



# **SG 2834**

*HIGH SPEED MODEM for*

- • **Data Transmission**
- • **Fax**
- • **Voice**

## ***User Manual***

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The device described in this manual is licensed under U.S. Patent No. 4,558,302 (the “Welch Patent”) and foreign counterparts.

## **Safety instructions for FAX-modem**

This equipment/building-in equipment has been designed and tested in accordance with the requirements of Standard IEC 950 „Safety of Information Technology Equipment, Including Electrical Business Equipment“

Extracts from these requirements according Standard IEC 950:

- The fax-modem may be only powered by direct plug-in power supply, according to IEC 950, class II equipment, with a safety extra low voltage max rating of 9 V ac and 500 mA.
- The fax-modem has been evaluated for use in office environment (pollution degree 2) and may only be used in this environment. For use in rooms with a higher pollution degree more stringent requirements are applicable.
- The fax-modem may not be opened.
- The ventilation opening may not be covered.
- The fax-modem was evaluated for a use in maximum ambient temperature of 35 °C.
- The fax-modem may only be used in countries where the modem is certified to the national standards.
- No data transmission cable should be connected or disconnected during a thunderstorm.

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The Data Modem you have purchased represents the latest state of the art in data communication; its comprehensive facilities provide all you will need for professional data transfer purposes.

In data modem mode, you can achieve active transfer speeds of up to 115 200 bps and up to 14 400 bps in fax mode.

This handbook, together with the descriptive information provided with your communications and fax software, gives all the information you need to install and operate the equipment.

## **What is a Modem?**

The word “Modem” is derived from the terms “MOD-ulator” and “DE-modulator”. Putting it more simply, it is a device which modulates digital information into an analogue carrier signal (tones) and demodulates the carrier signals which it receives, changing them back into digital data. This permits the transmission of data along wires, between data terminal equipment (computers, terminals, etc...).

## **About this Modem**

This modem operates as a full duplex, voice-band modem, where signal transmissions are made in both directions simultaneously and the analogue signals which are transmitted are in the voice-band of the telephone network - between 300 and 3000 Hz.

Data transmission between modem and terminal unit is in serial form - in other words, the individual data bits are sent, one after another, along a single transmission or receiving line. At this stage, a word of explanation regarding synchronous and asynchronous data transmission. In the synchronous mode, additional synchronisation signals are required, to synchronize the transmission and reception signals. In the asynchronous mode synchronisation is by means of “start-bits” and “stop-bits” which mark the beginning and end of each data word. The modem can dial by itself and also react automatically to incoming calls. The information it needs in order to dial a telephone number, together with the various configuration commands, are provided by the respective data terminal equipment via the same serial interface which is used to send the data. In this mode, the system operates with the so-called “AT” command set.

## UK Approval Information

It is a condition of type approval that the power required by the host and the total of all other adapter cards installed within the host apparatus, together with any auxiliary apparatus, does not exceed the power specifications as stated in the Technical Reference Material of the host apparatus.

For a host or other expansion cards fitted in the host using or generating voltages greater than 300 V (rms or dc), advice from a competent telecommunications safety engineer must be obtained before installation of the relevant equipment.

If you have any doubt as to how to safely install the SG 2834 correctly within a host chassis, please seek advice from a qualified telecommunications engineer.

## UK Type Approval Information

The SG 2834 has been approved for connection to the Public Switched Telephone Network provided by British Telecommunications PLC, Kingston-upon-Hull City Council and Mercury Communications Ltd. It can also be connected to analogue extension points on compatible PABXs.

The SG 2834 is suitable for household, office and similar general indoor use.

The SG 2834 is not suitable for use as an extension to a payphone.

The SG 2834 must only be used on telephone lines which provide either loop disconnect or multi-frequency (DTMF) dialling.

Please be aware that it is the SG 2834 which has been type approved and not the host computer into which it is installed.

There are no adjustments available to the user which could cause the SG 2834 to no longer conform with the type approval requirements applied by BABT.

## General Description

- Asynchronous
- Auto-protocol: the Modem adjusts automatically to all Full Duplex Transmission Protocols and Speeds
- MNP 5 and V.42bis Data Compression and Error Correction
- MNP 10; specially useful in association with Radio Telephones
- Max. 115.200 bps Active Transmission Rate (V.34 or V. Fast Class with V.42bis)
- Automatic Baud Rate Recognition at all Speeds up to 115 200 bps
- Automatic Dialling with Hayes AT Command Set
- Fax Transmission and Reception at up to 14 400 bps
- Number Storage for 4 Telephone Numbers
- **Answering machine** functionality by using a sound card or with Remote Access

## Installation Instructions

1. Use the interface cable supplied to connect the modem to a free COM interface on the computer
2. Use the telephone cable supplied to connect the modem to a Telephone jack
3. Use the mains cable supplied to connect the modem to a power socket (220-240 VAC)
4. When the "POWER" LED is lit, the modem is ready for operation and will provide data communication, using the factory settings which have been installed
5. Configure the modem with the communications software or fax software to meet your requirements

## Auto-Answering

The effective delay before the SG 2834 answers an incoming ring signal can be set using the S0 register. The S0 register sets the number of ring signals which must be received before the SG 2834 will answer.

When setting the S0 register, please note that the callers are accustomed to being answered within 10 seconds and most abandon calls not answered within 45 seconds.

The timing of any recorded answering announcement when the SG 2834 is being used in speech message mode is determined by the application software that you are using.

The SG 2834 does not provide a paytone detection facility. Paytone may be present for up to 13 seconds following answer of an incoming call when that call has been made from certain types of payphone. It is recommended that this fact is taken into consideration when constructing an answering announcement.

When recording answering announcements, best results will be obtained when recording is conducted in a quiet environment.

If you are using the SG 2834 within an application programme which allows the recording and storage of a number of answering announcements, please ensure that the correct announcement is selected prior to use.

## Connecting the SG 2834 to PABX systems

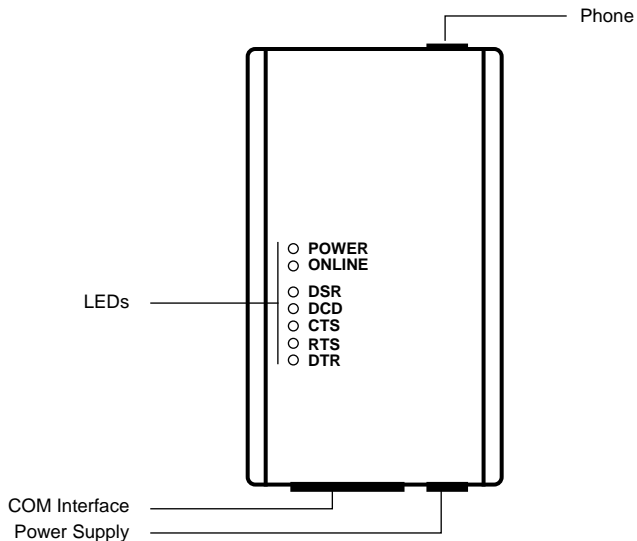
The SG 2834 is approved for connection as an extension instrument to compatible PABXs. Please contact the supplier of your SG 2834 for an up to date list of compatible PABXs.

It is not guaranteed that the apparatus will operate correctly under all possible conditions of connection to compatible PABXs. Any case of difficulty should be referred in the first instance to the supplier of your SG 2834.

## Basic Adjustments

To make it easier for you to use your modem, two basic settings have been made at the factory, which are suitable for the vast majority of connection systems. These settings can be activated with the “&F” command. In the fax mode or voice mode, the relevant software will carry out control of modem settings for you.

- for **BTX Operation (Datex-J with 2400 bps)**, select **AT&F1** in the software as the initialisation sequence
- For general **Remote Data Transmissions** select **AT&F0**. In this condition, the modem will attempt to create an error-corrected connection with data compression, depending on the capability of the other party



### What the LED Indicators mean:

- **POWER** Modem is ready for operation
- **ONLINE** Modem is switched to the transmission line
- **DSR** Answer tone is present
- **DCD** Modem has recognized the carrier tone from the remote modem
- **CTS** Modem is ready to transmit
- **RTS** Transmission request is present
- **DTR** Computer is ready for operation

⇒ *Ensure that the correct COM interface is used for the software employed !*

### Guidelines for Using AT Commands

The modem is programmed with AT commands from the data terminal equipment (computer, PC or terminal) and thus also receives instructions to cover automatic dialling. The communications or fax software will carry out most of these operations for you, so that in general circumstances you do not need to have a detailed understanding of the commands which are described below.

The modem must be in Command mode before it can accept commands. In this condition, all the characters sent from the computer are interpreted as commands and, where appropriate, confirmed by a modem message on the screen. When a connection is set up to a remote modem, the modem will switch to data mode and transfer all the characters it receives to the other party.

The modem can be switched from an existing connection, back into the command mode, by using the **Esc Sequence** (+++), **without** breaking off the connection to the remote modem. In this status, any commands which are entered will not be transferred to the remote modem.

The modem is activated by AT commands, the subsequent value of which will modify the form of the command. Modem messages provide information on the form of the commands.

In the Hayes Command Set, commands are entered by the character sequence **AT (at)** and can also be entered as a list of commands with or without spaces between the individual commands. The “Backspace” key is used for deleting. Commands can be entered in upper-case or lower-case. In the command mode, the modem automatically recognizes data frames and data speed.

◇ *AT commands can be transferred to the modem at the following data speeds: 115 200, 57600, 38400, 19200, 14400, 9600, 4800, 2400, 1200, 600 and 300 bps*

#### Examples of Command Syntax:

**ATX1<CR>**

**ATQ0<CR>**

**ATDP12345<CR>**

Individual commands ending with the <CR> Enter key, can be entered in a different manner with the same effect, by inserting as many spaces as you need, to make the command easier to visualise

**ATX1QODP12345<CR>** or:

**AT X1 Q0 DP 12345<CR>**

**Table 1** Modem Commands

<b>Standard Commands</b>	
<b>ATA</b>	Answer mode: Modem monitors telephone line
<b>A/</b>	Repeat last command line; entered without "AT"
<b>ATB</b>	Switching between BELL/CCITT Standards at 300 or 1200 bps
<b>ATD</b>	Enter automatic dialling
<b>ATE</b>	Controlling repeat of modem commands on screen
<b>ATH</b>	Break off an existing connection
<b>ATI</b>	Information on Modem product code
<b>ATL</b>	Loudspeaker volume control
<b>ATM</b>	Switch on loudspeaker
<b>ATO</b>	Return to Online-mode after entering Esc sequence
<b>ATP</b>	Select Pulse dialling
<b>ATQ</b>	Controlling modem messages
<b>ATS</b>	Read and modify modem register(s)
<b>ATT</b>	Select Tone dialling
<b>ATV</b>	Modem message format (verbal or numeric)
<b>ATW</b>	Directing speed messages
<b>ATX</b>	Modem function during dialling; modem messages
<b>ATY</b>	Long Space Disconnect
<b>ATZ</b>	Modem Reset and Load one of the stored modem profiles
<b>+++</b>	Escape Sequence to return temporarily to Command mode
<b>AT&amp;C</b>	Controlling M5 (DCD) Signal at the serial interface
<b>AT&amp;F</b>	Load the factory setting
<b>AT&amp;G</b>	Switch on a Guard Tone
<b>AT&amp;K</b>	Flow Check
<b>AT&amp;Q</b>	Autosync mode
<b>AT&amp;R</b>	Controlling M2 (CTS) and S2 (RTS) Signal at the serial interface
<b>AT&amp;S</b>	Controlling M1 (DSR) Signal at the serial interface
<b>AT&amp;T</b>	Modem test functions
<b>AT&amp;V</b>	Displaying current configuration
<b>AT&amp;W</b>	Storing Modem settings
<b>AT&amp;Y</b>	Selecting the configuration which will be active after modem start
<b>AT&amp;Z</b>	Storing telephone numbers
<b>AT+MS</b>	Select Modulation

## Extended MNP- and V.42bis-Commands

<b>AT\A</b>	Determining Data Block Size with MNP operation
<b>AT\B</b>	Sending a Break signal to the remote modem
<b>AT\G</b>	Modem-modem flow check (XON/XOFF)
<b>AT\K</b>	Effects of the Break Signal
<b>AT\N</b>	Switching between Direct, Normal and MNP modes
<b>AT%C</b>	Controlling Error correction and Data compression
<b>AT%E</b>	Authorise data compression
<b>AT*H</b>	Handshake speed between MNP 10 modems
<b>AT-K</b>	Grant extended MNP class 10

## AT - Attention Code

The AT (Attention) Code, which introduces each command line, can be entered in upper-case or lower-case characters.

Several commands (separated by spaces if desired) can be positioned one after another, in one line. A command line must end with the ASCII character which is stored in the S3 or S4 Register (or with both together). The standard value for S3 is Carriage Return (<CR>=13 decimal) and Line Feed (<LF>=10 decimal) for S4.

A command line without <CR>,<LF> will remain in the command buffer until <CR>,<LF> is entered, or until the action is broken off with <Cntrl-X>. Once <CR>,<LF> has been received, the modem carries out the commands following the AT and answers with an appropriate modem message.

The maximum length of a command line is 40 characters. If the capacity of the command buffer is exceeded, the modem issues an Error message.

◇ *The AT code enables the modem to recognize the speed, parity and character-length of the communication programme*

## The ESC Sequence

If the modem has established a data connection, you can enter more commands at any time, without breaking off the connection. This is achieved by sending three ASCII characters (S2 Register) from the computer to the modem. The standard setting is the “+” character. In order for this to be interpreted as the ESC sequence, certain time limits must be observed in entering the plus-characters. Before the first and after the last character, a Guard time is required (the standard is 1 second) and the individual characters must not be separated from each other by longer than this time period.

## A - Answer Mode

When the A command is entered, the modem switches to the “Off-Hook” condition in the Answer mode and takes over control of the telephone line connected. In this way, the modem transmits in the upper frequency band (upper channel)

If further commands are entered after the **A** command before a connection has been made, the modem interrupts the establishment of a connection, switches to command mode and issues a NO CARRIER message.

If no carrier is received from the remote station after the waiting time which is set in the S7 Register, the modem responds with a NO CARRIER message and returns to command mode. If the modem does receive the carrier signal, it issues a CONNECT message and switches to Data mode.

⇒ *If the handset is not replaced after the data transmission has been completed, the connection remains made and you will continue to pay for this !*

## A/ - Repeat Last Command Line

The A/ command causes the modem to repeat the command line which is stored in the command buffer, e.g. it will dial again, if the line is busy. This command is entered without AT and no reply is issued.

⇒ *A command line remains until the modem receives a new command. The data format should not be modified in the meantime.*

## B - BELL/CCITT Standard

The B command permits change-over between CCITT and Bell standards at 300 or 1200 bps. At 300 bps, this command will select between Bell 103 and CCITT V.21, while at 1200 bps it will select between Bell 212A and CCITT V.22.

**ATB0**            CCITT V.22, V.21 (factory setting)

**ATB1**            Bell 212A, Bell 103

⇒ *The **B** command refers only to connections at 300 or 1200 bps. All other speeds use the CCITT standard.*

## D - Automatic Dialling and Dialling Parameters

The D command instructs the modem to go on-line and to dial. If this command is entered without parameters, the modem will go on-line in Originate mode. The following characters are authorised in the dialling sequence:

<b>0 - 9</b>	The digits of the telephone number
<b>P, T</b>	In the Dial command, these parameters switch to pulse-dialling ( <b>P</b> ) or to tone-dialling ( <b>T</b> ) until the other parameter is entered. The standard setting is pulse-dialling.
<b>W</b>	Dialling tone recognition. When this parameter is entered, the modem will not continue dial until it has recognized the sign that the line is free. This is an advantage in branch exchanges, where it is not always possible to guarantee immediate access to a line.
<b>,</b>	Dialling pause (1 sec). This comand may not be used in the dialling sequence when the modem is supposed to wait for a new dial-tone. The <b>W</b> -parameter must be used in this case.
<b>A-D,*,#</b>	Additional characters when tone-dialling
<b>S=n</b>	Dialling number which is stored with <b>&amp;Zn</b>
<b>!</b>	Call exchange by Flash
<b>^</b>	Switch off calling tone; this applies only during the current dialling process
<b>;H</b>	Modem as automatic dialling device. Here, the dialling sequence is terminated by a semi-colon, followed by the <b>H</b> command. The modem goes off-line after dialling and you can take over the conversation using a telephone. The handset must be lifted <b>during</b> the dialling process.

**Example** of how to set up a Dial Command

**ATD T0, P 02212971**

With this, a private automatic branch exchange using tone-dialling dials zero, in order to obtain an exchange line. The modem then waits one second to dial the rest of the telephone number in pulse-dialling mode

**Example** of the Automatic Dialling Function

**ATD T0, P 02212971;H**

If you lift the handset **during** the dialling process, you can take over the connection yourself.

- ☞ *Where appropriate, ask the manufacturer of your private automatic branch exchange what specific features need to be taken into account in the dialling procedure*
- ☞ *If the handset is not replaced after the data transmission has been completed, the connection remains made and you will continue to pay for this !*

## E – Echo Function

The E command determines whether the modem will issue an echo of the command which is entered.

<b>ATE0</b>	No command echoes are issued to the computer
<b>ATE1</b>	Command echoes are issued (factory setting)

## H – Switch Hook Check (Replace Handset)

The H command will break off the existing telephone line connection (the modem “hangs up”) and the connection to the remote modem is cut off. After the H command, any other commands in the same line are ignored.

⇒ *This command can only be entered after an existing data link has been quitted by using the **Esc** sequence.*

## I – Firmware Information

<b>ATI0</b>	Gives the Product Code
<b>ATI1</b>	Gives the ROM test total
<b>ATI2</b>	The test total is calculated and compared with the value stored in the ROM (Message is OK or ERROR)
<b>ATI3</b>	Gives the firmware version
<b>ATI4</b>	Gives the name of the device
<b>ATI5</b>	Gives the Country Code
<b>ATI6</b>	Gives the Data Pump model
<b>ATI7</b>	DAA Code of MCU request

## L – Volume Level

The loudspeaker enables you to follow acoustically as the connection is established and data are transmitted.

<b>ATL0,1</b>	Low volume (factory setting)
<b>ATL2</b>	Medium volume
<b>ATL3</b>	High volume

## M – Switching the Loudspeaker On and Off

<b>ATM0</b>	Loudspeaker is always OFF
<b>ATM1</b>	Loudspeaker is ON until the carrier signal is recognized (factory setting)
<b>ATM2</b>	Loudspeaker is always ON
<b>ATM3</b>	Loudspeaker is OFF when dialling and after carrier tone recognition

## N – Recognizing Type of Modulation

This command commands the automatic recognition of the type of modulation.

<b>ATN0</b>	Automatic recognition not authorised. The Handshake is carried out to the value of S37. Where S37=0, the Handshake is set to the interface speed
<b>ATN1</b>	Automatic recognition is authorised

## O – Return to On-Line Operation

The O command causes the modem to return to Online mode, which had been left temporarily, using the Esc sequence. With the remote modems still online, you can continue data transmission.

## P – Selecting Pulse Dialling

This command specifies pulse-dialling as the standard dialling procedure, until the modem receives a Tone-dialling parameter in a dialling command, or until the T command is received.

## Q – Modem Messages On / Off

<b>ATQ0</b>	Modem messages are issued (factory setting)
<b>ATQ1</b>	Modem messages are not issued

## S – Reading and Modifying Registers

This command gives access to the internal modem registers. See chapter 4 for details of the possible values.

<b>ATS<math>n</math>=<math>v</math></b>	This sets Register $n$ to the (decimal) value $v$
<b>ATS<math>n</math>=<math>v</math>?</b>	This sets Register $n$ to the (decimal) value $v$ and sends the new value for checking
<b>ATS<math>n</math>?</b>	This reads Register $n$ and gives its value in decimal form

## T – Selecting Tone Dialling

This command specifies tone-dialling as the standard dialling procedure, until the modem receives a Pulse-dialling parameter in a dialling command, or until the P command is received.

## V – Verbal or Numeric Modem Messages

The V command determines the type of message which the modem returns to the computer.

- ATV0**            Numeric modem messages
- ATV1**            Verbal modem messages (factory setting)

## W – Controlling Connect Messages

This command controls the format of CONNECT messages. Other options can be controlled via the value of S95.

- ATW0**            Once the connection has been established, only the interface speed is advised
- ATW1**            Once the connection has been established, messages follow sequentially regarding the speed on the telephone line, the Error Protocol and the interface speed
- ATW2**            Once the connection has been established, only the speed on the telephone line is advised

## X – Extended Connect Messages; Making Connections

The X command determines which modem messages are authorised. Messages 0 to 4 are basic and are always issued.

Messages 5 to 81 are extended modem messages, which can be switched on or off by using the X command (see also the W command). The X command determines how the engaged tone will be handled (see also the D command).

- ATX0**            The modem issues only messages 0 to 4. To dial, the modem goes on-line, waits for the period of time preset in the S6 register (standard is 3 seconds) and then dials, whether or not there is a dialling tone. Once the connection has been established, a CONNECT message is issued. If this is not achieved in the time laid down in the S7 Register (standard is 60 seconds), a NO CARRIER message is issued. The modem does not recognize dialling or engaged tones.

- ATX1** The modem issues all messages. If the W parameter is used in the Dialling command but no dialling tone is recognized, a NO CARRIER message is issued.
- ATX2** The modem waits for a dialling tone and gives a NO DIALTONE message if the dialling tone is not recognized within the time set in the S6 Register. The engaged tone is not recognised.
- ATX3** The modem issues all messages. The dialling method is as for the X0 command; however, the busy tone is recognized and quitted with a BUSY message.
- ATX4** The modem dials blind, issues all messages and recognizes the engaged tone (factory setting).

## Y – Long Space Disconnect

The Y command determines whether the modem recognizes a “Long Space Disconnect” signal, that is, whether it will shut down the line if a Space signal of longer than 1.6 seconds is received from the remote modem.

- ATY0** Space signal not recognized (factory setting)
- ATY1** Space signal is recognized. In “Normal” and “Direct” connections, the modem will send a Space signal 4 seconds before shut-down before proceeding to “hang up”. Where the connection includes Error correction, it will go direct from the line.

## Z – Reset/Load a Stored Profile

The Zn command is used to carry out a Reset of an active configuration profile. In this procedure, the NVRAM values are written into the relevant Registers and the remaining parameters are changed again to the factory settings. You use the n parameter to select one of the configuration profiles which has been stored with &W (n=0,1). Any command following the Z command in the same command line will be ignored.

## &C – M5 Control Line

The M5 signal at the serial interface to the DTE is always made with the &C0 command and the current status of the carrier signal from the remote modem is ignored. With the &C1 command (factory setting), the M5 signal (DCD: Data Carrier Detect) displays the condition of the carrier signal which is received.

## **&F – Loading the Factory Settings**

The &Fn command (n = 0,1) is used to read any of the factory settings stored in the ROM. Any modified preliminary settings are over-written by this.

The **&F1** setting is specially intended for initialisation in the BTX operating mode, while **&F0** is used for general data transmissions.

### **A Selection of &F0 Factory Settings**

<b>E1</b>	Echo On
<b>L0</b>	Associated loudspeaker on low volume
<b>M1</b>	Loudspeaker On until connection is made
<b>Q0</b>	Modem messages switched on
<b>V1</b>	Complete alpha-numeric messages
<b>Y0</b>	Long Space Disconnect switched off
<b>X4</b>	Wait for dialling tone; engaged tone recognition
<b>&amp;B0</b>	CCITT
<b>&amp;C1</b>	M5 displays carrier recognition
<b>&amp;D2</b>	Modem “hangs up” when S1 line (DTR) goes off
<b>&amp;G0</b>	Guard tones switched off
<b>&amp;R1</b>	M2 always On
<b>&amp;T4</b>	Modem reacts to test loop request from remote party
<b>S0=0</b>	No automatic answer
<b>\N3</b>	Automatic operational mode dialling (buffering)

(Further settings are covered by the descriptions of the individual Commands and Registers).

## **&G – Guard Tone**

In the Answer mode (upper channel transmission), the unit can send a Guard tone which in certain circumstances is a requirement for connections to the UK from abroad. With Bell 212A and Bell 103, no Guard tone is transmitted.

<b>AT&amp;G0,1</b>	Guard tone Off (factory setting)
<b>AT&amp;G2</b>	1800 Hz Guard tone

## **&K – Flow Check**

This command determines the type of computer/modem flow check: -

- AT&K0** No flow check authorised
- AT&K3** RTS/CTS flow check authorised (standard for data modem operation), (factory setting).
- AT&K4** XON/XOFF flow check authorised
- AT&K5** Transparent XON/XOFF flow check
- AT&K6** XON/XOFF and RTS/CTS flow check authorised (standard for fax modem operation)

## **&Q – Autosync Mode**

This command extends the functions of the &M command and is used for controlling authorised types of connection.

- AT&Q4** *Hayes Autosync Operational Mode:* This modem supports *Autosync*, the Hayes Method of synchronous communication. Used in conjunction with the “Hayes Synchronous Interface” (HSI), this system permits synchronous communication with mainframe computers from an asynchronous terminal (PC). This requires no additional synchronous PC boards and the modem can change the operating mode without any configuration modification (see also Registers 19, 20 and 25).
- AT&Q5** The modem attempts to create a data link with Error correction. You can also specify in Register S36 whether the modem should go off-line or create an asynchronous link, if this is unsuccessful.
- AT&Q6** Asynchronous operation in “Normal” mode. (factory setting)

## **&R – Control Lines S2 and M2**

Control line CTS (M2) is always ON in command- and data-mode.

- AT&R0** CTS follows RTS (S2). When S2 changes over from On to Off, M2 switches on after the period of time specified in the S26 Register. Data received during CTS is off are ignored.
- AT&R1** RTS is ignored. (Assumption: RTS ON, CTS ON) (factory setting)

## **&S – Control Line M1 (107/DSR)**

With the &S0 command, the M1 control line is always set up when the modem is switched on. The effect of the &S1 command (factory setting) is to retain the M1 (DSR) in accordance with CCITT recommendations V.22bis/V.22.

## &T – Modem Test Functions

A number of diagnosis commands are available, to enable you to limit any communication problems. These can be entered only when the system is in Command mode (or in Esc command mode for remote test loops). To use them, the following procedures must be carried out:

- Set the communications software to 19200 (or 9600) bps
  - Send the command **AT\N0** to the modem
- ⇒ *In order to disengage the local or remote digital test loops, a telephone connection must first be created, from which you can use the **Esc** sequence to go into the **Esc** command mode*

<b>AT&amp;T0</b>	End the current test loop and issue an Error report
<b>AT&amp;T1</b>	Start a local, analogue test loop in order to check the computer/modem and modem/computer links. During this process, the inputs from your keyboard should be correctly displayed on the screen.
<b>AT&amp;T3</b>	Start a local, digital test loop, in which any data transmitted by a remote modem is returned to it.
<b>AT&amp;T4</b>	Authorise a remote digital test loop for the remote modem (factory setting)
<b>AT&amp;T5</b>	Stop the remote digital test loop
<b>AT&amp;T6</b>	Enquiry for a remote digital test loop. For this, the <b>Esc</b> sequence must be entered <b>in an existing connection</b> and AT&T4 must be active at the remote modem
<b>AT&amp;T7</b>	Enquiry for a remote digital test loop with Self-Test (see &T6). The “Self-Test” consists of a test sample, which is sent locally. At the end of this test, the number of errors detected will be reported to the computer.
<b>AT&amp;T8</b>	Start a local analogue test loop with Self-Test

⇒ *You can use the Test Timer (Register 18) to end a test loop; alternatively, once you have entered the Esc sequence (+++), you can enter the command AT&T0.*

## &V – Displaying the Current Configuration

This command can be used to cause the modem to display the current modem configuration, the configurations stored under &W and the first four stored telephone numbers.

**Table 2** Current Modem Configuration (Example)

```
ACTIVE PROFILE:
B0 E1 L1 M1 N1 P Q0 V1 W0 X4 Y0 &C1 &D2 &G2 &J0 &K3 &Q5 &R1 &S1 &T4 &X0 &Y0
S00:000 S01:000 S02:043 S03:013 S04:010 S05:008 S06:003 S07:060 S08:001 S09:006
S10:014 S11:090 S12:050 S18:000 S25:005 S26:001 S36:007 S37:000 S38:020 S44:020
S46:138 S48:007 S95:002

STORED PROFILE 0:
B0 E1 L1 M1 N1 P Q0 V1 W0 X4 Y0 &C1 &D2 &G0 &J0 &K3 &Q5 &R1 &S1 &T4 &X0
S00:000 S02:043 S06:003 S07:060 S08:001 S09:006 S10:014 S11:090 S12:050 S18:000
S36:007 S37:000 S40:105 S41:131 S46:138 S95:002

STORED PROFILE 1:
B0 E1 L1 M1 N1 P Q0 V1 W0 X4 Y0 &C1 &D2 &G0 &J0 &K3 &Q5 &R1 &S1 &T4 &X0
S00:000 S02:043 S06:003 S07:060 S08:001 S09:006 S10:014 S11:090 S12:050 S18:000
S36:007 S37:000 S40:105 S41:131 S46:138 S95:002

TELEPHONE NUMBERS:
0=                                     1=
2=                                     3=
```

## &W – Storing a set Profile

The &Wn command is used to store a number of values of the S Register's current configuration profile, in the non-volatile NVRAM. You can store two different profiles (n = 0, 1) and load these again by using the Z command.

## &Y – Selecting a Start Configuration

The &Yn command is used to determine which of the non-volatile stored profiles (&W command) will be active when the unit is switched on. The n parameter (n = 0, 1) is used to select the profile required (factory setting is 0).

## &Z – Telephone Number Storage

The modem can store up to 4 telephone numbers by using the AT&Zn=x command (n = 0-3). These can be dialled automatically by the command ATDS=n. Telephone numbers must not be more than 45 characters in length (digits + dialling parameters).

For example: **AT&Z2=P06897 123456**

The telephone number P (for pulse dialling) 06897 123456 is stored in memory 2.

## +MS – Select Modulation

This extended-format selects up to four different parameters:

- Modulation
- Enable or disable automode
- Lowest connection rate
- Highest connection rate

The command format is:

+MS= <mod> [, [<automode>] [, [<min\_rate>] [, [<max\_rate>]]]

**Example: AT+MS= 10,1,300,28800**

**The values have to be separated by commas.**

Following is a list of possible values:

**Table 3** Modulation Types

<mod>	Modulation	Possible Rates
0	V.21	300
1	V.22	1200
2	V.22bis	1200 or 2400
3	V.23	1200
9	V.32	9600 or 4800
10	V.32bis	14400, 12000, 9600, 7200 or 4800
11	V.34	28800, 26400, 24000, 21600, 19200, 16800, 14400, 12000, 9600, 7200, 4800 or 2400 (Default)
64	Bell 103	300
69	Bell 212	1200
74	V.Fast Class	28800, 26400, 24000, 21600, 19200, 16800 or 4400

For V.23, originating modes transmit at 75 bps and receive at 1200 bps; answering modes transmit at 1200 bps and receive at 75 bps. The rate is always specified as 1200 bps.

**Table 4** Enable/disable automatic modulation negotiation

<b>&lt;automode&gt;</b>	<b>Selected Option</b>
0	Automode disabled
1	Automode enabled (factory setting)

### **Minimum/Maximum connection rate**

These are optional numeric values to specify the lowest and/or highest rates at which the modem may establish a connection. The values are decimal coded, in units of bps.

### **Selected Options**

After the following command the modem sends a string of information consisting of the selected options:

**AT+MS?**

For example: +MS:10,1,300,28800

After the following command the modem sends a string of information consisting of the supported options:

**AT+MS=?**

For example:

+MS:0,1,2,3,8,9,10,13,64,69,74),(0, 1), (300–28800),(300–28800)

### **\A – Maximum MNP Block Size**

The \A command determines the maximum size of the data blocks for MNP4 and MNP5 connections but not for MNP1-3. Where good telephone lines exist, large data blocks will speed transmission, because the quantity of additional bits is less.

With poor telephone lines it is more sensible to transmit small data blocks as if there is an error, the entire data block will have to be sent again.

**AT\A0** Maximum block size is 64 bytes

**AT\A1** Maximum block size is 128 bytes

**AT\A2** Maximum block size is 192 bytes

**AT\A3** Maximum block size is 256 bytes (factory setting)

## \B – Sending a Break Signal

The \B command is used to send a Break signal to the remote modem (see \K command).

In order to enter the \B command, you must first return from the existing data connection to the Command mode, using the **Esc** sequence. The Break signal is fixed at 300 ms.

## \G – Modem/Modem Flow Check

The \G command determines whether the modem/modem Flow Check is switched on during a “Normal” connection. This Flow Check supports the modem, if data are sent more quickly than they can be handled.

If the MNP buffer is full, it will send an XOFF signal (13A decimal) to the computer, so that it will interrupt the data transmission. As soon as the buffer store is ready to accept data again, the modem sends an XON signal (11 decimal), whereupon the computer takes up the data transmission again.

**AT\G0**            XON/XOFF Flow Check OFF (factory setting)

**AT\G1**            XON/XOFF Flow Check ON

## \K – Type of Break Control

The \K command determines how the modem by-passes with a Break signal.

**Table 5**            Break Control

	<b>Break by Computer in Data Mode</b>	<b>Break by Computer in ESC-Command Mode</b>	<b>Break by Remote Modem in “Normal” Connection</b>
<b>\K0</b>	No break to remote modem; go into ESC command mode	Delete buffer send Break immediately to remote modem	Delete buffer and send Break to computer
<b>\K1</b>	Delete buffer send break to remote modem	as <b>\K0</b>	
<b>\K2</b>	as <b>\K0</b>	Send Break immediately to remote modem	Send Break immediately to computer
<b>\K3</b>	Send Break immediately to remote modem	as <b>\K2</b>	as <b>\K2</b>
<b>\K4</b>	as <b>\K0</b>	Send Break in Data sequence to remote modem	Send Break in Data sequence to computer
<b>\K5*</b>	Send Break in Data sequence to remote modem	as <b>\K4</b>	as <b>\K4</b>

## **\N – Data Transmission Mode**

The \N command is used to set up the preferred data transmission mode (Direct, Normal, MNP or V.42bis).

- AT\N0**        The modem tries to create a “Normal” connection (without data compression and Error correction). The intermediate store is used for buffering, as with an MNP connection. This data buffering permits different data rates at the interface and on the telephone line.
- AT\N1**        The modem makes a direct connection to the remote modem. No MNP is used and the Baud rate at the interface is adjusted to the Baud rate on the telephone line. To achieve successful data transmission, the data rate of the computer must, where appropriate, be adjusted to the transmission speed.
- AT\TN2**        The modem first tries to make a V.42 connection and then an MNP connection (Reliable). Where no Error Check is authorised at the remote modem, the modem will break off the connection and return to Command mode.
- AT\N3**        Depending on the remote modem setting, the modem tries to make a Normal, MNP or V.42 connection (Auto reliable). Hardware Flow Check is authorised (factory setting).
- AT\N4**        The modem tries to make a V.42 (Reliable) connection
- AT\N5**        The modem tries to make an MNP (Reliable) connection.

◇ *Some types of modem will not accept an MNP connection. In such cases, use the \N0 command (Buffering) or the \N1 command (Direct mode).*

## **-K – Extended MNP Operation**

This command determines whether the conversion of a V.42 connection to an MNP connection is authorised.

- AT-K0**        Not authorised
- AT-K1**        Authorised (factory setting)
- AT-K2**        MNP Extended Services inhibited during V.42 LAPM answer mode detection phase.

## **%C – Authorise Data Compression**

By using the %C command, you can select data compression for MNP or V.42. For the compression to work, the remote modem must also have the capability for data compression and a Reliable mode (\N2, \N3 or \N4) must be active.

- AT%C0**          Compression not authorised
- AT%C1**          MNP 5 compression authorised
- AT%C2**          V.42bis compression authorised
- AT%C3**          Both compression procedures authorised (factory setting)

⇒ *Where files selected for transmission are compressed, the speed of transmission is reduced with MNP5 or V.42 Protocols.*

## **%E – Automatic Retrain**

This command determines whether the modem will try to synchronize again with the remote modem, if conditions change on the telephone line.

- AT%E0**          Automatic Retrain not authorised (factory setting)
- AT%E1**          Automatic Retrain when line conditions deteriorate

## **\*H – Handshake Speed with MNP 10 Modem**

This command controls the Handshake speed before an MNP 10 connection is agreed.

- AT\*H0**          Handshake at maximum possible speed (factory setting)
- AT\*H1**          Handshake at 1200 bps
- AT\*H2**          Handshake at 4800 bps

The modem responds to AT commands with *Modem Messages*. You can control their format (verbal or numeric) with the **V** command.

In addition, the modem issues *Connection Messages*, when it recognizes activities on the telephone line. The **X** command determines which messages are authorized here.

Messages regarding Error correction are controlled via the **W** command and with the S95 Register. The following table gives an overview of the possible messages.

**Table 6** Modem Messages

Numeric/ Verbal	Reason/Description
(00) OK	Modem acknowledges execution of a command
(01) CONNECT	<ol style="list-style-type: none"> <li>1. Modem has created a data link at 300 bps</li> <li>2. Interface speed is 300 bps when link is made</li> <li>3. Link is made but <b>X0</b> command is on and modem issues no information on speed</li> </ol>
(02) RING	Modem has recognized an incoming call
(03) NO CARRIER	<ol style="list-style-type: none"> <li>1. "Free" signal recognized but no carrier in specified time</li> <li>2. No "Free" signal recognized in specified time (S7)</li> <li>3. Modem gone off-line following loss of carrier</li> <li>4. Answer when engaged signal is recognized</li> <li>5. Answer when no dialling tone is recognized</li> </ol>
(04) ERROR	<ol style="list-style-type: none"> <li>1. Modem has found an error in the command syntax or cannot carry out the command line</li> <li>2. Dialling blocked (X0, X1, X2 or X3 are engaged)</li> <li>3. Telephone handset not replaced</li> </ol>
(05) CONNECT 1200	<ol style="list-style-type: none"> <li>1. Modem has set up a data link at 1200 bps</li> <li>2. Interface speed is 1200 bps after link is made</li> </ol>
(06) NO DIALTONE	X2 or X4 is active and modem has not received a dialling tone
(07) BUSY	X3 or X4 is active and modem has received an engaged tone after dialling
(08) NO ANSWER	Modem recognizes "Free" signal until time set in S7 Register has expired

(09) CONNECT 0600	(59) CONNECT 16800
(10) CONNECT 2400	(16) CONNECT 19200
(11) CONNECT 4800	(61) CONNECT 21600
(12) CONNECT 9600	(62) CONNECT 24000
(13) CONNECT 7200	(17) CONNECT 38400
(14) CONNECT 12000	(18) CONNECT 57600
(15) CONNECT 14400	(19) CONNECT 115600
Where X1, X2, X3 or X4 is active, these messages show the interface speed, or the speed on the line, once the data connection has been made	
(22) CONNECT 75TX/1200RX	Modem has created a V.23 link in Originate mode
(23) CONNECT 1200TX/75RX	Modem has created a V.23 link in Answer mode
(24) DELAYED hh:ss:mm	Where X4 is active, this message shows dialled number is inaccessible
(32) BLACKLISTED	Modem goes into Blacklisted mode. This can be solved by switching the power supply OFF and On again.
The following messages apply where a carrier is recognized on the telephone line and S95=2 is active.	
(40) CARRIER 300	V.21 or Bell 103 carrier recognized
(44) CARRIER 1200/75	V.23 Backward-Channel carrier recognized
(45) CARRIER 75/1200	V.23 Forward-Channel carrier recognized
(46) CARRIER 1200	V.22 or Bell 212 carrier recognized
(47) CARRIER 2400	V.22bis carrier recognized
(48) CARRIER 4800	Data rate of 4800 bps in V.32 or V.32bis mode recognized
(49) CARRIER 7200	Data rate of 7200 bps in V.32bis mode recognized
(50) CARRIER 9600	Data rate of 9600 bps in V.32bis or V.32 mode recognized
(51) CARRIER 12000	Data rate of 12000 bps in V.32bis mode recognized
(52) CARRIER 14400 (/VFC)	Data rate of 14400 bps in V.34 or V.Fast Class mode recognized
(53) CARRIER 16800 (/VFC)	Data rate of 16800 bps in V.34 or V.Fast Class mode recognized
(54) CARRIER 19200 (/VFC)	Data rate of 19200 bps in V.34 or V.Fast Class mode recognized
(55) CARRIER 21600 (/VFC)	Data rate of 21600 bps in V.34 or V.Fast Class mode recognized
(56) CARRIER 24000 (/VFC)	Data rate of 24000 bps in V.34 or V.Fast Class mode recognized
(57) CARRIER 26400 (/VFC)	Data rate of 26400 bps in V.34 or V.Fast Class mode recognized
(58) CARRIER 28800 (/VFC)	Data rate of 28800 bps in V.34 or V.Fast Class mode recognized
(66) COMPRESSION CLASS 5	Modem has set up a link with MNP 5 and compression messages are authorised
(67) COMPRESSION V.42bis	Modem has set up a link with V.42bis and compression messages are authorised
(69) COMPRESSION NONE	Modem has set up a link without data compression and compression messages are authorised
(76) PROTOCOL NONE	Modem has set up a link with no form of Error correction and messages covering Error correction are authorised
(77) PROTOCOL LAPM	Modem has set up a link with V.42 Error correction
(80) PROTOCOL ALT	Modem has set up a link with MNP Error correction
(81) PROTOCOL ALT CELLULAR	Modem has set up a link with MNP 10 Error correction (specially suitable for radio telephones)

The modem has a series of S-Registers, in which the active configurations are stored. The contents of a number of Registers are stored in a non-volatile memory (NVRAM), which can be interrogated with **Z**, **&Y** and **&W** commands. The syntax for entering and requesting Register values is given in the description of the **S** command. The values of most of the Registers can be modified by using AT commands.

**Table 7** S-Registers (Summary)

Register	Range	Default.	Description
S0*	0-2 ring characters	0	Ring characters before modem answers
S1	0-255	0	Ring character counter
S2*	0-127 ASCII	43	Esc sequence character
S3	0-127 ASCII	13	Carriage return character
S4	0-127 ASCII	10	Line feed character
S5	0-127 ASCII	08	Backspace character
S6*	4-7 sec	4	Dial tone waiting time
S7*	0-58 sec	58	Waiting time for carrier after dialling
S8*	0-10 sec	1	Pause character comma
S9*	1-255 1/10 sec	6	Answer time after carrier recognition
S10*	14-100 1/10 sec	14	Delay: carrier loss to "hanging up"
S12*	0-255 1/50 sec	50	Guard time for Esc sequence
S14*	Bit-mapped	170 (AAh)	General options
S16	Bit-mapped	00	Modem test options
S18*	0-255 sec	0	Test Timer
S19	Bit-mapped	0	Autosync Register
S20	0-255	0	HDLC Address/BSC Synchronous Character
S21*	Bit-mapped	116 (74h)	V.21/General options
S22*	Bit-mapped	117 (75h)	Loudspeaker/modem messages
S23*	Bit-mapped	187 (BBh)	General options
S24*	1-120 sec	60	Inactivity timer for Low Power Operation
S25	0-255 sec; 1/100 sec	5	DTR delay time
S26	0-255 1/100 sec	01	Delay from RTS to CTS
S27*	Bit-mapped	9	General options
S28*	Bit-mapped	0	General options
S30	0-255 10 sec	0	Inactivity timer for "hanging up"
S31*	Bit-mapped	194 (C2h)	General options
S32	0-255 ASCII	17	XON character
S33	0-255 ASCII	19	XOFF character

Register	Range	Default.	Description
S36*	Bit-mapped	7	Fallback with V.42 link creation
S37*	Bit-mapped	0	Type of modulation (Line-Speed)
S38	0-255 sec	20	Delay before “hanging up”
S39*	Bit-mapped	3	Flow check
S40*	Bit-mapped	105 (69h)	General options
S41*	Bit-mapped	131 (83h)	General options
S46*	Bit-mapped	138	Control data compression
S48*	Bit-mapped	7	Control V.42 handshakes
S86	0-255	-	Error Codes for NO CARRIER-messages
S95*	Bit-mapped	2	Controlling extended connection messages
*Register values are stored with &W in the non-volatile NVRAM memory			

## S0 – Number of Ring Characters before Modem engages

Where the value of S0 = 0, automatic answering is switched OFF and the modem does not go on-line. Where the value of S0 = 1, the modem goes on-line at the first ring sign, or character.

**Range:** 0-2 ringing characters; factory setting: 0

## S1 – Ring Character Counter

The value of this Register is increased by 1 with each ring character which is recognized. It is deleted when pauses exceed 8 sec.

**Range:** 0-255 ring characters; factory setting: 0

## S2 – Esc Sequence Character

ASCII value of the character defined as the Esc sequence, to change from data mode to command mode. The Esc sequence is switched off where this value exceeds 127.

**Range:** 0-255; factory setting: 43 (ASCII+, “plus” sign)

## S3 – Carriage Return Character

ASCII value of the Carriage Return character (<CR>Carriage Return) ends the command lines and modem messages.

**Range:** 0-127; factory setting: 13 (ASCII CR, Carriage Return)

## S4 – Line Feed Character

ASCII value of the Line Feed character (<LF> Line Feed). The modem sends this character after <CR> to finish verbal modem messages in asynchronous operating mode.

**Range:** 0-127; factory setting: 10 (ASCII LF, Line Feed)

## S5 – Backspace Character

ASCII value for Backspace. Entering this will delete the character to the left of the cursor (and the last character in the command memory) and the cursor moves one space backwards.

**Range:** 0-32, 127; factory setting: 8 (ASCII Backspace)

## S6 – Waiting Time for Dialling Tone

The value of the S6 Register determines when the modem will begin to dial after “lifting the handset” (or after recognizing the W parameter in Dialling command mode). The X command controls the effect of the S6 Register. For X0, X1 or X3, the modem waits for the specified period, even if the dialling tone occurs earlier. You can enter any value between 0 and 255 sec in this Register; however, the modem will always remain in the allowed range.

**Range:** 4–7 seconds; factory setting: 4 sec

## S7 – Waiting for Carrier Signal

Where the extended mode commands X3 or X4 are active (X4 is the factory setting), the modem waits in Originate mode until the “Free” character is recognized (the other connection is being called). The value of the S7 Register determines the duration of the waiting period. In addition, the value of the S7 Register also determines how long the modem will wait for a carrier signal from the remote modem, before it “hangs up”. Since the modem also waits for a carrier signal, if it does not recognize a “Free” tone, the total waiting time can be twice as long as the value set in the S7 Register.

When answering, the Register value represents only the waiting time for carrier-tone recognition, since the “Free” character is of no importance here. Further, the value of the S7 Register determines the waiting time for a subsequent dialling tone (with no affect on the waiting time after the modem has “lifted the handset”), where the W parameter is in Dial command mode. The subsequent dialling tone is used in telephone systems, where a number is dialled beforehand to call the exchange.

**Range:** 0-58 sec; factory setting: 58 sec

## S8 – Pause Time after Comma

If a comma is included in the Dial command, the modem will pause when dialling, when it reaches this character. The length of this pause is determined by S8.

**Range:** 0-10 sec; factory setting: 1 sec

## S9 – Answer Time after Carrier Recognition

The period of time, during which the carrier from the remote station must be present, before the modem goes on-line. A higher value decreases the risk of an incorrect interpretation.

**Range:** 1-255 1/10 sec; factory setting: 6 (0.6 s)

## S10 – Delay between Carrier Loss and Hanging Up

The period of time, during which the modem waits after carrier loss, before it “hangs up”. This allows for a temporary loss of the carrier. The value must be greater than the value of the S9 Register, so that the modem does not “hang up” before recognizing the carrier.

**Range:** 14-100 1/10 sec; factory setting: 14 (1.4 s)

## S12 – Guard Time for Esc Sequence

The Guard Time is the period of time during which, both before and after entering the Esc sequence (+++), the modem is not permitted to receive any characters. Where the Register value is zero, the modem will always go into Command mode after three consecutive Esc signs.

**Range:** 0; 20 to 255 sec; interval 20 ms Factory setting: 50 (1 sec)

## S14 – General Options

Factory setting: 170 (AAh) (10101010b)

<i>Bit 0</i>	Reserved
<i>Bit 1</i>	Command echo (E command)
0	Echo OFF (E0)
1	Echo ON (E1)(factory setting)
<i>Bit 2</i>	Modem messages (Q command)
0	Modem messages ON (Q0) (factory setting)
1	Modem messages OFF (Q1)
<i>Bit 3</i>	Modem messages, verbal/numeric (V command)
0	Numeric modem messages (V0)
1	Verbal modem messages (V1) (factory setting)
<i>Bit 4</i>	Reserved
<i>Bit 5</i>	Pulse or Tone dialling (P and T dialling parameters)
0	Tone dialling (T)
1	Pulse dialling (P) (factory setting)
<i>Bit 6</i>	Reserved
<i>Bit 7</i>	Originate/Answer mode (A, D commands; R dialling parameter)
0	Answer mode
1	Originate mode (factory setting)

## S16 – Modem Test Options

Factory setting: 0

<i>Bit 0</i>	Local analogue test loop
0	OFF (factory setting)
1	ON (&T1)
<i>Bit 1</i>	Reserved
<i>Bit 2</i>	Local digital test loop
0	OFF (factory setting)
1	ON (&T3)
<i>Bit 3</i>	Status of remote digital test loop
0	OFF
1	ON
<i>Bit 4</i>	Status of a remote digital test loop, disengaged by the remote modem
0	OFF (factory setting)
1	ON (&T6)
<i>Bit 5</i>	Remote digital test loop with Self-Test
0	OFF (factory setting)
1	ON (&T7)
<i>Bit 6</i>	Local analogue test loop with Self-Test
0	OFF (factory setting)
1	ON (&T8)
<i>Bit 7</i>	Reserved

## S18 – Test Timer

This determines the duration of a test loop, disengaged by &Tn. Where the Register value is zero, test loops must be ended with &T0 or with the H command.

**Range:** 0-255 sec; factory setting: 0

## S19 – Autosync Register

<i>Bit 0</i>	Reserved
<i>Bit 1</i>	Synchronous protocol
0	BSC
1	HDLC
<i>Bit 2</i>	Control of “Address Detector”
0	Address Detector not authorised
1	Address Detector authorised
<i>Bit 3</i>	Non return to zero
0	NRZ1
1	NRZ
<i>Bit 4</i>	
0	Mark idle
1	flag or sync idle
<i>Bit 5-7</i>	Reserved

## S20 – HDLC Address/BSC Synchronous Character

**Range:** 0-255; factory setting: 0

## S21 – V.24/General Options

Factory setting : 116 (74h) (11100100b)

<i>Bit 0,1</i>	Reserved
<i>Bit 2</i>	Condition of Control Lines RTS (S2) and CTS (M2)
0	CTS follows RTS (&R1) (factory setting)
1	CTS always on (&R0)
<i>Bit 3,4</i>	Reserved
<i>Bit 5</i>	Condition of Control Line DCD (M5)
0	(&C0)
1	(&C1) (factory setting)
<i>Bit 6</i>	Condition of Control Line DSR (M1)
0	(&S0)
1	(&S1) (factory setting)
<i>Bit 7</i>	Long Space Disconnect
0	(Y0) (factory setting)
1	(Y1)

## S22 – Loudspeaker/Authorised Modem Messages

Factory setting : 117 (75h) (01110101b)

<i>Bit 0,1</i>	Volume
0, 1	Low (L0, 1) ( L0, factory setting)
2	Medium (L2)
3	Loud (L3)
<i>Bit 2,3</i>	Loudspeaker Condition
0	Always OFF (M0)
1	OFF after carrier recognition (M1) (factory setting)
2	Always ON (M2)
3	ON during Handshake (M3)
<i>Bit 4-6</i>	Authorised modem messages
0	(X0)
4	(X1)
5	(X2)
6	(X3)
7	(X4) (factory setting)
<i>Bit 7</i>	Reserved

## S23 – General Options

Factory setting : 187 (BBh) (10111011b)

<i>Bit 0</i>	Authorise a remote digital test loop for remote modem
0	Not authorised (&T5)
1	Authorised (&T4) (factory setting)
<i>Bit 1-3</i>	Interface speed
0	0-300 bps
1	600 bps
2	1200 bps
3	2400 bps
4	4800 bps
5	9600 bps
6	19200 bps
7	Over 19200 bps
<i>Bit 4,5</i>	Parity
0	Even
1	Reserved
2	Odd
3	No parity (factory setting)
<i>Bit 6,7</i>	Guard Tone (country dependend)
0	No Guard Tone (&G0)
1	No Guard Tone (&G1)
2	Guard Tone 1800 Hz (&G2) (factory setting)

## S24 – Current Saving Switch

This determines when the modem goes into a current saving switch, where it does not register activity at the interface, nor on the telephone line.

**Range:** 60 sec, fixed

## S25 – DTR Delay Time

Period of time between the departure of DTR and “hanging up”. In synchronous operational mode, the measurement units are seconds, while in other operational modes they are hundredths of seconds.

**Range:** 0-255 sec (1/100 sec); factory setting: 5

## S27 – General Options

Factory setting : 9 (9h) (000001001b)

*Bit 0–5* Reserved

*Bit 6* CCITT/Bell Mode (B) (only at 300 and 1200 bps)

0 CCITT (B0) (factory setting)

1 Bell (B1)

*Bit 7* Reserved

## S28 – General Options

Factory setting : 0

*Bit 0–5* Reserved.

*Bit 6–7* MNP connection speed (\*H)

0 Handshake at maximum possible speed (\*H0) (factory setting)

1 Handshake at 1200 bps (\*H1)

2 Handshake at 4800 bps (\*H2)

## S30 – Inactivity Timer

This determines when the modem goes off-line, when no data are being sent or received. If no Error Correction procedure is active, this Register is reset only by transmitted data. With other procedures, the Register is reset by any data which are recognized. The timer works only in asynchronous mode.

**Range:** 0-255 sec (1/10 sec); factory setting: 0

## S31 – General Options

Factory setting : 194 (C2h) (11000010b)

<i>Bit 0</i>	Reserved
<i>Bit 1</i>	Controlling Automatic Speed Recognition (N)
0	Automatic Speed Recognition OFF (N0)
1	Automatic Speed Recognition ON (N1) (factory setting)
<i>Bit 2,3</i>	Controlling Extended Connection Messages (W)
0	Interface speed only (W0) (factory setting)
1	All information (W1)
2	Only modem speed (W2)
<i>Bit 4-7</i>	Reserved

## S32 – XON Character

Determines the value of the XON character.

**Range:** 0-255 (ASCII); factory setting: 17

## S33 – XOFF Character

Determines the value of the XOFF character.

**Range:** 0-255 (ASCII); factory setting: 19

## S36 – Fallback on V.42 Connection Set-up

Factory setting : 7 (7h) (00000111b)

<i>Bit 0-2</i>	This value determines what is to be done when a V.42 connection is set-up unsuccessfully. The Fallback options immediately become active if the value of S48=128. If invalid values are entered, this Register returns to the factory setting.
0	Modem goes off-line
1	Modem seeks a Direct connection
2	Reserved
3	Modem seeks a Normal connection
4	Modem seeks to make an MNP connection and goes off-line if this is unsuccessful
5	Modem seeks to make an MNP connection and makes a Direct connection if this is unsuccessful
6	Reserved
7	Modem seeks to make an MNP connection and makes a Normal connection if this is unsuccessful (factory setting)
<i>Bit 3-7</i>	Reserved

## S37 – Speed on the Telephone Line

Factory setting : 0

*Bit 0-4* Select transmission speed. If invalid values are entered, the Register returns to the factory setting.

0 Automatic speed recognition (F0) (factory setting)

1-3 300 bps (V.21)

4 Reserved

5 1200 bps (V.22)

6 2400 bps (V.22bis)

7 V.23

8 4800 bps (V.32 or V.32bis)

9 9600 bps (V.32 or V.32bis)

10 12000 bps (V.32bis)

11 14400 bps (V.32bis)

12 7200 bps (V.32bis)

*Bit 5-7* Reserved

## S38 – Delay before Hanging Up

This Register determines how long the modem will wait after it has received an H command (or after an ON/OFF movement of the DTR), before it goes off-line. It is active only with Error-corrected connections. This is to ensure that data in the modem buffer can still be transmitted before the connection is broken off. If data are lost nevertheless, the modem will send the message “NO CARRIER” after receiving the H command. Where it is possible to transmit all the data from the buffer in the predetermined time, you will receive an “OK”.

**Range:** 0-255 sec; factory setting: 20

## S39 – Flow Control

Factory setting : 3 (3h) (00000011b)

*Bit 0-2* Status of Flow Control

0 No Flow Control

3 RTS/CTS (&K3) (factory setting)

4 XON/XOFF (&K4)

5 Transparent (&K5)

6 Both methods (&K6)

*Bit 3-7* Reserved

## S40 – General Options

Factory setting : 105 (69h) (01101001b)

<i>Bit 0, 1</i>	MNP 10 authorised
0	MNP 10 not authorised (-K0)
1	MNP 10 authorised (-K1) (factory setting)
2	MNP 10 not authorized during
<i>Bit 2</i>	Reserved
<i>Bit 3-5</i>	Handling the Break Signal
0-5	\K0 to \K5 (factory setting is \K5)
<i>Bit 6,7</i>	MNP Block size
0	64 characters (\A0)
1	128 characters (\A1)
2	192 characters (\A2)
3	256 characters (\A3) (factory setting)

## S41 – General Options

Factory setting : 31 (83h) (10000011b)

<i>Bit 0,1</i>	Determining Type of Compression
0	No compression authorised (%C0)
1	MNP 5 (%C1)
2	V.42bis (%C2)
3	MNP 5 and V.42bis (%C3) (factory setting)
<i>Bit 2, 6</i>	Automatic Retrain
0	Automatic Retrain not authorised (%E0) (factory setting)
1	Automatic Retrain authorised (%E1)
<i>Bit 3</i>	Modem/Modem Flow Check
0	Flow check not authorised (\G0) (factory setting)
1	Flow check authorised (\G1)
<i>Bit 4, 5, 7</i>	Reserved

## S46 – Authorising a Data Compression

**Range:** 136 or 138; factory setting: 138

S46=136 Error Correction Protocol without Data compression

S46=138 Error Correction Protocol with Data compression (factory setting)

## **S48 – Directing the V.42 Handshake**

<b>Range:</b>	0, 7 or 126; factory setting: 7
S48=0	No V.42 Handshake; attempt to make a V.42 connection
S48=7	The remote modem's capabilities are checked (factory setting)
S48=128	No V.42 Handshake, but direct Fallback. This setting can be used to force an MNP connection

## **S86 – Error Codes for NO CARRIER Messages**

For every NO CARRIER message a value is written into this Register, which assists in discovering the cause of the error. In each case, the initial cause of the NO CARRIER message is recorded.

S86=0	Normal break of connection; no error
S86=4	Loss of carrier
S86=5	Remote modem has no V.42 capabilities
S86=9	No common protocol possible with remote modem
S86=12	Normal break of connection, initiated by remote modem
S86=13	Remote modem has not reacted after the 10th repeat of the same information
S86=14	Protocol error

## **S95 – Extended Connection Messages**

This Register can be used to render various W-command settings inactive. With the bits listed below, the value 1 will allow the messages described, no matter what the W-command setting may be.

Bit 0	CONNECT message gives the modem speed
Bit 1	CONNECT XXXX REL messages for connections with Error correction)
Bit 2	CARRIER XXXX connection messages authorised (factory setting)
Bit 3	PROTOCOL XXXX connection messages authorised
Bit 4	Reserved
Bit 5	COMPRESSION XXXX connection messages authorised
Bit 6,7	Reserved

Your modem is programmed with a set of parameters required by your country's communications regulations. The major country-specific changes (this depends on the country your modem has an approval for) to the values listed in this manual are described in the following tables.

## Austria

Register	Range	Default/Unit
0	0-5	0 rings
6	2-6	2 sec
7	0-60	40 sec
25	0-100	5 1/100 sec
29	10 fixed	10 ms
30	0-255	60 10 sec

## Denmark

Register	Range	Default/Unit
6	0-10	10 sec
30	0-255	120 sec

## Finland

Register	Range	Default/Unit
7	0-60	40 sec
30	0-255	9 10 sec

## France

Register	Range	Default/Unit
30	0-255	18 10 sec

## Germany

Register	Range	Default/Unit
0	0-5	0 rings
6	3-6	3 sec
7	0-100	60 sec
10	0-100	14 1/10 sec
29	6-10	9 ms

## Holland

Register	Range	Default/Unit
6	5–40	10 sec
7	0–60	40 sec
29	11 fixed	11 ms

## Italy

Register	Range	Default/Unit
6	4–10	10 sec
7	0–60	60 sec

## Norway

Register	Range	Default/Unit
6	0–20	10 sec
7	0–90	40 sec

## Sweden

Register	Range	Default/Unit
6	0–60	10 sec
30	0–255	12 10 sec

## Switzerland

Register	Range	Default/Unit
6	4–6	5 sec
7	0–100	60 sec

# Appendix TECHNICAL INFORMATION

## Digital Interfaces

To set up a connection between modem and computer/terminal (DTE = Data terminal equipment), an interface cable with the following features is required: ISO 2110 (SUB-D 25) to V.42 with V.28 level

**Table 8** Interface Cables to V.42

DIN	CCITT	DIN 41612	ISO 2110 SUB-D25	Wire function	Description	Direction Mod.-DTE
E2	102	16c	7	Operating earth	Frame GND	
D1	103	11c	2	Sende data	TxD	<<
D2	104	12c	3	Receive data	RxD	>>
S1	108	16a	20	Transmission line On DTE ready to operate	DTR	<<
M1	107	15c	6	Operational readiness	DSR	>>
S2	105	13c	4	Switch on transmitter	RTS	<<
M2	106	14c	5	Ready to send	CTS	>>
M3	125	19a	22	Incoming call	Ring Indicator	>>
M5	109	18c	8	Receiver signal level	DCD	>>
PS2	140	18a	21	Remote test loop ON	Remote Loopback Request	<<
PS3	141	14a	18	Local test loop ON	Local Loopback Request	<<
PM1	142	-	25	Display test mode		<<
T1	113	21a	24	Transmit clock to DCE	Transmit Clock DTE-Source	<<
T2	114	11a	15	Transmit clock from modem	Transmit Clock DCE-Source	>>
T4	115	13a	17	Receive clock from modem	Receive Clock DCE-Source	>>

## LED Indicators

The LED indicators show the operating condition of the modem:

Display	Meaning and Function (Operating Condition)
<b>POWER</b>	Modem is ready for operation
<b>ONLINE</b>	Modem switched to transmission line
<b>DSR</b>	Answer tone is present
<b>DCD</b>	Modem has recognized carrier tone from remote modem
<b>CTS</b>	Modem is ready to send
<b>RTS</b>	Transmit request is present
<b>DTR</b>	Computer is ready for operation

## GLOSSARY

A AE	Automatic Answering Equipment
AM	Amplitude Modulation
BPS	Characters per second
BSC	Byte Synchronous Communication (synchronous protocol)
DCE	Data Communication Equipment
DTE	Data Terminal Equipment
DPSK	Differential Phase-Shift Keying
DTE	Data Terminal Equipment (= DTE)
ETX	End of Text
FCS	Frame Checking Sequence
FM	Frequency Modulation
FSK	Frequency Shift Keying
HDLC	High Level Data Link Control (Synchronous Protocol)
MFV	Multi-Frequency Dialling Procedure (= Tone Dialling)
MNP	Microcom Networking Protocol (Process for Error Checking and Data Compression)
oK	Upper Channel
PM	Phase modulation
PSK	Phase Shift Keying
QAM	Quadratic Amplitude Modulation
Retrain	renewed Synchronisation of Modem where Line Conditions have changed
SDLC	Synchronous Data Link Control (synchronous protocol)
STX	Start of Text

SYN	Synchronous Character
uK	Lower Channel
Sign	Data Frame, made up of Data bits
Length	Start, Stop and Parity bits

## CCITT RECOMMENDATIONS

V.8	Method for initiating a data transfer with the best modulation possible
V.21	300 bps, full-duplex, synchronous and asynchronous, 2-point Frequency Shift Keying
V.22	1200 bps with Fallback to 600 bps, full-duplex, synchronous and asynchronous 4-point Frequency Shift Keying
V.22bis	2400 bps with Fallback to 1200 bps, full-duplex, synchronous and asynchronous 16-point Quadratic Amplitude Modulation
V.23	1200/1200 bps in 4-wire operation, 1200/75 bps in 2-wire operation, 600/600 bps in 4-wire operation, 75/1200 bps in 2-wire operation, 75/600 bps in 2-wire operation, 75/75 bps in 2-wire operation, synchronous and asynchronous, Frequency Shift Keying
V.24	List of definitions for interface cabling between Data Terminal Equipment (DTE) and Data Communication Equipment (DCE)
V.25	Automatic Call-Answering Equipment and/or Parallel Dialling Equipment in the public telephone dialling system, using 200 Group interface cabling
V.25bis	Automatic Dialling and/or Call-Answering Equipment in the public telephone dialling system, using 100 Group interface cabling
V.26	2400 bps with Fallback to 1200 bps, 4-wire dedicated line, 4-phase differential modulation
V.26bis	2400 bps with Fallback to 1200 bps, dialling line operation, half-duplex, synchronous, 4-phase differential modulation
V.26ter	2400 bps with Fallback to 1200 bps, dialling and 2-wire dedicated line operation with echo elimination, full-duplex, synchronous, differential phase modulation
V.27	4800 bps with Fallback to 2400 bps, 4-wire dedicated line operation, 8-phase differential modulation, synchronous, half/full-duplex
V.27bis	4800 bps with Fallback to 2400 bps, full or half-duplex in 4-wire, dedicated line operation, 8-phase differential modulation at 4800 bps; 4-phase differential modulation at 2400 bps
V.27ter	4800 bps with Fallback to 2400 bps, dialling line operation, half-duplex; with 8-phase differential modulation at 4800 bps and 4-phase differential modulation at 2400 bps.
V.28	Definition of the electrical characteristics of so-called non-symmetrical polar lines
V.29	9600 bps, dedicated line operation; Fallback to 7200 or 4800 bps. 16-point quadratic amplitude modulation

V.32	9600, 4800 and 2400 bps with Fallback to 4800 bps dialling line; synchronous and asynchronous, echo suppression; 16/32-point quadratic amplitude modulation; differential Trellis Coding and/or non-redundant coding, full-duplex
V.32bis	9600, 4800 and 2400 bps with Fallback to 4800 bps
V.34	28800...14400, 9600, 4800 u. 2400 bps, Fallback to 4800 bps; full-duplex and half-duplex
V.Fast Class	28800...14400
V.42bis	Error Correction and Data Compression Procedure to CCITT

**Table 9** Technical Specifications

<b>Parameter</b>	<b>Specifications</b>
<i>Methods of operation</i>	Asynchronous with manual and automatic dialling (AT-commands)
<i>Error Correction and Data Compression</i>	MNP Classes 1–5, 10 or V.42bis
<i>Transmission rates and Modulation procedure</i>	See <i>Chapter 1</i>
<i>Tolerance for deviation from nominal speed</i>	Max.: +1 (+2,3), -2,5%
<i>Character length asynchronous</i>	7, 8, 9, 10, 11 Bits (incl. Star and Stop bits)
<i>Pulse adjustment in synchronous mode</i>	Internal: Local oscillator Extern: Pulse loop (Receive pulse = send pulse)
<i>Interface with telephone network</i>	Dialling line: 2-wire, full duplex
<i>Digital interface</i>	Computer interface: V.24 Protokoll with V.28 level
<i>Automatic dialling</i>	Pulse/MFV dialling
<i>Input for automatic dialling</i>	Serial computer interface
<i>Loudspeaker</i>	Software-controlled: 3 volume levels.
<i>MFV amplitude fluctuation</i>	<1 dB
<i>Tone duration</i>	90 ms
<i>Frequency/key ratio with pulse dialling</i>	10 pulse/sec 39/61% (On/Off)
<i>Guard tone</i>	1800 Hz, or no Guard tone
<i>Power supply</i>	230 V ± 10% (external power supply)
<i>Low-voltage jack:</i>	600 mA AC
<i>Charging rate Power supply</i>	8.5 VAC
<i>Temperature range</i>	0–45 °C
<i>Storage temperature</i>	-25–+70 °C
<i>Air humidity</i>	max. 85% (Rel.)
<i>Dimensions</i>	140 * 85 * 33 mm (L*B*H)
<i>Weight</i>	ca. 250 g without outlet power supply