone number of the remote modem. Then the trace messages +RNO CARRIER and +RCONNECT appear (at the time of <xon>), followed by the entries of the remote modem (user password and phone number).

If method 2 is used, the trace messages appear before the RING and CONNECT. After a +RRING and +RCONNECT, first the password and phone number of the remote modem are displayed. Then the trace messages +RNO CARRIER and +RCONNECT appear (at the time of <xoff>), followed by the entries of the remote modem (user password and phone number).

→ **NOTE** → <xon> and <xoff> represent the respective handshake signals, depending on the setting of the **AT\Q** command (see page 41).

If the password protection or the automatic callback function is active, the following messages can be displayed at the remote modem:

PASSWORD	The entered password is echoed on the screen.
PHONE NUMBER	The entered digits are echoed on the screen.
PASSWORD OK	This message appears if the password-protected access without callback function is active.
CALLBACK IN n MIN.	If the callback function is active, this message appears with a value for n as defined in register S43.
NO CARRIER	This message appears after three invalid identification attempts.

Remote configuration The remote configuration allows you to configure your modem from any location you are calling from, and can be used in combination with the

automatic callback function. Up to 19 different user passwords can be stored with the **AT$P** command (see page 71).

*E Enable remote configuration

*** AT*E0 : Remote configuration off**
AT*E1 : Remote configuration on

The **AT*E** command is used to enable or disable the remote configuration.

The **AT*E0** command disables the remote configuration.

The **AT*E1** command enables the remote configuration.

When a connection has been established, the modem is in the online state as usual. However, once the **configuration command** is entered, which consists of four characters (default setting: ********, see also register S34, page 57), followed by a **valid command line**, the modem enters the configuration mode. This allows the modem to temporarily leave the online transmission without aborting the connection.

Configuration command — The configuration command is only recognized in the online transmission state.

Valid command line — A valid command line begins with an **AT** or **at** and is terminated with Enter. The **A/** or **a/** command is not valid after the configuration command. Also, a valid command line is limited to 40 characters.

The user at the remote modem is prompted to identify himself by entering his user password. If his entries are correct, the message PASSWORD OK is displayed, and the remote configuration is active.

If the remote configuration is used in combination with the automatic callback function with password protection, the password is requested directly after the connection establishment, and therefore the remote configuration becomes active immediately after the valid configuration command.

Example:

```
ELSA MICROLINK

PASSWORD  : ********
PASSWORD OK

REMOTE CONFIGURATION ACTIVE

OK
>
```

→ **NOTE** → The prompt (>) indicates that you are in configuration mode. Locked commands are answered with ERROR.

*U Save remote configuration settings

AT*U : Save current remote configuration

If you want the changes made in the remote configuration mode to remain active after leaving the remote configuration mode, they must be saved with the **AT*U** command. Otherwise the settings are only valid within the current remote configuration session.

To keep the changes after the modem is switched off, the configuration profile must also be saved in the non-volatile memory with the **AT&W** or **AT*W** command.

*X Exit remote configuration

AT*X : Exit remote configuration

Upon the **AT*X** command the modem leaves the remote configuration mode and returns to the online online state. Remote configuration settings not saved with **AT*U** will be lost.

5.8 Modem Result Codes

Commands which influence result codes

Unless the modem is set to **ATQ1** (result codes off, see page 41), it will confirm command entries and display messages - e.g. indicating an incoming call or an established connection.

With **ATV1** (default setting, see page 45) the modem sends the result codes in verbose form (followed by <CR> <LF>). If configured to **ATV0**, the modem sends the result codes in short form as a number (followed by <CR>).

V1	V0	Meaning
OK	0	Command line executed
RING	2	Incoming call
NO CARRIER	3	No connection reached or carrier lost for longer than 10 seconds
ERROR	4	Error in entered command
NO DIALTONE	6	No dial tone detected
DIAL LOCKED	6	Dial function locked (not in all countries)
BUSY	7	Telephone line busy
NO ANSWER	10	Remote modem or fax does not answer

CONNECT messages

The CONNECT messages, i.e. the result codes indicating a successful connection, are influenced by the **AT-M**, **AT\V** and **ATX** commands (see pages 38, 45 and 47).

The following table provides an overview of possible CONNECT messages.

V1	V0	X0	X1 X2 X3 X4	-M0	-M1	\V0	\V1	\V2	\V8	Type of connection
CONNECT	1	■		■	■	■	■	■	■	Any bit rate and protocol
CONNECT 300 CONNECT 1200 CONNECT 2400 CONNECT 4800 CONNECT 7200 CONNECT 9600 CONNECT 12000 CONNECT 14400 CONNECT 16800 CONNECT 19200 CONNECT 21600 CONNECT 24000 CONNECT 26400 CONNECT 28800 CONNECT 31200 CONNECT 33600 CONNECT 1200/HX CONNECT 75/1200 CONNECT 1200/75	1 5 10 11 16 12 13 14 110 111 112 113 114 115 116 117 51 52 53		■	■		■	■	■	■	Transfer bit rate 300..33,600 bps duplex no error correction / data compression Transfer bit rate 1200 bps CONNECT 1200/HX
CONNECT 300 CONNECT 1200 CONNECT 2400 CONNECT 4800 CONNECT 7200 CONNECT 9600 CONNECT 12000 CONNECT 14400 CONNECT 16800 CONNECT 19200 CONNECT 21600 CONNECT 24000 CONNECT 26400 CONNECT 28800 CONNECT 31200 CONNECT 33600	1 5 10 30 34 32 36 38 130 132 134 136 138 140 142 144		■	■		■				Transfer bit rate 300 bps duplex with MNP or transfer bit rate 1200..33,600 bps duplex with MNP or V.42(bis)

V1	V0	X0	X1 X2 X3 X4	-M0	-M1	\V0	\V1	\V2	\V8	Type of connection
CONNECT 300/REL	20									
CONNECT 1200/REL	22									
CONNECT 2400/REL	23									
CONNECT 4800/REL	31									
CONNECT 7200/REL	35									
CONNECT 9600/REL	33									Transfer bit rate 300 bps duplex with MNP or Transfer bit rate 1200..33,600 bps duplex with MNP or with V.42(bis)
CONNECT 12000/REL	37									
CONNECT 14400/REL	39		■	■			■			
CONNECT 16800/REL	131									
CONNECT 19200/REL	133									
CONNECT 21600/REL	135									
CONNECT 24000/REL	137									
CONNECT 26400/REL	139									
CONNECT 28800/REL	141									
CONNECT 31200/REL	143									
CONNECT 33600/REL	145									
CONNECT 300/REL - MNP	20									
CONNECT 1200/REL - MNP	22									
CONNECT 2400/REL - MNP	23									
CONNECT 4800/REL - MNP	31									
CONNECT 7200/REL - MNP	35									
CONNECT 9600/REL - MNP	33									
CONNECT 12000/REL - MNP	37									Transfer bit rate 300..33,600 bps duplex with MNP
CONNECT 14400/REL - MNP	39		■	■				■		
CONNECT 16800/REL - MNP	131									
CONNECT 19200/REL - MNP	133									
CONNECT 21600/REL - MNP	135									
CONNECT 24000/REL - MNP	137									
CONNECT 26400/REL - MNP	139									
CONNECT 28800/REL - MNP	141									
CONNECT 31200/REL - MNP	143									
CONNECT 33600/REL - MNP	145									
CONNECT 1200/REL - LAPM	22									
CONNECT 2400/REL - LAPM	23									
CONNECT 4800/REL - LAPM	31									
CONNECT 7200/REL - LAPM	35									
CONNECT 9600/REL - LAPM	33									
CONNECT 12000/REL - LAPM	37									Transfer bit rate 300..33,600 bps duplex with V.42(bis)
CONNECT 14400/REL - LAPM	39		■	■				■		
CONNECT 16800/REL - LAPM	131									
CONNECT 19200/REL - LAPM	133									
CONNECT 21600/REL - LAPM	135									
CONNECT 24000/REL - LAPM	137									
CONNECT 26400/REL - LAPM	139									
CONNECT 28800/REL - LAPM	141									
CONNECT 31200/REL - LAPM	143									
CONNECT 33600/REL - LAPM	145									

V1	V0	X0	X1 X2 X3 X4	-M0	-M1	\V0	\V1	\V2	\V8	Type of connection
CONNECT 300/MNP	21									
CONNECT 1200/MNP	22									
CONNECT 2400/MNP	23									
CONNECT 4800/MNP	24									
CONNECT 7200/MNP	25									Transfer bit rate 300..33,600 bps duplex with MNP class 1..4
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									
CONNECT 1200/MNP5	72									
CONNECT 2400/MNP5	73									
CONNECT 4800/MNP5	74									
CONNECT 7200/MNP5	75									
CONNECT 9600/MNP5	76									
CONNECT 12000/MNP5	77									Transfer bit rate 300..33,600 bps duplex with MNP class 5
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									
CONNECT 2400/LAPM	83									
CONNECT 4800/LAPM	84									
CONNECT 7200/LAPM	85									
CONNECT 9600/LAPM	86									
CONNECT 12000/LAPM	87									Transfer bit rate 300..33,600 bps duplex with V.42
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	\V0	\V1	\V2	\V8	Type of connection
CONNECT 1200/LAPM/V42BIS	92									
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									Transfer bit rate 300..33,600
CONNECT 14400/LAPM/V42BIS	98		■	■					■	bps duplex with V.42bis
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									
										Any bit rate
CONNECT	*)		■		■	■	■	■	■	without MNP and V.42
CONNECT MNP	*)		■		■	■	■	■	■	with MNP class 1..4
CONNECT MNP5	*)		■		■	■	■	■	■	with MNP class 5
CONNECT LAPM	*)		■		■	■	■	■	■	with V.42
CONNECT LAPM/V42BIS	*)		■		■	■	■	■	■	with V.42bis

*) The **AT-M1** command has no effect on the abbreviated forms of the result codes. These correspond to the result codes with the **AT-M0** setting (see page 38).

5.9 Fax Operation

In addition to the modem operating modes, the ELSA *MicroLink*® modems described in this manual are equipped with both the SendFax and the ReceiveFax function. In conjunction with the supplied fax software, fax documents can be conveniently sent and received at speeds from 2400 bps up to 14,400 bps half-duplex (V.17, V.33, V.29 and V.27ter).

5.9.1 Fax Command Sets

Class 2/Class 2.0 The compliance with the fax command set TR-29.2 Class 2 (SP-2388) and TR-29.2 Class 2.0 (TIA/EIA-592) also allows any standard fax software to be used (e.g. 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 (phone number on page 99).

Class 1 The additional support of the fax command set Class 1 (TIA/EIA-578) is necessary for example to use your ELSA *MicroLink*® modem for the E-mail function of Windows for Workgroups and the file transfer function of WinFax PRO 4.0. A brief description of the Class 1 fax commands supported by the ELSA *MicroLink*® modems is available in the MODEMS forum file area of the *ELSA ONLINE* Support BBS (phone number on page 99).

5.9.2 Data Flow Control in Fax Operation

By default the modems described in this manual are capable of using both hardware and software handshake simultaneously in fax Class 1 and Class 2, as long as the **AT\Q** command is not used. As soon as a certain handshake method is selected with **AT\Q**, only the selected method is used.

The possibility to use both handshake methods simultaneously is controlled by bit 6 of register S130 (see page 67).

5.9.3 Adaptive Answer Function

ELSA *MicroLink*® modems are capable of automatically detecting whether an incoming call is a fax call or a data call. To use this adaptive answer function, the following notes should be regarded (the initialization examples apply to normal fax receiving; providing fax messages for polling is also possible with the appropriate commands).

Upon reception of "+FDM" or "DATA", the respective communications program should be started. If it sends an initialization string, bit 6 of the modem register S14 must be set to 1 (see also page 52), to prevent the modem from hanging up.

Adaptive answer function in the fax command set:

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, if necessary

Result codes for incoming fax call:

RING	Incoming call
+FCO	Fax connect message

Result codes for incoming data call:

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

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 message

Result codes for incoming data call:

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

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 message

Result codes for incoming data call:

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

→ NOTE → Note that in fax Class 2 and Class 1, a RING received directly after the **at+fclass=2** or **at+fclass=1** command is sent at 19,200 bps by the modem. However, if another AT command has been sent to the modem in the

meantime, the modem switches back to the bit rate at which this AT command was sent.

5.10 Voice Operation with *MicroLink 33.6TQV/28.8TQV*

The *MicroLink 33.6TQV* and *MicroLink 28.8TQV* modems are equipped with a voice function, allowing you to use your modem as an answering machine in connection with the supplied voice software. See the software documentation for information on how to use the voice function.

A detailed description of the voice commands is available in the *ELSA ONLINE* Support BBS for download (phone number on page 99).

If you play old voice files with your modem and you find that these files sound distorted, this may be due to an older recording method where the byte order of the voice data is reversed. You can select both methods via register S229 as described below.

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 read for playback). By default the new method (default value = 0) is used. By entering **ATS229=1** you can switch to the older method with reversed byte order. You may save this setting with **AT*W** or include the command in the initialization of your voice program.

→ **NOTE** → The value of register S229 is not reset to the factory default by the **AT&F** command.

Notes:

Appendices

A AT Command Summary

Command	Meaning
A	Accept incoming call
%A	Fallback character in the negotiation phase
B0	**Modem complies with ITU-T standards V.21/V.22bis**
B1	Modem complies with Bell standards 103/212A (not available in the United Kingdom)
$B0	**No callback**
$B1	Method 1, RING and CONNECT are displayed before the access procedure
$B2	Method 2, RING and CONNECT are displayed after the access procedure
%B300	DCE rate 300 bps
%B1200	DCE rate 1200 bps
%B1200/75	DCE rate 1200/75 bps
%B75/1200	DCE rate 75/1200 bps
%B2400	DCE rate 2400 bps
%B4800	DCE rate 4800 bps
%B7200	DCE rate 7200 bps
%B9600	DCE rate 9600 bps
%B12000	DCE rate 12,000 bps
%B14400	**DCE rate 14,400 bps**
%B16800	DCE rate 16,800bps (*MicroLink 33.6TQV/28.8TQV* only)
%B19200	DCE rate 19,200 bps (*MicroLink 33.6TQV/28.8TQV* only)
%B21600	DCE rate 21,600 bps (*MicroLink 33.6TQV/28.8TQV* only)
%B24000	DCE rate 24,000 bps (*MicroLink 33.6TQV/28.8TQV* only)
%B26400	DCE rate 26,400 bps (*MicroLink 33.6TQV/28.8TQV* only)
%B28800	**DCE rate 28,800 bps** (*MicroLink 33.6TQV/28.8TQV* only)
%B31200	DCE rate 31,200 bps (*MicroLink 33.6TQV* only)
%B33600	**DCE rate 33,600 bps** (*MicroLink 33.6TQV* only)
%C0	No data compression
%C1	Data compression complying with MNP5 only
%C2	Data compression complying with V.42bis only
%C3	**Data compression complying with V.42bis or MNP5**
\C0	**No data buffering in the negotiation phase**
\C1	Data buffering in the negotiation phase
\C2	No data buffering, fallback character recognition (AT%A)
&C0	DCD is always active
&C1	**DCD follows the state of the carrier**
&C2	DCD is dropped only during hang up
Dn	Dialing (connection establishment)
$D0	**Enable DTR dialing**
$D1	Disable DTR dialing
%D	Delay before forced hang up

Command	Meaning
&D0	Ignore DTR
&D1	Change to command state if DTR→ OFF
&D2	**Hang up if DTR → OFF**
&D3	Reinitialize modem if DTR→ OFF
:D0	**Modem does not go online if DTR OFF→ ON**
:D1	Modem goes online if DTR OFF→ ON
\D0	**DSR and CTS always on**
\D1	DSR follows answer tone and CTS always on
\D2	DSR always on and CTS follows DCD
\D3	DSR follows answer tone and CTS follows DCD
E0	Commands are not echoed
E1	**Commands are echoed**
%E0	Automatic retrain off
%E1	**Automatic retrain on**
***E0**	**Remote configuration off**
*E1	Remote configuration on
&F	Restore factory configuration
\F	Display stored telephone numbers
%G0	**DCE rate determined by DTE rate**
%G1	DCE rate set with AT%B
&G0	**Calling tone on, no guard tone** (not in the United Kingdom)
&G1	Calling tone on, guard tone 550 Hz
&G2	Calling tone on, guard tone 1800 Hz (**default for the United Kingdom**)
&G4	Calling tone off, no guard tone (not in the United Kingdom, **default for USA**)
&G5	Calling tone off, guard tone 550 Hz
&G6	Calling tone off, guard tone 1800 Hz
H0	Terminate connection (hang up)
H1	Go off-hook (pick up)
-H0	**Normal operation**
-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
I7	Display result of self-test
I9	Display Plug and Play information
-J0	Detect phase off
-J1	**Detect phase on**
\J0	**DTE rate determined by CONNECT bit rate**
\J1	(Same effect as AT\J0)
\Kn	Break control (n = 0..5; default value = **5**)

Command	Meaning
L0	Low speaker volume
L1	Low speaker volume
L2	**Medium speaker volume**
L3	High speaker volume
%L0	Partial bit rate adaptation
%L1	**V.100 bit rate adaptation**
%L2	No fallback
%L3	V.100 bit rate adaptation
M0	Speaker always off
M1	**Speaker on during dialing and waiting for answer tone**
M2	Speaker always on
M3	Speaker on during waiting for answer tone
-M0	**Verbose CONNECT messages dependent on AT\V**
-M1	Verbose CONNECT messages independent of AT\V
%M0	**V.8 bit rate adaptation on** (*MicroLink 33,6TQV/28.8TQV* only)
%M1	V.8 bit rate adaptation off (*MicroLink 33,6TQV/28.8TQV* only)
\N0	Normal mode
\N1	Direct mode
\N2	MNP
\N3	**(V.42), MNP, normal**
\N4	V.42
\N5	V.42, normal
\N6	V.42, MNP
O0	Return to online state without retrain
O1	Return to online state with retrain
P	Set pulse dialing
$P	Enter and save user password and callback number
\Pmn	Store telephone numbers (m = 0..9)
Q0	**Enable modem result codes**
Q1	Disable modem result codes
Q2	Disable modem result codes in answer mode
***Q0**	**Enable CONNECT message after invalid Escape sequence**
*Q1	Disable CONNECT message after invalid Escape sequence
\Q0	No handshake
\Q1	XON/XOFF handshake bidirectional
\Q2	CTS handshake unidirectional
\Q3	**RTS/CTS handshake bidirectional**
\Q4	XON/XOFF handshake unidirectional
$R	Display user passwords and parameters
%R	Display register contents
Sn=x	Set register n to the value x
Sn?	Display the value of register n
Sn	Make register n the default register
?	Display the value of the last referenced register (default register)
=x	Set the last referenced register (default register) to the value x
$S	Set access flags

Command	Meaning
$S?	Display current access flag setting
&S0	**DSR always active**
&S1	DSR active between answer tone and hang up
\S	Display the current configuration in verbose form
T	**Tone dialing method**
&T0	Normal operation
&T1	Local analog loopback
&T3	Local digital loopback
&T4	**Remote digital loopback is accepted**
&T5	Remote digital loopback is not accepted
&T6	Remote digital loopback
\Tn	Disconnect inactivity timer (n = 0..255; default value = **0**)
V0	Result codes in abbreviated form as numbers
V1	**Result codes in verbose form**
%V	Display firmware version
&V	Display stored configuration profiles
\V0	No modified CONNECT messages
\V1	Identification of error-corrected connections
\V2	Identification of MNP and V.42(bis) connections
\V8	**Identification of MNP, V.42 and V.42bis connections**
&W0	Store configuration profile 0
&W1	Store configuration profile 1
*W0	Store extended configuration profile 0
*W1	Store extended configuration profile 1
X0	Ignore dial tone / busy tone
X1	Ignore dial tone / busy tone
X2	Wait for dial tone / ignore busy tone
X3	Ignore dial tone / evaluate busy tone
X4	**Wait for dial tone / evaluate busy tone**
*X	Exit remote configuration
\X0	**XON/XOFF signals are not transmitted**
\X1	XON/XOFF signals are transmitted
$Y	Change supervisor password
&Y0	**Use configuration profile 0 at startup**
&Y1	Use configuration profile 1 at startup
Z0	Load configuration profile 0
Z1	Load configuration profile 1
&Zm=n	Store telephone numbers (m = 0..19)

B Error Correction and Data Compression

AT%C
AT-J
AT\N

The two following tables provide an overview of the interdependencies between the **AT%C**, **AT-J** and **AT\N** commands which you use to configure your modem to error correction and data compression methods.

Example:

The default configuration for the modem is **AT%C3**, **AT -J1** and **AT \N3**. In the upper table this configuration is described as case **4**. Column **4** of the lower table shows the error correction and data compression methods possible for this setting (connection with V.42bis, V.42, MNP5, MNP4 or without protocol).

The arrows pointing down in the lower table denote a fallback if the respective mode is not supported by the remote modem.

	\N0	**\N1**	**\N2**	**\N3**		**\N4**	**\N5**	**\N6**
				-J0	**-J1**			
%C0	0	0	2	16	9	14	10	5
%C1	0	0	3	1	15	14	10	11
%C2	0	0	2	16	7	13	8	12
%C3	0	0	3	1	**4**	13	8	6

	0	1	2	3	**4**	5	6	7	8	9	10	11	12	13	14	15	16
V.42bis																	
V.42														■	■		
MNP 5																	
MNP4			■	■		■	■					■	■				
physical	***)**	■			■			■	■	■	■					■	■

***)** Physical connection (AT\N0 in normal mode **or** AT\N1 in direct mode)

C Technical Specifications

Power supply	Europe:	AC adapter, 230V_{AC} / 9V_{AC} , 800 mA		
	USA:	UL listed AC adapter, 120V_{AC} / 9V_{AC} , 1.5 A		
Operating current	***MicroLink***	***33.6TQV***	***28.8TQV***	***14.4TQ***
	Online state (connection):	700 mA approx.	700 mA approx.	590 mA approx.
	Command state (stand-by):	350 mA approx.	350 mA approx.	240 mA approx.
	Sleep mode (power-down):	250 mA approx.	250 mA approx.	160 mA approx.
Power input	Online state (connection):	9.2 VA approx.	9.2 VA approx.	8.5 VA approx.
	Command state (stand-by):	6.0 VA approx.	6.0 VA approx.	5.6 VA approx.
	Sleep mode (power-down):	5.1 VA approx.	5.1 VA approx.	4.7 VA approx.
Design	Desktop model with metal housing			
Dimensions	108 x 38 x 140 mm (W x H x D)			
Environment	Temperature:	5..40°C (41..104°F)		
	Relative humidity:	0..80%, non-condensing		
CE approval	according to EN 50082/part1, EN 55022, EN 60950			

International Connector Types

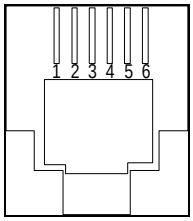
Connector for Belgium

Connector for the UK

Connector for the Netherlands

Connector for the USA and Spain

RJ11 socket pin assignment



Line	Telephone socket
-	1
b_2	2
b	3
a	4
a_2	5
-	6

D The RS-232C Interface

Types of interface lines

The serial interface between modem and computer consists of various data lines, control lines and signal lines. The status of the majority of these interface lines is indicated by LEDs on the front panel of the housing.

The pin configuration of the RS-232C interface for 9-pin or 25-pin connectors is as follows:

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

***** U = housing/shield

The interface lines have the following meaning:

Computer/terminal ready for operation

DTR = ***D**ata **T**erminal **R**eady*
The effect of this control line on the modem is determined by the **AT&D** command (see page 31).

Request data from the modem

RTS = ***R**equest **T**o **S**end*
The effect of this control line on the modem is determined by the **AT\Q** command (see page 41).

Modem ready for operation

DSR = ***D**ata **S**et **R**eady*
This signal line is usually always active (ON), but is influenced by the commands **AT\D** (see page 32) and **AT&S** (see page 42).

Modem ready to send

CTS = ***C**lear **T**o **S**end*
This output is usually always active (ON), but is influenced by the commands **AT\D** (see page 32) and **AT\Q** (see page 41).

Incoming call

RI = ***R**ing **I**ndicator*
This modem output is active (ON) when the modem detects an incoming call.

Connection

DCD = ***D**ata **C**arrier **D**etect*
This modem output is usually active (ON) when the modem detects a carrier signal during an existing connection. It is influenced by the **AT&C** command (see page 29).

E Answers to Frequently Asked Questions

General Modem Operation

How can I give AT commands to my modem?

To communicate with a modem via your PC, you need a communications software, also called "terminal program". All ELSA *MicroLink* ® modems are shipped with the communications program **Telix**. After starting Telix, you can enter AT commands in the terminal screen. Telix sends these commands to your modem via the serial interface of your PC. See the Telix documentation for detailed information on how to use Telix.

What is the best initialization string for using my modem to call a BBS?

All ELSA modems are already preconfigured for standard BBS operation. If you have changed the configuration and come across problems with a BBS, you can restore the factory default settings with the **AT&F** command and save the configuration with **AT*W**.

My modem does not recognize any AT command - is it improperly configured or defective?

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

- Is your communications program set to the correct serial interface (COM port), i.e. the one your modem is connected to?
- Is the IRQ used by this COM port set in the communications software as well? You can use the supplied diagnostic program MODEMTST.EXE to check the IRQ setting of your serial interface.
- Is the DTE rate (serial port bit rate) of your communications program set to a value within the speed range recognized by your modem? *MicroLink 14.4TQ* recognizes DTE rates up to 57,600 bps, *MicroLink 28.8TQV* recognizes DTE rates up to 115,200 bps and *MicroLink 28.8TQV* recognizes DTE rates up to 134,400 bps.
- If your modem configuration has been changed, try to reset the modem to the factory default configuration with the **AT&F** command (even if this command does not appear on the screen). In the default state, you should be able to enter an **AT** which is answered with **OK** by the modem.

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 it makes no sense to compress already compressed files again during the transfer, the V.42bis compression protocol is able to recognize compressed files and to disable the compression during the file transfer. It is thus no longer necessary to disable the data compression manually.

What can I test with the program MODEMTST?

All ELSA *MicroLink*® modems are shipped with the diagnostic program MODEMTST.EXE. You will always find the latest version in the *ELSA ONLINE* Support BBS (phone number on page 99) and in the ELSA forum in CompuServe for download. MODEMTST offers the following functions:

- Test the serial ports (e.g. to determine the IRQ and the UART chip used)
- Display the modem configuration in verbose form
- Display modem parameters
- Display register values with verbose description
- Establish a test connection (with the *ELSA ONLINE* BBS)

I get a NO DIALTONE message from the modem after each dialing attempt and cannot establish a connection. What can be the reason?

You are probably dialing from an extension of a private telephone exchange (PABX). Most private telephone systems require an escape digit (e.g. 0) to be dialed to get the dial tone of the main (external) line. If the digit is 0, use the dial command **ATDT0W**<number> (tone dialing) or **ATDP0W**<number> (pulse dialing). The dialing parameter **W** causes the modem to wait for the continuous dial tone before dialing the <number>.

If you are calling another extension within the telephone system, no dial tone is present. In this case, use the dial command **ATX3DT**<number> or **ATX3DP**<number>, respectively. The **X3** parameter tells the modem not to wait for a dial tone. You can make this setting permanent with the **ATX3*W** command.

I am dialing from an extension of a telephone system, and though the line is not busy, I always get a BUSY message from the modem. What is the reason?

In some cases the modem may regard the internal dial tone of a private telephone exchange as a busy tone. Disable the busy tone detection with the **ATX0** command (in the Netherlands: **ATX2**), and save this setting with **AT*W**. If you dial a busy line with this setting, you will get a NO CARRIER message.

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?

CRC errors can have different reasons. One possible reason is an improper or missing handshake method. To take advantage of data compression protocols, the DTE rate (i.e. the serial port rate defined in the communications software) should normally be set higher than the telephone side (DCE) rate (e.g. for *MicroLink 14.4TQ,* 57,600 bps instead of 14,400 bps, for *MicroLink 28.8TQV* 115,200 bps instead of 28,800 bps and with the *MicroLink 33.6TQV* 134,400 bps instead of 33,600 bps). However, this absolutely requires a handshake method for data flow control, either hardware handshake (RTS/CTS) or software handshake (XON/XOFF).

The same handshake method must be set in both the modem and the communications software. If this is not the case, CRC errors are likely to occur in data transfers. If you are using RTS/CTS handshake, the reason may also be the interface cable: If you are using an RS-232 adapter from 25-pin to 9-pin (also called "mouse adapter"), it is possible that the RTS and CTS lines (pins 4 and 5) are not connected. Please make sure that you use an RS-232 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, a UART chip of type 16550 should be used. This UART is equipped with a 16-byte FIFO buffer, allowing considerably higher transfer rates. UARTs of the types 8250 and 16450 are reliable up to 9600 bps only. At rates of 19,200 bps and higher, these UARTs may lose characters and will thus cause CRC errors.

Why do I get CRC errors while downloading with ZMODEM and 115,2000 (*MicroLink 28.8TQV)* even though my COM port is equipped with a UART 16550 with FIFO? The throughput rate for 28,800 bps CONNECTs is just 2000 cps.

The poor throughput rate is caused by constant CRC errors. Check that your computer BIOS settings for the entry `IDE HDD BLOCK MODE` are set to `DISABLED`.

WinFax

What should be considered when using the DeIrina WinFax software?

The WinFax PRO package includes the test software DELTEST which classifies ELSA modems as Class 1 modems. As ELSA *MicroLink* modems also support Class 2 fax commands, we recommend that you configure your modem as a Class 2 modem. Fax transmissions with this command set are far more reliable than with Class 1.

In most cases, the selection of the "Generic Class 2Modem" and the initialization string **AT&F&C1&D2S7=55** should enable immediate and problem-free operation. If problems do arise, try the following initialization strings:

WinFax Version	Initialization String
WinFax 2.0	AT&C1&D2\Q4
WinFax PRO 3.0 or 4.0	AT&C1&D2\\Q4\

More information to using WinFax PRO with ELSA *MicroLink* modems can be downloaded from the MODEMS forum of the ELSA ONLINE support BBS and in the MODEM SOFTWARE library of the ELSA forum in CompuServe

OS/2

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 reason.

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 MODEMS forum (file area KONFIG) of the *ELSA ONLINE* Support BBS. The compressed file contains detailed installation instructions.

Telix

How can I set the bit rate in Telix to 28,800 bps or 14,400 bps for *MicroLink 28.8TQV* or *MicroLink 14.4TQ*, respectively? I only find settings for 9600, 19,200 and 38,400 bps.

The bit rate you set in Telix is the DTE rate, i.e. the speed of your serial interface. This rate cannot be set to 28,800 bps or 14,400 bps. However, it is possible and recommended to set the DTE rate to a higher value than the 28,800 bps or 14,400 bps that your *MicroLink 28.8TQV* or *MicroLink 14.4TQ* supports on the telephone side (DCE rate). On the serial interface, *MicroLink 28.8TQV* can transfer data at up to 115,200 bps, *MicroLink 14.4TQ* up to 57,600 bps. On the telephone side, the modem then attempts to use the next lowest possible speed (i.e. 28,800 bps or 14,400 bps, respectively). If V.42bis data compression is enabled, which can compress data down to about 25% of the original size, it is possible to achieve effective transfer rates up to four times higher than the DCE rate, if the DTE rate is set to 115,200 bps or 57,600 bps, respectively (4 x 28,800 = 115,200, 4 x 14,400 = 57,600). Therefore, it is recommended to set the DTE rate to 115,200 bps for *MicroLink 28.8TQV* and 57,600 bps for *MicroLink 14.4TQ*.

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

A common reason for frequent CRC errors is an improperly set handshake method. The same method must be enabled in both your modem and Telix. All ELSA modems are preset to RTS/CTS handshake (**AT\N3**). 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 make the changes become active each time Telix is started.

RIP

What is the RIP protocol, and what do I need to use it?

RIP is the abbreviation of ***R**emote **I**maging **P**rotocol*, a standard that allows the access of online systems with a graphical, mouse-controlled user interface. The protocol is based on a text-oriented 7-bit ASCII scripting language and allows the fast transfer of graphics and predefined strings with a modem. RIP also allows RIP commands to be mixed with conventional ANSI or VT100 commands. The graphics display resolution of the current RIP version 1.54 is 640 x 350 pixels with 16 colors.

To use RIP, both the called BBS and your communications program must support RIP. The *ELSA ONLINE* Support BBS (+49-241-9177-981) and e.g. the CyberCity BBS (+49-241-21130) can be called

with RIP-supporting terminal programs like RIPterm (freeware, available in the *ELSA ONLINE* BBS for download) or Telix for Windows.

F Product Support

You need help?

If you encounter any problems during the installation or operation of your modem, 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:

- Precise model name and firmware version of the modem (the firmware version can be displayed with the **ATI3** command, see page 35)
- Configuration of the modem (the parameter settings can be displayed with the **ATI4** command, see page 35)
- Your computer configuration
- Name and version of your communications program

→ **IMPORTANT** →

- 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.
- Use the supplied diagnostic software MODEMTST.EXE to test your *MicroLink* modem. The latest version of MODEMTST is always available in the *ELSA ONLINE* Support BBS for download.

Who to contact?

First you should contact the dealer or firm where you bought your modem. If there are still questions remaining, contact one of the following:

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

  Phone +49-241-9177-981
  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

- Or write to:
  ELSA GmbH
  Data Communications Support
  Sonnenweg 11
  52070 Aachen
  Germany
  Fax +49-241-9177-600

- In very urgent cases, call the **ELSA Hotline** in Germany:
  Phone +49-241-9177-112

Monday to Thursday	from 9 am to 4:30 pm (CET)
Friday	from 9 am to 12 pm (CET)

- In the USA, you may also contact the ELSA subsidiary:
  ELSA Inc.
  2150 Trade Zone Blvd., Suite 101
  San Jose, CA 95131
  USA

Phone	+1-408-935-0350
	+1-800-272-ELSA
Fax	+1-408-935-0370
BBS	+1-408-935-0380
Internet	http://www.elsa.com

Configuration problems?

In the *ELSA ONLINE* Support BBS and in ELSA's CompuServe forum you will find information about the configuration of many applications for the use with ELSA *MicroLink*® modems.

Support BBS

The *ELSA ONLINE* Support BBS has been established as a service for customers and other persons interested in ELSA products (modems, ISDN products 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 the latest product information, examples and software tools.

→ **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 MODEMS forum if you have questions about your modem. 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 21)
via MicroLink Modem at 33600 bps, protocol: V.42bis
////////////////////////////////////////////////

           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 item "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 worked on within a few working days. After that, you are a registered user, entitled to access the product information forums and ask 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 modems" for questions about your modem. 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 whether your modem is defective or maybe only the configuration is wrong, please call the ELSA Hotline, before you send us the modem for repair.

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

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

G Glossary

Adaptive modem This designates a →modem which automatically adapts itself to the transmission bit rate of the remote station. ELSA was the first manufacturer to obtain a postal registration for an *adaptive modem* and is using an optimized method according to ITU-T V.100. Since then every modem delivered by ELSA is adaptive according to V.100.

ASCII The ***A****merican* ***S****tandard* ***C****ode for* ***I****nformation* ***I****nterchange* is the most commonly used international code to represent a 128 character alphabet. It is also called *standard ASCII*, unlike *extended ASCII*, which is an extension of the code by international special characters and graphic symbols to a set of 256 characters (also called *IBM character set*). Standard ASCII can be coded with a word length of 7 bits (2^7 = 128), whereas extended ASCII requires a word length of 8 bits (2^8 = 256).

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 *asynchronous transmission* 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 synchronous transmission, it is comparatively easy to perform.

AT command set "Intelligent" modems are able to establish connections and accept calls automatically. This requires a set of modem control commands. The extended *AT command set* (AT = command prefix ***AT****tention*) has become a world-wide standard for the syntax of these commands. All ELSA modems are equipped with an automatic dialing device and can accept calls automatically. They use an extended AT command set, depending on the respective modem type.

Baud *Baud* (abbreviation: Bd) is the unit for the step rate (1 Bd = 1 step per second), i.e. the frequency of status changes on a transmission channel per second. Erroneously, the unit Baud is often confused with the transmission rate measured in →bps. In the case of signals having only two states, the step rate is identical with the transmission rate. Rates over 1200 bps are, however, normally performed by transmission of four, eight or more bits per step, so that in these cases the step rate is lower than the transmission rate. Example: V.32 = step rate 2400 Baud, transmission rate 9600 bps.

BBS Abbreviation of ***B****ulletin* ***B****oard* ***S****ystem* (also called Electronic Mail System). A *BBS* is an automatic information system with one or more connections to a telephone network or digital networks like the ISDN. The users of a BBS usually have the opportunity to send messages to each other and to use the BBS as a communication forum. In addition, many BBS's are offering libraries containing software and information about various areas. The ***ELSA ONLINE*** Support BBS, which can be accessed with the phone number +49-241-9177-

981 (Germany), was set up as a forum for ELSA customers to exchange experiences and to post questions for the ELSA support team. Furthermore, ***ELSA ONLINE*** constantly offers topical product information, application examples and user software.

bps Abbreviation of ***b**its **p**er **s**econd.* This is the unit to measure the speed of a data transmission. Unlike the step rate measured in →Baud, the transmission rate indicates the actual amount of information transferred per second.

CCITT →ITU-T

Communications software In order to access a modem from a personal computer, for example to choose transmission parameters or to start a data transfer (→Download, →Upload), a suitable *communications software*, also called *terminal program*, 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* ® modems supporting the →AT command set are shipped with the communications program **Telix**.

Data flow control Modems featuring *data flow control* are equipped with an internal receiving and sending buffer in order to optimize data flow in error-correcting modems. The most important two control methods, also called *handshake*, are hardware control using the signals RTS and CTS, and software control using the characters XON and XOFF. ELSA modems featuring error correction are capable of both methods for data flow control.

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 *data format*. The most common data formats for asynchronous transmission are: 8N1 (1 start bit, **8** data bits, **n**o parity bit and **1** stop bit = 10 bits per byte) and 7E1 (1 start bit, **7** data bits, 1 parity bit (**e**ven parity) and **1** stop bit = 10 bits per byte).

DCE rate *DCE* is the abbreviation of ***D**ata **C**ommunications **E**quipment*, another name for your modem. The DCE rate is the speed your modem uses for communications over the telephone line, given in →bps. It must not be confused with the →DTE rate.

Download *Download* denotes a transfer of data, in which a file transmitted by the remote station is received and saved.

DTE rate *DTE* is the abbreviation of ***D**ata **T**erminal **E**quipment*, meaning the local computer or terminal your modem is connected to. The DTE rate is the speed your DTE (i.e. your communications software) uses to communicate with your modem over the serial interface, given in →bps. It must not be confused with the →DCE rate.

Duplex In this mode of operation (also called *full duplex*), data can be sent and received simultaneously. In *half-duplex* mode, data transmission is possible in both directions as well. However, the two connected systems cannot send or

receive simultaneously, but only alternately in one direction. In *simplex* mode, data can be sent only in one previously determined direction, i.e. a conversational mode is not possible.

Effective transfer rate

The *effective transfer rate* 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 routines, 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 transmission bit rate.

Firmware

Firmware means the totality of control software integrated with the hardware of a device, which cannot be modified by the user.

FullFax

ELSA MicroLink modems equipped with the *FullFax* feature are capable of sending and receiving documents to and from Class 3 telefax devices. Of course, the other modem functions are fully maintained, so an ELSA FullFax modem can be used as a multifunctional device for both telefax and data communications.

Host

Host designates a central computer that carries out certain functions for other units (e.g. terminals), for instance saving of data.

ITU-T

The ***T****elecommunications Standardization Sector* of the ***I****nternational* ***T****elecommunications* ***U****nion* (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. The ITU-T is the successor organization of the CCITT *(****C****omité* ***C****onsultatif* ***I****nternational* ***T****élégraphique et* ***T****éléphonique).*

Log-in

In a *log-in* procedure (also called *log-on* procedure), a system user has to identify by entering a registered user identification and to prove his entitlement of access with a password, before he is allowed to use the services of a →host.

MNP

Due to the noise and distortion characteristics of a telephone network, conventional modems cannot guarantee a perfect, error-corrected transmission. The ***M****icrocom* ***N****etworking* ***P****rotocol* (MNP) is an error correction method making 100% error-corrected transmission possible even on distorted telephone lines. This method is used world-wide in millions of modems. It may only be used by manufacturers licensed by Microcom, the developer of MNP. Besides the error correction protocol, MNP class 5 additionally provides a data compression method, thus increasing the effective transfer rate by a factor 1.3 to 2.0. Thus in a physical connection of 14,400 bps an →effective transfer rate of up to 28,800 bps can be achieved. To transmit data that have already been compressed (e.g. *.ZIP, *.ARC), MNP class 4 should be used, for no considerable further compression can be reached by MNP5 with these

files, and the compression method might even slow down the transmission. ELSA *MicroLink*® modems featuring MNP support both classes of this error correction protocol, as well as the methods according to →V.42, V.42bis.

Modem Abbreviation of ***MO****dulator/****DEM****odulator*. A modem converts digital signals into "acoustic" signals and vice versa. Modems have gained a great importance for data transfer across public telephone networks, since they allow fast and inexpensive connections of data processing systems over long distances. ELSA has been developing and manufacturing modems since the German Telekom regulations were liberalized in 1987. ELSA developed the first modem with three transmission bit rates (300, 1200 and 2400 bps) that obtained a Telekom approval in Germany, as well as the first registered V.32bis high-speed modem. Today ELSA offers all common transmission rates from 300 to 33,600 bps with →effective transfer rates up to 134,400 bps.

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.

Pulse dialing In this dialing method, which is also called *loop disconnect dialing*, each dialed digit is coded with a number of pulses. So if you hear a "rattling" sound when dialing, it is *pulse dialing*. This method requires less technical effort than the more up-to-date →tone dialing, but is also considerably slower.

SysOp Abbreviation of ***Sys****tem* ***Op****erator*, the administrator or operator of a →BBS or data bank.

Tone Dialing In this dialing method, which is also called *touch tone dialing* or *multi-frequency dialing,* each digit is coded with a particular pair of frequencies. So if a sequence of different short beeps is audible when dialing, it is *tone dialing*. Due to its speed, tone dialing is superior to the older →pulse dialing method.

Transmission protocol To transmit data files from one computer to another, a range of *transmission protocols* 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 *MicroLink* ® modem that uses the AT command set), supports many common transmission protocols, such as →XModem, XModem-1k, Ymodem and →ZModem.

UART A UART (**U**niversal **A**synchronous **R**eceiver/**T**ransmitter) is a chip used to convert a parallel data flow to a serial one and vice versa. Personal computers normally use these asynchronous interface chips for modem communications.

Upload *Upload* denotes a file transfer, in which a data file is sent to another data station (for example a →BBS) and is saved there.

V.Fast Class V.Fast Class is a modulation method defined by Rockwell, anticipating the ITU-T V.34 standard, with bit rates from 16,800 bps up to 28,800 bps, which operates at variable bit rate and adapts itself to the current line quality in steps of 2400 bps. The modems measure the quality of each connection and thus determine the appropriate transmission behavior.

V. series The →ITU-T standards of the *V. series* contain standards for data transmission over telephone networks. V.21 describes the protocol for 300 bps →duplex; V.22bis for 1200 bps and 2400 bps duplex; V.23 for 1200 bps half-duplex, 1200/75 bps and 75/1200 bps duplex; V.32 for 4800 bps and 9600 bps duplex; V.32bis for rates up to 14,400 bps duplex; and V.34 for rates up to 28,800 bps duplex. The product line of ELSA modems covers all the above transmission protocols.

V.42, V.42bis The →ITU-T standards V.42 and V.42bis describe an error correction and data compression method, respectively. V.42bis includes a data compression protocol that can increase the →effective transfer rate by a factor up to four. *MicroLink 28.8TQV* and *MicroLink 14.4TQ* support (besides →MNP) both V.42 and V.42bis. Thus effective transfer rates of up to 115,200 bps (or 96,000 bps respectively) can be achieved.

XModem *XModem* is a →transmission protocol featuring automatic error detection and error correction. Data are transmitted as data blocks of 128 bytes. If a transmission error has been detected, the defective block is transmitted again. XModem is one of the most common protocols and is supported by many standard terminal programs, but has meanwhile been surpassed by more efficient modern protocols like →ZModem.

ZModem *ZModem* is a very fast and reliable →transmission protocol. It is one of the few protocols based on the →duplex technology. That means that the receiving of acknowledgments and error reports from the remote station does not interrupt the transmission of further data blocks. The block length is automatically adapted to the error rate. By means of these two measures, ZModem achieves a comparatively high transfer rate. In addition, it provides supplementary features like transmission of several files in batch mode or resumption of disrupted transmissions at a later time. ZModem is especially suitable for transmissions via satellite lines or networks with data packet switching. ZModem is supported by the →communications software **Telix**.

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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British Telecom Application Form

This page applies only to the BABT approved British versions of the *MicroLink 28.8TQV* or *MicroLink 14.4TQ* modem. Not all modem models described in this manual may be BABT approved at this time.

If you want to connect your modem to the British Telecom PSTN, you are required to fill in the form found below and send it to your local BT agency in order to have the appropriate connection socket installed. Please don't forget to enter your modem's Approval Number, which is printed on the label placed on the modem housing.

Please refer to section 3.1 of this manual for further information on national regulations for your modem.

To : British Telecom

I am now the owner of an

ELSA *MicroLink*® 28.8TQ modem
ELSA *MicroLink*® 28.8TQV modem

ELSA *MicroLink*® 14.4TQ modem (Please mark your model with a cross)

BABT Approval Number ..... (See label on the modem housing)

Please come and fit ..... extension socket(s) for me as soon as possible.

Name: .....

Address: .....

.....

Telephone No: .....

Date: .....

Signed: .....