

MODEM
USER
GUIDE

Issue RC1.3

CONGRATULATIONS !

You have purchased one of our modems which will give you many years of trouble-free operation. The modems in this series are microprocessor-based, and incorporate high speed data communications capabilities. They work with computers and terminals equipped with a V24 or RS232C ports for "on-line" communication with other computers. Your modem is completely compatible with CCITT V.21, V.22, V.22bis, V.23, V32 and V.32bis standards, and can operate at port speeds from 300 bps to 57,600bps (The 288/336 versions also support V.34 modes and speeds up to 115.2Kbps). Both auto answer and auto dial are available as normal functions. The modem supports V.42 & V.42bis in addition to MNP* (up to classes 4 & 5) for error correction and data compression to ensure the maximum integrity and throughput for your data.

If you find that technical manuals such as this guide are more than you can handle initially and want to try out the modem, Go ahead !!

As it works with most PCs and terminals you may not need to read further than this if your software will lead you through the procedures required. You won't cause any damage to your computer, modem or phone if it doesn't work the first time. You should however first read the conditions of approval for connection to telephone lines given in Chapter 9. If this is your first modem and you are new to computing it could take a few hours of use before you get the feel of what is required to make it work. It is also recommended you learn the etiquettes of modem use where you are sharing facilities such as bulletin boards. (They often restrict access to a certain amount of time per day).

* MNP is acknowledged as a trademark of Microcom Inc.

CONTENTS

Chapter 1	Introduction
Chapter 2	Installation
Chapter 3	Operation
Chapter 4	Commands and Responses
Chapter 5	Dialling
Chapter 6	AT Commands
Chapter 7	Registers
Chapter 8	Diagnostics and Testing
Chapter 9	Statutory Information for the Modems
Appendix A	Data Communications for Beginners
Appendix B	Technical Specifications
Appendix C	Cable Specification
Appendix D	Troubleshooting Tips
Appendix E	Glossary
Appendix F	PABX Notes
Appendix G	Command Summary
Appendix H	Fax Operation

CHAPTER 1

INTRODUCTION

There are six modems in the series covered by this guide:-
Desktop, PC card and PCMCIA format, each with maximum
operating speeds of 14400bps or 28800/33600bps

Each Modem is a communications device designed to work with a
terminal or personal computer. The modem operation is based
on ITU V.21, V.22, V.22 bis, V.23 , V.32, and V32bis. The 288/
336 models also have V.34 operation.

The Modem can 'touch-tone' dial telephone numbers and is
approved in the United Kingdom. (For details of the BAPT
aspects please see Chapter 9.)

Using standard commands you can instruct your modem to dial or
answer calls from a terminal or a computer set up for terminal
emulation. Program commands also allow you to change your
modem's effects and many operating parameters. The Modem will
reply to each command you send, and will keep you informed of
your modem's current state. Indicators (LEDs) on the front
panel of the desktop Modem provide you with a visual check of
your modem's operations.

Inside your Modem (accessible only by authorised technicians)
a small speaker allows you to listen to the status of dialled
calls.

Three modes of operation, a Command Mode, Fax and Data
Mode, and optional Voice mode are supported. These are further
discussed in Chapter 4.

Operating Modes

- a) Data- In this mode your modem can connect to
bulletin boards, Internet or other service
providers for browsing or
uploading/downloading files.
- b) Fax- In this mode, the modem is able to send or
receive faxes from any fax machine,
provided your computer is equipped
with suitable software.
- c) Voice- Where supported on the modem, this facility
allows the modem to send or receive voice
calls, provided your computer is equipped
with suitable software.

Your Modem incorporates an internal speaker which allows you
to monitor the dialled calls - you can hear the establishment
of carrier. The sound depends on the modulation scheme (i.e.
V.23, V.34 etc) being used. This enables you to hear a
dialling tone, busy signal, detect and connection problem and
determine when a wrong number has been reached.

Standard Features

The following components are included in your Modem package.

Before proceeding, please confirm for yourself that all components listed below are in your package.

1. Your Modem.
2. This User's Guide.
3. Modem Power Supply (for desktop modems)
4. Line Cord (for connecting modem to wall socket)

CHAPTER 2

INSTALLATION

Your Modem is designed for use with PCs, or terminals. This chapter contains instructions on how to install your modem. Turn to page 2.9 for instructions on the initial installation of the PC card modem.

Installation procedure for the desktop Modem.

To install your Modem you should complete the following steps:

1. Find a suitable location to place your Modem.
2. Connect your Modem to your computer, printer or terminal.
3. Connect your Modem to the telephone line.
4. Connect your power supply to the modem and to a mains AC outlet.

Location

Your Modem is designed to fit neatly on a desk or shelf, and should be placed near a 220-240V AC power source (such as a wall outlet). The length of your RS-232C cable determines the distance between your modem and the computer, printer or terminal that you wish to interface with.

You should be able to see the LED indicator lights on the front panel clearly and be able to hear the internal speaker when dialling calls.

PC Connection Requirements

The following components are required to connect your Modem to a personal computer:

1. An RS-232C or V.24 serial port in the computer.
2. A cable with a male connector to connect to your Modem; the gender of the connector on the other end depends on your computer requirements. (25 pin female for most PCs). See Appendix C. for cable descriptions.
3. The appropriate software (usually a 'COMMS' package or terminal emulator) to operate the computer-to-modem interface. (eg. Terminal' in MS-Windows)

When connecting your Modem to a computer, printer or terminal not equipped with a DB-25 connector, you will need to obtain an adapter cable. See your computer dealer for the appropriate cable.

Connection Procedure (To a PC or Terminal)

Complete the following steps to connect your Modem to a computer, printer or terminal:

1. Plug the male DB-25 connector on your cable into the connector marked DTE INTERFACE on the back of your Modem (Figure 2.1).
2. Plug the other end of the cable into the V.24 connector on your computer. If you need assistance, consult the manual which came with your PC or contact your computer dealer.

Connection Procedure (to telephone line)

Complete the following steps to connect your Modem to your telephone line:

1. If you have not yet provided British Telecom PLC with the information described under BABT Regulations (refer to chapter 9) please do so at this time.
2. Make sure you have one of the British Telecom line standard jacks (unit 601A).
3. If you are using your modem without a telephone, simply plug the modem cable into the wall jack.
4. If you want to have your telephone connected alongside your modem, connect the telephone handset to the socket on the modem's rear panel.

Connection Procedure (for a telephone)

The modem may share a telephone line with a telephone. This facility is only suitable for simple telephones, and the connection should be made by plugging the connector on the telephone line cord into the socket marked 'PHONE' on the modem's rear panel. Refer to Chapter 9 for points on the use of this facility.

Connection Procedure (to an AC outlet)

Plug the mains plug into a 220 - 240V AC outlet to complete the installation. When power has been connected, you should notice the following :

- a) The MR indicator on the front panel will illuminate.
- b) If your PC is connected and ready to communicate, the TR indicator will also be lit.

LED Indicators

The front panel of your Modem contains nine LED indicators which show your current operating status. From left to right, the indicators are as described in Table 2.2

LEGEND	V.24 SIGNAL	MEANING	FUNCTION
MR	DSR	Modem Ready	ON when modem is READY.
TR	DTR	Terminal Ready	ON when your computer or terminal is sending its DTR signal.
CD	DCD	Carrier Detect	ON when your Modem detects a remote modem's carrier signal. OFF when remote carrier signal is not detected or remote modem hangs up.
SD	TXD	Send Data	Flashes when your computer or terminal sends a command to your Modem, or when your Modem sends data to the remote modem.
RD	RXD	Receive Data	Flashes when your Modem receives data from the remote location or when your Modem sends data or responses to your computer or terminal.
HS		High-Speed	ON for (V.22 bis) operation (or faster) OFF at 300 & 1200 bps operation.
AA		Auto Answer	ON when your Modem receives an incoming call and is set up to automatically answer calls . OFF when set up to ignore calls

(Register
S0 value set to
0).

OH	Off-Hook	ON when your Modem is using the telephone line (off-hook).OFF when your Modem is not using the telephone line (on-hook).
TST	Test	ON when the Modem is in a test mode.

TABLE 2.2 LED INDICATORS

INITIAL SETUP

When first configuring the Modem for use with your own system it is best to put it into a known state by ensuring the Factory profile is loaded. This may be achieved by entering the AT&F command. The most important of the Factory settings that will be loaded are :-

The most important of the Factory settings that will be loaded are:-

FEATURE	SETTING
Terminal type	Asynchronous (&M0).
Terminal speed/data format	Auto detect on entry of AT command.
Command echo	ON (E1).
Flow Control	RTS and CTS (&K3).
CTS signal	Follow RTS (&R0).
DTR signal	Active (&D2). (&D0 on 144 modems)
DSR signal	Always ON (&S0).
DCD signal	Active &C1. (&C0 on 144 modems)
Result codes	Verbose (V1).
Connect codes	Extended (X4).
Dialling method	Tone
Auto-answer	Enabled (S0=2).
Speaker	ON until connect (M1).
Volume	Medium (L2).

Having loaded the Factory settings and put the modem into a known state you may now proceed to change particular settings as required by your application.

GENERAL REQUIREMENTS

Typical settings that may be important for any type of application are:-

- 1) **TERMINAL SPEED / DATA FORMAT.** By default, the modem will automatically work out what speed the PC is using, the word length and the parity, each time it receives an AT command from the terminal. As the Modem features a 'constant speed interface' it does not matter if the PC port speed is different from the line speed. In fact it is generally more efficient to run the port at a higher speed than the intended line speed. This is particularly important if you intend to use MNP or V.42 (with or without data compression). As a guide, the port speed should be at least twice the line speed when using error control. When using data compression, the port speed should be four times the line speed. For instance, when using the modem at V.32bis (14400bps) the port speed should be 57600.

However, if you intend to operate the PC at a speed higher than 19.2kbps, it is important that your COM port hardware is a 'buffered - UART' or. If in doubt, run 'MSD' from the DOS prompt on your PC to verify the COM port characteristics, (any ports identified as '8250' should not be run higher than 19200).

2. **FLOW CONTROL.** Whilst the modem's default is to use

RTS/CTS (hardware) flow control, your particular system or application may require the use of XON/XOFF (software) flow control. This may be selected using the AT&K4 command, or adding &K4 to the modem's initialisation string.

CENTRAL SITE OPERATION

- 1) If your host system echoes user commands or data AT ANY TIME, it is essential that you change the '+++' (escape sequence) by entering ATS2=nn, where nn is an ascii code for a character other than '+'. If you do not, when a user types '+++' your modem will hang!
- 2) To avoid being repeatedly disturbed by incoming calls you should disable the speaker using the ATM0 command.
- 3) As the serial ports on host systems usually echo characters, you should use ATQ1E0 to disable Result codes and prevent character echo. For example this prevents 'RING' messages being echoed by the host, which would in turn prevent the modem from answering an incoming call.
- 4) If host system is activated when the DSR signal is taken high by the modem, then DSR should be set to follow DCD. This is carried out by entering the AT&S2 command.

Telephone Line Interference

The modem is supplied with a standard modular jack lead permanently fitted to the port marked 'LINE' on the rear of the modem. This should be plugged directly into the BT type 600 telephone wall socket. If you are using an associated telephone handset this should now be plugged into the socket marked 'TEL' on the rear of the modem.

If you experience telephone-line trouble after installing the Modem, disconnect the modem from the line and test the line for function (i.e. does it dial/answer ?) and quality (i.e. do you get clear connections ?) using an ordinary telephone handset. The telephone company is not responsible for disturbances caused by non-telephone company equipment (the modem).

Installation of PC card version of modem

Refer to Chapter 9 'Statutory Information' before attempting to install the modem card in your PC

- i) Ensure that your PC is switched off and remove the mains lead from the wall socket.
- ii) The PC Modem must be installed within your personal computer, consult your PC User Manual for details on how to install expansion cards. You must install your modem board in a free ISA (8-bit) expansion slot.
- iii) When installing the modem the configuration switches must be set to ensure that the modem is compatible with your PC. Your computer will probably be equipped with COM1 and COM2 serial ports, in which case the modem will have to be set to either COM3 or COM4 as no two ports are allowed to have the same address. The Interrupt (or IRQ) number also needs to be considered as COM1 and COM3 generally share IRQ4, and for COM2 and COM4, it's IRQ3. If you have a serial mouse on COM1, then the modem should be set to COM4 (factory setting) to avoid using the mouse's interrupt. Where the mouse is on COM2, then the modem should be changed to COM3 (see below for switch settings). Communications software generally uses IRQ4 for COM1 and COM3; and IRQ3 for COM2 and COM4.
- iv) Once installed, the telephone jack lead should be plugged into your telephone wall socket. Additionally you may wish to plug a telephone into the socket (marked TEL) on the rear panel of the modem.

If you are not happy at the prospect of dismantling your computer to install the modem, arrange for your dealer or a qualified engineer, to do it for you.

For example, to use conventional interrupt settings for COM ports, use the following table:-

COM1/INT4	All switches should be OFF, except	3, 5 & 7
COM2/INT3		2, 5 & 8
COM3/INT4		3, 6 & 7
COM4/INT3		2, 6 & 8

FUNCTION	SWITCH				ADDRESS
COM SELECTION	SW5	SW6	SW7	SW8	
COM1 (Set INT4 also)	ON	OFF	ON	OFF	3F8
COM2 (Set INT3 also)	ON	OFF	OFF	ON	2F8
COM3 (normally INT4)	OFF	ON	ON	OFF	3E8
COM4 (normally INT 3)	OFF	ON	OFF	ON	2E8

INTERRUPT SELECTION

INT9 (Special software)	SW1 ON	(SW 2, 3, 4 OFF)
INT3	SW2 ON	(SW 1, 3, 4 OFF)
INT4	SW3 ON	(SW 1, 2, 4 OFF)

INT5 (Special software) SW4 ON (SW 1, 2, 3 OFF)

Installing the PCMCIA modem

On laptop PCs with PCMCIA slots, there are two additional device drivers which must run on the PC. In logical terms, these drivers (known as CARD-SERVICES and SOCKET-SERVICES) provide an interface between the hardware (ie. the slot in the PC) and any comms or fax software running on the PC.

If the Lap-top PC has been prepared 'modem-ready' by the manufacturer, these utilities will already have been installed/loaded and you will be able to insert the modem and use it directly.

If you experience difficulty getting a PCMCIA modem to operate correctly, these drivers and their configuration should be checked.

Both drivers are invariably loaded from the CONFIG.SYS file. To date the modems have been tested with the following types of driver:-

CARDSOFT PHOENIX DATABOOK AMICARDZ IBM

Each lap-top computer manufacturer generally pre-installs one of the above, the only exception being IBM which has developed its own drivers.

Lap-top PCs running Windows-95 are a special case, as the Card and Socket Services are included within Windows-95.

Each requires different lines in the CONFIG.SYS file to load the various parts. The remainder of this chapter shows those which have been found to operate with the modem. In order to check the CONFIG.SYS file, you should type the following at the DOS prompt:-

```
c:> EDIT C:\CONFIG.SYS
```

You will then be able to compare the file with the lines on the following pages, and make changes where necessary.

Usually the drivers have a user interface which can allow the user to ascertain that a modem card is present, details of this interface are mentioned overleaf for each software driver.

All PCMCIA devices interface to the PC via an area of common memory known as the CIS Table. The CIS table holds a series of operating parameters including the card's manufacturer and the type of card (eg modem), model number etc.

The PCMCIA modem identifies itself with 'ROCKWELL' as the manufacturer, the modem type being either RC144DPL or RC288DPL..

CARDSOFT

The following lines are required in the CONFIG.SYS:-

DEVICE=C:\CARDSOFT\SSCIRRUS.EXE This line to SOCKET-SERVICE
will vary depending on the
hardware chips used in the
laptop's slot.

DEVICE=C:\CARDSOFT\CS.EXE This line loads
CARD-SERVICES.

DEVICEHIGH=C:\CARDSOFT\CSALLOC.EXE Loads a 'plug-and-play'
card manager.

DEVICEHIGH=C:\CARDSOFT\CARDID.EXE

CARDSOFT has a WINDOWS control panel which allows the user to
confirm cards inserted, identifying manufacturer and model
number etc. It is invoked by double-clicking on the icon which
depicts red and blue PCMCIA cards.

DATABOOK

The following lines are required in the CONFIG.SYS:-

DEVICEHIGH=C:\CARDTALK\TMB240.SYS/io:240 Loads Socket
services, here
for a DATABOOK
TMB240 adaptor.

DEVICEHIGH=C:\CARDTALK\CTALKCS.EXE Loads Card
Services.

DEVICEHIGH=C:\CARDTALK\CARDTALK.SYS /SERIAL=4 /COM4IRQ=3 /A
/IOW /MEMW /NOSHARE This line loads
the modem
utility, here
with COM 3.

There is no DATABOOK DOS utility to query card status, but
there is a WINDOWS utility, its icon is a stylised letter 'D'

PHOENIX

The following lines are required in the CONFIG.SYS:-

```
DEVICE=C:\PCM3\CNFIGNAM.EXE /DEFAULT
```

```
DEVICE=C:\PCM3\PCMSSDB.EXE           Loads Socket Services,
                                     in this case for
                                     DATABOOK hardware
```

```
DEVICE=C:\PCM3\PCMCS.EXE             Loads Card Services
```

```
DEVICE=C:\PCM3\PCMRMAN.SYS
```

```
DEVICE=C:\PCM3\PCMSCD.EXE
```

With the Phoenix suite loaded, type PCM at the DOS prompt for a utility which reads the CIS and identifies the card type(s) detected in the PC.

PHOENIX also has a WINDOWS utility which allows the user to confirm cards inserted, identifying manufacturer and model number etc. It is invoked by double-clicking on the icon which depicts a PCMCIA card with a large Arrow on its upper surface.

AMICARDZ

The following lines are required in the CONFIG.SYS:-

```
DEVICE=C:\PCMCIA\SSVADEM.SYS         Loads Socket Services,
                                     for VADEM chipset in
                                     this example.
```

```
DEVICE=C:\PCMCIA\AMICS.SYS           Loads Card Services
```

```
DEVICE=C:\PCMCIA\PCBE.SYS
```

```
DEVICE=C:\PCMCIA\PCMODEM.SYS
```

```
DEVICE=C:\AICARD29.EXE
```

There is no AMICARDZ DOS utility to query card status, but there is a WINDOWS utility.

IBM

As the IBM software is only designed for IBM machines, there are fewer options.

There is a DOS utility which queries and displays card status.

On later IBM ThinkPads with the 'plug-and-play' facility, there is no configuration required.

WINDOWS-95

Windows-95 installations are different from the above as Microsoft include Card and Socket Services within Windows-95.

The following method is required to inform the PC that an M5134-LT modem is installed:-

From the Control Panel, select 'Add New Hardware', then Modem. Now ensure the modem is plugged into (either) PCMCIA slot.

Insert the manual/driver disc and choose the modem type as an Enhanced Modem (PCMCIA type).

The PC will now test the modem and identify it as being present.

CHAPTER 3

OPERATION

This chapter describes the functions which are supported on the Modem. These functions allow you to set your Modem to dial automatically and also automatically to answer an incoming call. The Command and Data operational modes are also discussed in this chapter, together with control characters, reset procedures and baud rate options.

Auto-Dialling

The Modem automatically dials both voice and data calls. When a compatible modem answers your data call, the Modem automatically makes the data connection. If your software is able to operate with AT-commands (i.e. it expects a 'Hayes-compatible' modem) you can use such commands to dial calls automatically.

Auto-Answering

Although the Modem is preset to answer calls automatically, you can disable this by entering the ATSO=0 command (see chapter 7).

Operating Modes

Two basic operating modes, Command Mode and Data Mode are supported on the Modem. In Command Mode you can send keyboard instructions to the Modem to respond to a variety of dialling and answering functions. In Data Mode you can exchange data across the telephone line with a modem at a remote location. Do not send commands when in Data Mode, as the modem assumes everything it receives from the computer or terminal is data and will send it across the telephone line.

Command Mode

The Modem automatically enters Command Mode when:

1. You turn on the modem.
2. You touch any key on the keyboard while the modem is dialling, answering or training, causing it to hang up.
3. Either modem fails to detect the other's carrier signal, due to a hang up or telephone line noise, and breaks the data connection.

Command Sets

The Modem supports a command set or 'language' for control of its operation:- AT commands provide the modem with 'Hayes-compatibility'. In this command set, all commands are entered in asynchronous mode and each command begin with the letters AT or at.

Data Mode + + + Characters

The Modem lets you switch from Data Mode to Command Mode without losing the data connection to a remote modem (by use of the +++ characters). This could be convenient when you want to check or change a setting and then return to sending data.

The following procedure shows how to return to Command Mode without losing a data connection which was already established.

1. Make the data connection with your Modem - either by dialling out or answering an incoming call.
2. Wait at least one second without typing anything. (This wait time is determined by Register S12).
3. Type three plus characters + + +. (If you desire, you can use characters other than + + +. See the description of Register S2).
4. Wait at least one second (again set by Register S12).

The Modem will respond with an OK and enters Command Mode while maintaining the data connection (unless the remote modem disconnects or drops the telephone connection). You can then use commands to check a setting, change a register value, or have time to consult a manual. To leave Command Mode and resume sending data, type ATO (AT command) and press the RETURN key.

Alternatively you can terminate the call by typing ATH and pressing RETURN. The modem then stays in command mode.

Resetting your Modem.

1. Turn your Modem off then on.
2. Type ATZ and press RETURN key.

Either step resets your Modem, causing the following to occur:

1. The commands assigned specific parameters will return to default values.
2. Registers S0 through S19 return to default values.
3. Your modem goes on-hook if it was off-hook.
4. The last-executed command is deleted from memory.
5. Your Modem remains in Command Mode.
6. Your Modem sends you the OK response.

Speed Requirements (Baud Rate)

When sending commands to your Modem from your PC or terminal, be sure that the speed of the connection is 300, 600, 1200, 2400, 4800, 9600 or 19200 bps; 38400, 57600 bps or 115.2Kbps. Use the appropriate software command to set the transmission speed of your computer or terminal to match or exceed that of the remote system. Consult your manual to see how to set the speed, it can be set to any combination of the following software:-

Data:	7 or 8 databits per character
Stop Bits:	1 or 2
Parity:	Odd, Even or None (Also Mark or Space, but see note below)

The use of Mark or Space parity will be accepted and transmitted by the modem as follows:-

Terminal/Computer	Modem
7-bit + Mark	7-bit None
7-bit + Space	8-bit None
8-bit + Mark	8-bit None
8-bit + Space	8-bit Even

When in 'Direct' or unbuffered mode (AT\N1) and your Modem connects to another modem, it determines the transmission speed of the remote system from the carrier signal of the modem originating the call (this speed could be different from that currently in use between your terminal and the modem). The Modem will then select an interface speed to match that of the line (remote modem). A connect message showing the new speed is firstly issued at the previous interface speed, then the interface speed changes to the new rate.

CHAPTER 4

COMMANDS AND RESPONSES

This chapter offers guide-lines to follow when sending commands to your Modem and describes the responses sent by your Modem in reply to your commands.

Executing Commands

When your Modem is in Command Mode (explained in Chapter 3), you can use your keyboard to send your modem a command. Commands are sent in the form of mnemonics to specify the requested operation; the Modem will then respond with an appropriate response. The remainder of this chapter describes how to use each of the command sets to control the modem.

Using AT commands

Use the following guide-lines when typing AT commands:

1. With your Modem in Command Mode, the letters AT (in upper or lower case) must appear at the start of every command line.
2. Type the command mnemonics in upper-case or lower-case letters (note that many mnemonics are prefixed by symbols (e.g.. &,\ etc)). Include any parameters required by the command. The command line must contain no more than 127 characters.
3. After typing the command(s), press the RETURN key to execute the command line. The modem sends a response (often OK) when it executes the command line.
4. Always wait for the OK response before typing the AT prefix of the next command line.
5. If you type a character by mistake you can erase it by typing a backspace.
6. You can abort a command line at any point by typing CTRL X
7. You can place multiple commands on a single line by omitting AT from all except the first command. Spaces may be used between commands to improve readability.

Your Modem saves the last executed command line in memory; you can then use the A/ or a/ to re-execute that command line (see Chapters 6 and 7). This is the only command not precede with an AT.

If your command line was not executed, or if you did not receive any response, refer to the section on 'Troubleshooting' in this chapter.

Troubleshooting AT Commands

If your Modem did not execute the command line when you pressed RETURN, check the following items:

1. Was your modem in Command Mode (see Chapter 3)?
2. Did AT appear at the beginning of the command line ?
3. Check that the TR LED is ON. This will indicate that your terminal is active and that the Modem is waiting for commands. If the TR LED is OFF then the modem is not expecting to receive commands or the terminal is not active.

If you received an ERROR response after pressing the RETURN key, check the following items:

1. That your equipment is sending commands at 300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600 (or 115200 for the 288/336 modem) That your
- command line contains no more than
2. That your command line contains no more than 127 characters including AT and any spaces.
3. That the command syntax was correct: i.e. the correct symbols e.g. \, &, % etc were used, and that numeric and alpha characters were used where required.

Deleting AT Commands

Use the BACKSPACE key if you make a mistake while typing a command line. Pressing BACKSPACE deletes the last character you entered. Note that BACKSPACE will not delete the AT prefix.

If necessary, the backspace character may be changed to another ASCII character by assigning a new value in the S5 register (see Chapter 7).

To delete the entire command line, press CTRL X which will cause the command line to be aborted.

AT Commands:- Responses

Your Modem sends responses in reply to commands from your keyboard. Responses can appear as words or digits (default is words). You will most likely want to receive word responses to monitor modem operation. Certain software packages may require numeric responses, use the ATV0 command to receive such digit (numeric) responses. Word responses are preceded and followed by a carriage return and line feed. Digit responses are followed by a carriage return.

Responses can come from a basic response set or an extended response set (default). The basic responses do not indicate the speed of connection. If you need to know the speed of a data connection, use the X4 command to select the extended response set. Table 4.1 on the following page lists all possible word and digit responses.

WORD RESPONSE	DIGIT RESPONSE	MEANING
OK	0	Command line executed successfully.
CONNECT	1	Remote carrier detected.
RING	2	Incoming ring detected.
NO CARRIER	3	Remote carrier lost or not detected.
ERROR	4	Command line contains error. The modem cannot recognise the command.
CONNECT 1200	5	Remote carrier detected
NO DIALTONE	6	A dialtone was expected but not found.
BUSY	7	Remote line is busy.
NO ANSWER	8	The remote modem did not answer the call, or answered incorrectly.
CONNECT 600	9	Connection established at 600bps
CONNECT 2400	10	Connection established at 2400bps
CONNECT 4800	11	Connection established at 4800bps
CONNECT 9600	12	Connection established at 9600bps
CONNECT 7200	13	Connection established at 7200bps
CONNECT 12000	14	Connection established at 12000bps
CONNECT 14400	15	Connection established at 14400bps
CONNECT 19200	16	Connection established at 19200bps
CONNECT 38400	17	Connection established at 38400bps
CONNECT 57600	18	Connection established at 57600bps
CONNECT 75TX/1200RX	22	V.23 connection established
CONNECT 1200TX/75RX	23	V.23 connection established
CARRIER 300	40	Remote carrier detected at V.21
CARRIER 75/1200	42	Remote carrier detected at V.23
CARRIER 1200/75	43	Remote carrier detected at V.23
CARRIER 1200	46	Remote carrier detected at V.22
CARRIER 2400	47	Remote carrier detected at V.22bis
CARRIER 4800	48	Remote carrier detected at V.32
CARRIER 7200	49	Remote carrier detected at V.32
CARRIER 9600	50	Remote carrier detected at V.32
CARRIER 12000	51	Remote carrier detected at V.32bis
CARRIER 14400	52	Remote carrier detected at V.32bis
CARRIER 16800	53	Remote carrier detected at V.34
CARRIER 19200	54	Remote carrier detected at V.34
CARRIER 21600	55	Remote carrier detected at V.34
CARRIER 24000	56	Remote carrier detected at V.34
CARRIER 26400	57	Remote carrier detected at V.34
CARRIER 28800	58	Remote carrier detected at V.34
CARRIER 31200		Remote carrier detected at V.34
CARRIER 33600		Remote carrier detected at V.34
COMPRESSION: CLASS 5	66	MNP-5 Data Compression in operation
COMPRESSION: V.42BIS	67	V.42bis Data Compression in operation
COMPRESSION: NONE	69	No Data Compression
PROTOCOL: NONE	70	No Error Correction Protocol
PROTOCOL: LAPM	77	LAPM (V.42) Error Correction Protocol
PROTOCOL: MNP	80	MNP-4 Error Correction Protocol

TABLE 4.1 AT COMMAND RESPONSES

Modem Control Strings

Communications and Fax software packages generally have 'strings' which are used at different times to control the modem operation.

Each string is made up of selected 'AT' commands, each of which is described in detail in Chapter 6.

RESET

This is likely to be issued when the software tries to recover from an unknown state. Usually simply an ATZ command.

INITIALISATION

Its job is to change the modem from whatever state it has been left in, to a known state that is compatible with your fax or comms software. The modem is very straightforward without any unusual features which your software would have to take account of, so the most simple of Initialisation strings will be sufficient, eg AT&F which will select the modem's factory defaults.

DIAL

Simply ATD for the modem range.

HANGUP

Use ATH to hangup

CHAPTER 5

DIALLING

The dialling commands available on your Modem are detailed in this chapter.

The Modem is designed to dial automatically (originate) telephone calls without requiring additional or auxiliary equipment (such as a telephone).

Dial Commands

Table 5.1 is a complete summary of available DIAL commands and their functions which are supported on your Modem when you are originating a call.

Internal Speaker Control

You can use your Modem's internal speaker to listen for a dial tone, busy signal, ringing and carrier.

Dialling Procedure and D Commands

The D command instructs your Modem to dial a telephone number. An example of a typical Dial Command might be:

AT D 5551212

This command line instructs your Modem to:

1. Wait the number of seconds specified in register S6 for a dial tone (S6 default is 5 seconds).
2. Dial the telephone number 5551212.
3. Wait the number of seconds specified in register S7 for the remote modem carrier tone (S7 default is 40 seconds).

If the Modem detects the carrier tone within the allowable time, it makes the data connection and sends a CONNECT response and enters data mode. If the modem detects the busy signal and X3 or X4 response set is selected, it goes back on-hook and sends a BUSY response. If the modem does not detect carrier tone, it hangs up, sends a NO CARRIER response, and returns to Command Mode.

COMMAND SYNTAX

AT	FUNCTION
D	<p>Your Modem dials a number in the originate mode.</p> <p>Digits supported are:</p> <p>0 - 9</p> <p>Symbols # and * (Touch-Tone only)</p>
T	Use the Touch-Tone dialling method.
;(semi-colon)	Return to Command Mode after dialling.
!	<p>Causes the modem to perform a timed-break recall (Hook Flash) at this point in the dialling operation.</p> <p>Some PABX systems allow the caller to break off from a call and obtain dial tone once more (Recall), this is normally used to facilitate such operations as transferring a call or accessing special functions etc. One method of achieving 'Recall' is to break the connection to line for a specified amount of time hence 'Timed-Break Recall'. The break time can be set using S29. Check if the PABX supports this method of recall before attempting to utilise the ! command.</p>
W	<p>Causes your Modem to wait for dial tone (for the period specified by register S6).</p> <p>If a busy tone is detected, your Modem will go on-hook and display a BUSY signal. A keyboard input will subsequently be accepted and an on-hook will occur with an OK response. An ERROR response will occur if the W command is not in the dial string.</p> <p>NOTE: Only one consecutive W command may be inserted into a dial string at any one time.</p>
, (comma)	Causes a short pause for 3 seconds (Contents of S register 8).
S=n	Dial stored number n, where n is 0 to 1.

TABLE 5.1 DIAL COMMANDS

The Pause Command

When you wish to dial a call through a Private Branch Exchange (PABX) you must first dial an access code (usually the digit 9) to reach an outside line. The , (comma) command instructs your Modem to pause for up to 11 seconds.

The use of the , (comma) and the W commands should be restricted to single insertions within a dial string. Longer delays can be created by increasing the value of registers S6 and S8. The maximum pause permitted is 11 seconds. A typical Dial command line containing the , (comma) command might be:-

ATD9,5551212

which instructs your Modem to dial 9, pause, then dial the remaining digits.

Return to Command Mode after Dialling

The ; (semi-colon) command at the end of a command line, instructs your Modem to return to Command mode after dialling (without hanging up). This feature lets you call locations such as telephone-order services or banks which recognised Touch-Tone as data.

The ; command also lets you perform voice calls using your Modem.

Note: Pressing the RETURN key after typing a command line instructs your Modem to wait for a carrier signal from the remote modem. The modem returns to Command Mode and hangs up if no carrier is detected within the specified time (normally 40 seconds).

Sending Touch-Tones as Data

When calling a service which interprets Touch-Tone as data, use the command sequence in Table 5.2 below as an example guide: (The use of * and # codes will be defined by the service being used).

COMMAND TO BE ENTERED	MEANING	MODEM RESPONSE
ATD5551212;	Dial telephone number 555-1212 then return for command	OK
ATD123435#;	Send I.D. number 123435 then return for command	OK
ATD1232#;	Send password 1232 then return for command	OK
.ATD218*100#;	Send transaction number 218*10# then return for command.	OK
ATH;	Hang up (terminate) call.	OK

TABLE 5.2 TOUCH-TONE COMMANDS

Auto Dialling Voice Calls

Plug a simple telephone handset into the socket on the rear of the modem. You can then type the ; command at the end of a Dial command line when using your Modem as an auto dialler. For example, typing:

```
ATDT9, 5551212;
```

and pressing RETURN instructs your Modem to Touch-Tone (T) dial and digit 9, pause (,), dial 5551212 and return to Command Mode. When you hear the ringing of the remote telephone through your Modem's internal speaker, pick up your telephone handset and send the Hang Up command (type ATH and press RETURN). Then talk to the person at the other end of the line.

You could also send a Dial command line by omitting the semi-colon, waiting for the remote telephone to ring then lifting the receiver and pressing any key.

Cancelling a Call

To cancel a call after pressing the RETURN key, press any key on your keyboard; your Modem then hangs up, sends on OK response while dialling, or NO CARRIER response when waiting for carrier, then returns to Command Mode.

Hanging Up

At the end of a call, put your Modem in Command Mode (using the escape characters if necessary), type ATH and press the RETURN key. The modem then hangs up the call, sends an OK response and returns to Command Mode.

Your Modem may also disconnect a call when the RS232C signal DTR (pin 20) changes. See the AT&D command which controls the use of this feature.

Stored Numbers

Your Modem has the capability of saving 4 telephone numbers in its internal memory. These numbers are protected from reset or power failure so will be available for use even after your Modem has been switched off. In order to save a stored number use a command such as:

```
AT&Z3 = 5551212
```

This command saves the telephone number 5551212 in the third memory location. The stored number can be recalled during a dial command with the S command followed by the memory location, e.g. ATDS=3

Manual dialling

Plug a telephone handset into the socket on the rear of the modem. You can then dial numbers with the telephone. When you hear the answertone from the remote modem, type ATD <RETURN> . Replace the receiver immediately afterwards and the Modem will 'take-over' the dialled call.

Object: Typed in upper or lower-case letters at the beginning of a command line to inform your Modem of the transmission speed, character format, and the parity your equipment is set for. Executing a command line without AT at the start, results in no response at all.

\A Maximum MNP Block Size

Parameters: \A0: Sets the maximum block size to 64 characters.
 \A1: Sets the maximum block size to 128 characters.
 \A2: Sets the maximum block size to 192 characters.
 \A3: Sets the maximum block size to 256 characters.

Default: \A3

Purpose: To set the maximum MNP block size Class 4 and Class 5 operation. This command has no effect on Class 3 and lower operations, which limit the maximum block size to 64 characters.

Object: This command should be used to transmit smaller blocks of data when communicating over poor quality telephone lines to avoid retransmission of data and improve throughput.

\Bn Send Break Signal

Parameters: 1-9 (Non-error corrected links only)

Default: 3

Purpose: Send break to remote system.

Object: The \B command is equivalent to pressing the break key on a terminal keyboard. For standard (non-error corrected) connections, type a number from 1 to 9 after this command to indicate how long the modem is to provide the break signal. The number will be multiplied by 100 ms and the break signal provided for that duration. For error-corrected operation the break is always 300 milliseconds.

%C Data Compression

Parameters: %C0: Disable data compression
 %C1: Enable MNP-5 data compression negotiation

Default: %C1

Object: Enable or disable data compression. If disabled the modem will operate with error correction only.

&C DCD Option

Parameters: &C0: DCD always on
 &C1: DCD on if valid carrier

Default: &C1 (&C0 in 144 models)

Purpose: Control use of DCD (pin 8) on the V.24/RS232C interface.

Object: Certain software applications wish to know when a carrier is present, i.e. modem is connected to a remote modem. The DCD pin on the RS232C interface is used for this.

D Dial

Object: The D command is used in conjunction with the digits 0 to 9, the * and # symbols, and the Dial commands (such as T and , see Chapter 5) to dial a call.

&D DTR Options

Parameters:

- &D0 Ignore DTR.
- &D1 Go to Command State when DTR ON-OFF.
- &D2 DTR drop causes modem to hang-up, auto-answer inhibited.
- &D3 Soft Reset when DTR ON-OFF.(=ATZ command action).

Default: &D2 (&D0 in 144 models)

Purpose: Allows control of response to DTR transitions.

Object: The DTR signal of the V.24 RS232C Interface (Pin 20 or line control register for integral modem) is normally ON when a terminal or PC is connected to your Modem and when communication software is running.

This command allows special actions to be taken when the DTR signal goes from ON to OFF.

E Echo Commands

Parameters:

- E0: Does not echo commands.
- E1: Echoes commands.

Default: E1.

Purpose: During operation, command characters are echoed to your screen as they are sent to your Modem. This permits you to view the correct, error-free command line which is being sent.

Object: Use the E0 command when your Modem is connected to echople equipment or host computer ports.

%E Auto-retrain

Parameters:

- %E0: Disable auto-retrain
- %E1: Enable auto-retrain

Default: %E1

Purpose: To allow better adaption to a poor quality line.

Object: The %E1 setting causes the modem to try several retrain attempts, if unsuccessful, the call will be dropped.

&G Select Guard Tone

Parameters: &G0: disable guard tone
 &G1: As &G0
 &G2: Select 1800Hz guard tone

Default: &G2

Purpose: The modem will use the guard tone selected by the parameter supplied. Always use &G2 for operation in the UK.

\G Modem to Modem Flow Control

Parameters: \G0: Disable modem-to-modem flow control.
 \G1: Enable modem-to-modem flow control.

Default: \G0

Purpose: Set modem-modem flow control (during non error-corrected calls connection only.)

Object: The \G1 command allows the modem to generate and recognise XON/XOFF characters for flow control. On an error-corrected link, the \G setting is ignored.

H On Hook or Off Hook

Parameters: H0: Goes on-hook.
 H1: Goes off-hook.

Default: H0

Purpose: On-Hook: This is equivalent to your telephone handset resting on its hook, i.e. the modem is "hung up".
 Off-Hook: This is equivalent to your telephone handset off its hook, i.e. the modem is online using the telephone line. The OH indicator goes ON on the front panel when the modem is off-hook.

Object: Usually the default (H0) is used. This allows the Modem to go back 'on-hook' when the modem terminates a call.

I Identification

Parameters: I0: (Send product code).
 I1: (Send checksum (testing only)).
 I2: (verify PROM checksum - OK response).
 I3: PROM Device.
 I4: Modem Capabilities.

Purpose: To provide information on the modem's identity.

Object: This command allows you to interrogate the
 modem to check its firmware and
 configuration codes.

&K Flow Control

Parameters: &K0: Disable DTE flow control.
 &K3: Enable Bi-directional RTS/CTS
 interface signals. Modem uses CTS
 line to control data from DTE. DTE
 uses RTS line to control data from
 modem.
 &K4: XON/XOFF. Modem uses XOFF character
 to stop data from DTE and XON
 character to resume transmission.
 DTE also uses XOFF to stop modem from
 sending data and XON to resume
 transmission.

Default: &K3

Purpose: Set DTE port flow control.

Object: Ensures that the same method of flow
 control is set on the modem and DTE
 (terminal device or PC).

\K Break Control

Parameters: 0 - 5

Default: \K5

Purpose: The \K command determines the action
 performed by the modem when it receives a
 break from the DTE port, the modem port,
 or from a \B command.

Object: The way in which the modem reacts to these
 options is summarised in the following
 table.

L Loudspeaker Volume

Parameters: L1: Low volume.
 L2: Medium volume.
 L3: High volume.

Default: L2

Purpose: To set the volume level on the integral
 loudspeaker.

M Loudspeaker Control

Parameters: M0: Speaker OFF.
 M1: Speaker ON until carrier detected.
 M2: Speaker ON continuously.
 M3: Speaker ON only during answering
 phase.

Default: M1

Purpose: To allow manual control of your Modem's
 internal speaker.

Object: If you do not want to use the speaker to monitor calls, send the M0 command.

&M Async/Sync Mode

Parameters: &M0: Direct Asynchronous operation.
&M1
&M3: Reserved.

Default: &M0

Purpose: To allow selection of sync/async modes and support automatic dialling in sync mode.
Note that Synchronous modes are supported on desktop modems only.

+MS Select Modulation

This extended-format command is available only on the 288/336(V.34) modem. It selects the modulation (modem-modem speed) to be used for future connections. In addition the +MS command can enable or disable automode, and optionally specifies the lowest and highest speeds using extra parameters. The command format is:

+MS=<mod>,<automode>,<min_rate>,<max_rate><CR>

Not all subparameters have to be entered, (enter a comma only or <CR> to skip the last parameter). This action will leave unspecified parameters at their current values.

Subparameter Definitions

1. <mod> = A decimal number which specifies the preferred modulation (automode enabled) or the only modulation (automode disabled) to use in originating (dialling) or answering a call. The options are listed in the following table.

<mod>	Modulation	Possible rates (bps) (see note 1.)
0	V.21	300
1	V22	1200
2	V22bis	2400 or 1200
3	V23	1200 (see note 2.)
9	V32	9600 or 4800
10	V32bis	14400, 12000, 9600, 7200, 4800
11	V34	33600, 31200, 28800, 26400, 24000, 21600, 19200, 16800, 14400, 12000, 9600, 7200, 4800, or 2400 see note 3
64	Bell 103	300 (not UK)
69	Bell 212	1200 (not UK)
74	V.Fast	28800, 26400, 24000, 21600 19200, 16800, or 14400

Notes:

1. See optional <automode>, <min_rate> and <max_rate> parameters.
2. For V.23, originate is 75Tx, 1200Rx answer is 75Rx,

1200Tx.

3. <mod> 11 is the default.

Notes: If you are using software which uses the N and S37=x commands, then support is provided at 14400 bps and lower speeds, in which case the reported +MS subparameters will be modified to reflect the N and S37=x settings. However this method is not generally recommended because of the speed limitation and because S37 is not updated by the +MS command.

Examples:-

AT+MS=2 Instructs the modem to assume V.22bis mode for future connections.

at+ms=74 Sets the modem up as a V.Fast modem

2. <automode> is an optional numeric value which enables or disables automatic modulation negotiation. The options are:

- 0 Automode disabled
- 1 Automode enabled using V.8 or V.32 Annex A

The default value is 1, which enables automode. Note however, there are modulations for which there is no automatic negotiation, e.g. Bell 212 (<mod>=69)

For <automode> = 0 (automode disabled i.e. fixed modulation):

- a. If <max_rate> is within the rates supported by the selected modulation, the selected rate is that specified by <max_rate>.
For example: +MS=9,0,1200,4800 selects V.32 4800 bps fixed rate.
- b. If <max_rate> is greater than the highest speed supported by the modulation specified by <mod>, the starting rate is the highest rate supported by the selected modulation.
For example: +MS=9,0,2400,14400 selects V.32 9600 or 4800 bps.
- c. To force a specific modem-to-modem speed ie. select fixed mode operation, specify the <max_rate> and <min_rate> both to be the same speed, and <mod> to be the modulation for that speed. For example:

+MS=11,0,16800,16800 selects V.34 16800 bps fixed mode (no comparable S37 command)

+MS=9,0,12000,12000 selects V.32bis 12000 bps fixed mode (same as N0S37=10)

For <automode> = 1 (automode enabled i.e. automatically selected speed and modulation):

When a call is made, the modems negotiate and connect at the highest possible rate supported by both modems. The scheme for this negotiation is either V.8, or V.32bis Annex A.

- a. If <max_rate> is greater than the highest rate supported by the modulation specified by <mod>, the modem automodes

down from the highest rate of the selected modulation.
For example:

+MS=10,1,1200,24000 selects automoding down, starting at
V.32bis 14400 bps.

- b. To set the modem for a wide range of negotiation (automode), specify the initial modulation and rate using <mod> and <max_rate> respectively. Set <min_rate> to 300bps.
For example:
- +MS=11,1,300,16800 selects automode starting at V.34 16800 bps.
- +MS=9,1,300,12000 selects automode starting at V.32bis 12000 bps.
3. <min_rate> is an optional number which specifies the lowest rate at which the modem may establish a connection. The value is decimal coded, in units of bps, e.g. 2400 specifies the lowest rate to be 2400 bps. The default is 300 (for 300 bps).
4. <max_rate> is an optional number which specifies the highest rate at which the modem may establish a connection. The value is decimal coded, in units of bps, e.g. 14400 specifies the highest rate to be 14400 bps. The default is 33600bps. Note that the modem will assume that the <max_rate> will not be greater than the current DTE (terminal) speed.

Reporting Selected Options

The user is able to view the selected +MS options by issuing the following command:

```
AT+MS?           The response is:
+MS:<mod>,<automode>,<min_rate>,<max_rate>
```

For example, +MS: 11,1,300,33600 shows default values.

Reporting Supported Options

This command allows the user to query which possible modes are supported on the modem, the command is:-

```
AT+MS=?          The response is:
+MS: (list of supported <mod> values), (list of supported
      <automode> values) (list of supported <min_rate>
      values), (list of supported <max_rate> values)
```

For example, +MS: (0, 1, 2, 3, 8, 9, 10, 13, 64, 69, 74),
(0,1) (300-33600),(300-33600)

N Automode Enable

This command enables or disables automode detection. The parameter value, if valid, is written to Register S31 bit 1. Default is N1. See also +MS for the 288/336 modem.

```
N0 Automode detection is disabled. A subsequent
    handshake will be conducted according to the
    contents of Register S37.
```

N1 Automode detection is enabled. A subsequent handshake will be started according to the contents of Register S37 or, if S37 is zero, starting the highest speed supported on the modem.

Error Correction Operating Mode

Parameter:

- \N0: Standard operation (non error-corrected, buffered data).
- \N1: Direct operation (non error-corrected, data not buffered).
- \N2: Reliable operation (MNP). If the modem fails to negotiate a reliable connection it will drop the call.
- \N3: Auto-Reliable operation (V.42 or MNP). If the modem fails to negotiate a reliable connection it will adopt a standard connection as fallback.
- \N4: Enable V42 error correction only.
- \N5: Enable MNP error correction only.

Default: \N3

Purpose: To specify which error correction negotiation will occur after carrier is established.

0 On Line

Parameters: None.

Object: To return your Modem to Data Mode after the +++ characters switched it to Command Mode.

Q Suppress Modem Responses

Parameters: Q0: Sends responses.
 Q1: Does not send responses.

Default: Q0

Purpose: To enable or disable the result codes from the modem.

Object: The Modem sends responses when executing commands and at other times during its operation.

If you do not want to receive modem responses, send the Q1 command. One such situation is when a printer is connected to your Modem and you do not want the modem responses printed.

&Q Async Operating Mode

Purpose: Identical to the &M command to control the connection modes allowed.

Object: See &M

&R RTS Operation

Parameters: &R0: CTS follows RTS after delay specified by S26
 &R1: RTS transitions are ignored, CTS always ON.

Default: &R0

Purpose: This controls how the modem will operate in synchronous mode.

Sr? Read Register r

Parameters: r = 0-95

Purpose: To read the value of the modem's register. The entire procedure is described in Chapter 7.

Sr=n Set Register r to Value n

Parameters: r : 0-95
n : 0-255, varies with register

Purpose: To change the value of an Modem register. The entire procedure is described in Chapter 7.

; (Semicolon) Return to Command Mode after Dialling

Parameters: None

Object: Typed at the end of a Dial command line to instruct your Modem to return to Command Mode after dialling, without going on-hook. Allows data to be sent as Touch-Tones to services such as the telephone order service of banks, which recognise Touch-Tones as data.

&S DSR Options

Parameters: &S0 DSR always on.
&S1 DSR follows V.24 RS232C Specification.

Default: &S0

Purpose: Allow control of DSR.

Object: &S0 may be used for terminals and PCs that require DSR to be ON permanently.

T Touch-Tone Dialling

Parameters: None

Purpose: To 'tone' dial the digits which follow T in a Dial Command Line.

Object: Type the T command anywhere, even between digits in a dial command line, to cause the modem to tone dial.

&T (Test) Test Mode Enable/Disable

Parameters: &T0: End Self-test mode.
&T1: Local Analog loopback.
&T3: Local digital loopback.
&T4: Grant RDL request.
&T5: Deny RDL request.
&T6: Remote digital loopback.
&T7: Remote digital with self test.
&T8: Local Analog loopback with self test.

Default: &T0 &T4

Purpose: To enable/disable the self-test mode. Full details of the Self-test and diagnostic functions are discussed in Chapter 8, "Diagnostics and Testing".

V Word or Digit Responses

Parameters: V0: Digit responses.
V1: Word responses.

Default: V1

Purpose: To define whether the modem responds with words (e.g NO CARRIER) or numeric codes.

Object: V1 is preferred so you can recognise problems and remain updated with the modem's current operating status.If your software package does not handle character strings efficiently, either end the V0 command or Q1 command.

&V Show Profile

Parameter: &V - Displays active profile stored profile 0
&V1 - Displays active profile stored profile 1

Purpose: Display settings of all parameters.

Object: Use this command to display the current settings of your Modem. The active profile, two stored profiles and stored telephone numbers are displayed.

&W Store Modem Profile

Parameters: &W0: Store Profile 0
 &W1: Store Profile 1

Purpose: Store active settings in non-volatile memory.

Object: The Modem allows storage of the active settings (a profile) of important parameters into two stored profiles - 0 and 1. These profiles are stored in non-volatile memory so survive power off.

X Select Result Code Set

Parameters: X0: Basic result code set (code 0-4).
 X1: Extended result code test, displays:
 CONNECT
 CONNECT 1200
 CONNECT 2400
 CONNECT 1275
 CONNECT 7512.

 X2: Extended result code with Dialtone detect.

 X3: Extended result code with BUSY signal
 detection.

 X4: Extended response set with BUSY signal and
 Dialtone detection.

Default: X4

Object: Use basic responses X0 when the CONNECT response is suitable for data connection at all speeds. Send the X1 command when you require the CONNECT response to include the connection speed. If busy and/or dialtone detection is required use X2, X3 or X4. See also S register 95 for message enhancements.

&Y Select Profile

Parameters: &Y0: Select Profile 0
 &Y1: Select Profile 1

Default: &Y0

Purpose: Select Profile for power up reset.

Object: By default stored Profile 0 is used after a reset for the active profile settings. Use this command to cause Profile 1 to be used.

Z Fetch Profile

Parameters: Z0: Fetch Profile 0
Z1: Fetch Profile 1

Default: Z0

Purpose: Reset your Modem to one of two stored profiles.

Object: Sending the Z command to reset your Modem causes the modem to:

Hang up (if off-hook).
Registers are fetched from the selected stored profile.
Delete the last-executed command from memory.

The user should wait at least one-half second after receiving OK before sending another command.

&Zm Store Telephone Number

Parameters: &Zm = 123456.

Purpose: To store a telephone number in non volatile memory.

Object: A stored phone number may be conveniently used in dialling, e.g. ATDS=2, dial stored number 2.

Four numbers may be stored i.e. m = 0 to 3 e.g. AT&Z2 = 5551212 stores number 5551212 in location 2.

See AT&V to view stored numbers.

CHAPTER 7

REGISTERS

The Modem has Special Registers which control many operating parameters. These are known as S-registers. The remainder of this chapter lists the registers which are available for user access. Many other registers are used by the modem for its operating parameters, and writing values directly to any registers (other than those which follow) could result in unpredictable behaviour by the modem.

Reading a Value

To read the current value of a register, use the Sr? command, with r indicating the register number required. The Modem then sends you the decimal value of the register.

For example, to read the current value in Register S0 type:

AT S0?

and press the RETURN key.

003 This value indicates that Modem automatically answers calls after three rings.

OK The Modem completed the command and waits for your next command.

Changing a Value

To change a register value, use the Sr=n command, with:

r: indicating the register number (0 - 95), and

n: indicating the new (decimal) value.

In the previous example, the S0 register value was 1 for the Modem to answer an incoming call after the first ring.

To cause your Modem to answer the call automatically after five rings, type:

AT S0=5

and press RETURN. When your Modem executes the command, it sends the OK response.

Setting Pointer

The Modem places a pointer at the last register whose value was read or changed. The pointer is a shortened access technique to a chosen register chosen. You can also use the S command and omit the ? and = to set the pointer without reading or changing value for example by typing:

AT S0

and pressing RETURN sets a pointer to the S0 register immediately. You can then read S0 value by typing:

AT?

and pressing RETURN; the S command is unnecessary and is the register number. Similarly, typing:

AT=8

Changes the value of the S0 register to 8.

Note: The pointer remains set at the last register you accessed (Register S0 in the above examples) until you use the S command to access (and move the pointer to) a different register.

Register S0 Auto Answer Ring Number

Range = 0 - 255 (rings)

Default = 2 rings

Assigning a value from 1 to 255 in Register S0 automatically instructs your Modem to answer incoming calls. A value of 0 disables auto answer.

Register S1 Count Incoming Rings

The S1 register works only when the S0 value is greater than 0. The value in register S1 adds up with each incoming ring received by your Modem. It clears if no rings occur within approximately eight seconds after the last ring. You will rarely use the S1 register, but you can read or set it. If the telephone does not ring, this value clears to zero after eight seconds.

Register S2 Escape Character

Range = 0 - 255 (ASCII)

Default = 43 (ASCII +)

Register S2 identifies the decimal value of the ASCII characters used to perform the escape feature (described in Chapter 3).

The default value (decimal 43) is the ASCII character +, although you can change this register to most values from 0 to 127. Values greater than 127 disable the escape feature, preventing you from sending a HANG UP command since you cannot return from Data Mode to Command Mode while keeping the data connection. To disconnect in this instance, either the remote modem must hang up, or you must de-assert Data Terminal Ready (DTR) on (pin 20) the Modem's DTE interface (see AT&D command).

Register S3 Carriage Return Characters.

Range = 0 - 127 (ASCII)

Default = 13 (CTRL M)

Register S3 identifies the character used to end (and execute) a command line, and the character you receive following a modem response.

Normally, you will want to use the default value of 13. However, you may want to change this value if using

non-standard equipment.

Register S4 Line Feed Characters

Range = 0 - 127 (ASCII)

Default = 10 (CTRL J)

Register S4 identifies the line feed character output after the carriage return when receiving word responses from your Modem (V1 command).

If you neither want, nor require a line feed character, you can change the value in this register to select a null character, but you cannot disable line feeds.

Register S5 Backspace Character

Range = 0 - 255 (ASCII)

Default = 8 (CTRL H)

Register S5 indicates the BACKSPACE key character and the character echoed to move the cursor back one position.

Pressing the BACKSPACE key does the following:-

1. Echoes the keystroke to your computer or terminal.
2. Moves the cursor back over the last character entered.
3. Deletes the last character in your Modem's memory.
4. Causes your Modem to send an ASCII space (blank) to erase the character on the screen. The space moves the cursor to the next position, with the result the modem just sends another backspace character to back up the cursor again.

As two extra characters are sent after the backspace, the response is somewhat slow. A repeat key on terminals may not work properly when used to backspace. A value greater than 32 disables this feature.

Register S6 Wait Time For Dial Tone

Range = 5 - 6 (seconds)

Default = 5 seconds

Register S6 determines the time delay your Modem makes after accessing the telephone line before dialling the first digit in the dial command. The delay allows time for a dial tone to be provided on the line.

The default of 5 seconds is the minimum delay time. If you can assign a value less than 5, your Modem still waits 5 seconds.

You may want to increase the value in this register if you have trouble receiving a dial tone within 5 seconds.

Register S7 Wait Time For Remote Carrier Signal

Range = 0 - 58 (seconds)

Default = 40 or 50 seconds depending on model

Register S7 determines the number of seconds your Modem waits for a remote modem's carrier signal before hanging up. The timer starts when the modem completes dialling.

The default delay value is usually enough time. However, you can assign a value from 0 to 58.

NOTE: There is a statutory requirement that this wait time does not exceed 59 seconds.

Register S8 Pause Time for Comma in Dial Commands

Range = 3 - 10 (seconds)

Default = 3 seconds

Your Modem pauses for each comma (,) it encounters in a Dial command line. The comma is generally used when dialling through a PBX or other special telephone service.

Register S8 determines how long to pause for each comma. The 3 second default value is usually enough time for most applications.

Register S9 Carrier Detect Response Time

Range = 0 - 255 (x 100ms)

Default = 6 (600ms)

Register S9 sets the carrier detect response time.

This is the time taken for a carrier from a remote modem to be present on the telephone line before the DCD signal is asserted. S9 must have a value less than S10 for a connection to occur.

Setting the register value below 6 might result in noise on the telephone line being confused with a carrier signal.

Register S10 Carrier Detect Loss Time

Range = 0 - 255 (x 100ms)

Default = 14 (1.4 seconds)

Register S10 sets the carrier detect loss time. This is the time taken for an absence of carrier during a connection with a remote modem, to signify that the connection has ended. S10 must have a value greater than S9 for a connection to occur.

Register S12 Escape Guard Time

Range = 0 - 255 (x 20ms)

Default = 50 (1 second)

Register S12 sets the escape guard time (the time delay required both before and after entering the escape characters). It also determines the maximum inter-character time.

The guard time prevents your Modem from misinterpreting the escape characters as data. If you assign a value of 0, timing will not be a factor; you will be able to enter the three escape characters without concern for timing considerations. You must though still enter the characters consecutively.

Note: If you assign small values to this register, you may be unable to enter the three escape characters fast enough, be sure to take into account the time it takes to send one character at the current transmission speed.

Register S18 Test Timer

Range = 0 - 255 (seconds)

Default = 0

Register S18 sets the duration of the test modes. A value of 0 will cause the test to run continuously.

Register S25 DTR (off) Delay

Range = 0 - 255 x 10ms

The modem ignores an OFF condition of DTR for a period of less than this register value. (Applicable for synchronous operation only).

Register S29 Hook Flash Time

Range = 5 - 9 (x 10ms)

Default = 5 (50ms)

The modem will go back on-hook for this time period when it encounters a ! character in the dial string.

Register S30 Inactivity Timer

Range = 0 - 255 (x minutes)

Default = 0 (disabled)

S30 contains the length of time for which it will stay on-line with no data activity. A value of 0 disables the Inactivity Timeout feature. When in non-error-corrected mode, transmit data activity refreshes the timer; when in error-corrected mode both transmit and receive activity refresh the timer.

CHAPTER 8

DIAGNOSTICS AND TESTING

If failures in a communications link occur, the Modem's diagnostic and test facilities assist you to determine the source of the difficulty. Problems occasionally encountered are usually characterized by slow throughput, spurious characters or a total inability to communicate. Problems can be encountered in either the local or remote data terminal equipment, the local or remote modem, or the telephone circuit, and the Modem's diagnostics are designed to help you find the cause of the problem.

Five diagnostic tests are supported on your Modem. These tests are:

Local Analogue Loopback (V.54 loop 3), which tests the communications path between your Modem and local data terminal equipment, including Local Analogue with Self Test, which tests your Modem's status.

Remote Digital Loopback (V.54 loop 2), which tests the communications path between your data terminal equipment, the Modem, then telephone circuit and a remote modem.

Remote Digital Loopback with Self Test which tests the circuit with pre-defined data.

Local Digital Loopback, which allows a remote modem without remote digital loopback capabilities to test the telephone circuit.

- A. To determine if a failure is due to a faulty telephone circuit:

Perform the local analogue loopback with self test. If both modems pass this test, but the remote digital loopback with self test fails, this is good indication the telephone circuit is at fault. However before reporting a problem with the circuit, you should confirm that there are also problems when operating with a telephone handset.

Note: Should you experience continuous connection failures you should report the problem, in the first instance to your modem supplier.

- B. To determine if failure is due to data terminal equipment:

Perform the local analogue loopback test. This test will verify both the modem and the data terminal equipment. If the local analogue loopback with self test proves satisfactory, but the local analogue loopback test fails, this probably indicates the data terminal equipment is at fault.

Important Note: All diagnostic tests should be initiated from the Command Mode with a Standard (AT\N0) or Direct (AT\N1) connection.

S18 Test Timer

Register S18, when set to a non-zero value, establishes the durations of your Modem's diagnostics tests. When a test is active for a period equal to the value chosen for this register (from 1 to 255 seconds), the modem will automatically halt the test and return to the command state. Loading S18 with zero disables the test timer (factory setting).

&T1 Local Analogue Loopback Test

The Local Analogue Loopback Test is used to verify the integrity of the communications path. The test path includes: your Modem and the local data terminal equipment (see also, Local analogue Loopback with Self Test, &T8).

The following is an example using the Local Analogue Loopback Test. When in the test, the local Modem will echo characters received from the local data terminal.

The TST LED illuminates when in a test mode. The TST LED will briefly extinguish each time an error is received when running self-tests (&T8 and &T7).

The Local Analogue Loopback test is also able to be initiated from the V.24/RS-232 interface by the DTE asserting LL on pin 18 (circuit 141). The modem asserts the TI signal (pin 25) to acknowledge the application of the test.

Example 1

Terminal	AT\N0&T1	Start test
	CONNECT Modem now in TEST mode	
	The silent hawk caught the sleepy chicken	Type in test message (Confirm that all the characters are received correctly)
	+ + +	Escape sequence
Modem:	OK	Acknowledges + + +
Terminal:	AT&T0	End Test
Modem:	OK	Test terminates

The test is passed if your Modem echoes the test message back to the local data terminal exactly as it was transmitted.

Note: For the Local Analogue Loopback to be performed, with or without self test, your Modem should not have a call established.

&T8 Local Analogue Loopback with Self Test

The primary purpose of the Local Analogue Loopback with Self Test is to verify the integrity of the modem. If both modems individually pass the test, the Remote Digital Loopback with Self Test may then be performed to verify the complete modem to modem communication path. The following are examples using the Local Analogue Loopback with Self Test.

Example 1

Terminal:	ATS18=0&T8	Start Test
Modem	CONNECT	Modem now in TEST mode
Terminal:	AT&T0	End Test
Modem:	000	OK Acknowledgement

Test performed with no errors.

Example 2

Terminal:	ATS18=0&T8	Start Test
Modem	CONNECT	Modem now in TEST mode
Terminal:	AT&T0	End Test
Modem:	012	12 errors
	OK	Acknowledgement

Test performed with 12 errors.

Example 3: Test time set to 10 seconds

Terminal:	ATS18=10&T8	Start Test
Modem:	CONNECT	Modem now in TEST mode
Modem:	000	Timer expired
	OK	Test completed

Test performed with no errors

Example 4

Terminal:	ATS18=10&T8	Start Test
Modem:	CONNECT	Modem now in TEST mode
Modem:	007	Timer expired
	OK	Test completed

Test performed with 7 errors

&T6 Remote Digital Loopback Test

The Remote Digital Loopback test is used to test the local data terminal equipment, the local and remote modem, and the telephone circuit. The test can only be carried out if the remote modem is able to respond to V.54 loop requests. The remote modem will loop its receive stream back to the line and hence to the local data station. The local data terminal can then compare the received stream of data with its transmitted message to verify the connection. If the data pattern which is received does not match the information transmitted, then either the local data terminal, the local or remote modem, or the telephone circuit is at fault. If this is the case, both the local and remote stations may individually initiate local analogue loopback tests to further isolate the cause of the problem.

Note: The Remote Digital Loopback with or without self test, and Local Digital Loopback can only be performed when your Modem is connected with a remote modem and operating a non-error corrected call. If not, an ERROR message will be received.

You can initiate the Remote Digital Loopback test by:

1. Establishing a dialled connection.
2. Returning to the command mode by issuing the escape sequence.
3. Issuing the &T6 command once in the command state.

The local modem requests a digital loopback with the remote modem through a special CCITT standard handshake sequence (see CCITT Recommendation V.54 for details). The remote modem automatically acknowledges the request if it has been conditioned to do so. The remote modem then loops the output of the modem receiver into the input of the modem transmitter to test the remote modem circuits. See also Remote Digital Loopback with Self Test. Your Modem may be conditioned to accept a request from a remote modem for a remote digital loopback with the &T command (factory setting), or it can be programmed to refuse such a request by issuing the &T5 command.

The Remote Digital Loopback test is also able to be initiated from the V.24/RS-232 interface by the DTE asserting RL on pin 21 (circuit 140). The modem asserts the TI signal (pin 25) to acknowledge the application of the test.

The following is an example using the Remote Digital Loopback Test. Assume starting from an on-line state. The local data terminal equipment must be set to expect characters to be echoed, and your Modem is set to echo commands received from the local data terminal.

Example 1 Test timer disabled

Terminal:	+++	Escape sequence
Modem:	OK	Acknowledges + + +
Terminal:	ATS 18=0&T6	Start test
Modem:	CONNECT	Modem now in test mode
Type the test:	The silent hawk caught	(confirm no errors
Message:	the sleepy chicken	in 'echoed' message)
Terminal:	+ + +	Escape Sequence
Modem:	OK	Acknowledges + + +
Terminal:	AT&T0	End test
Modem:	OK	Test terminated

The local terminal equipment, the local and remote modems and the telephone circuit are all proved to the OK if your Modem echoes the test message back to the local data terminal exactly as it was transmitted.

&T7 Remote Digital Loopback with Self Test

The Remote Digital Loopback with Self Test is used to test the local and remote modem and the telephone circuit. Your Modem sends a standard test message to the remote modem. The remote modem, when properly conditioned, loops its receive stream back to the local modem.

The local modem examines the receive pattern and increments an internal error counter each time an error is detected. At the end of the test, your Modem returns a three-digit error count representing the errors accumulated during the testing interval.

If the error count is 000, both the local and remote modem and the telephone circuit test correctly. If errors were encountered, you may want to initiate local analogue loopback with self test to further isolate the source of the problem.

After escaping from on-line state to command mode, you can initiate the Remote Digital Loopback with Self Test by issuing the &T7 command once in the command mode.

The following are examples using the Remote Digital Loopback with Self Test. Assuming that you start from the on-line state with a non error-corrected call established, local data terminal equipment set to expect characters to be echoed, and Modem is set to echo commands received from the local data terminal.

Example 1 Test Timer Disabled

Test performed with no errors:


```
Terminal:    +++                Escape sequence
Modem:       OK                 Acknowledges + + +
Terminal:    ATS 18=0&T7        Start test
Modem:       CONNECT

Terminal:    AT&T0              End test
Modem:       000                No errors
Modem:       OK                 Acknowledgement
```

Example 2

```
Terminal:    +++                Escape sequence
Modem:       OK                 Acknowledges + + +
Terminal:    ATS 18=0&T7        Start test
Modem:       CONNECT

Terminal:    AT&T0              End test
Modem:       001
Modem:       OK                 Test completed with 1
                                error
```

Example 3 Test timer set to 10 seconds

```
Terminal:    +++                Escape sequence
Modem:       OK                 Acknowledges + + +
Terminal:    ATS 18=10&T7       Start test
Modem:       CONNECT

Modem:       000
Modem:       OK                 Test completed with no
                                errors:
```

Example 4

```
Terminal:    +++                Escape sequence
Modem:       OK                 Acknowledges + + +
Terminal:    ATS 18=10&T7       Start test
Modem:       CONNECT

Modem:       019                Timer expired
Modem:       OK                 Test completed with 19
                                errors
```

Note: An error count of 255 indicates 255 or more errors were detected, or that no synchronisation was achieved with the returned data pattern.

&T3 Local Digital Loopback Test

The Local Digital Loopback Test is used to loop the data stream received from the remote modem back to the remote modem. The remote data terminal, by transmitting a known data pattern to its local modem and comparing this pattern with that of the received data stream, can verify the integrity of both the local and remote modem (which is not CCITT V.54 compatible) to engage in a remote digital loopback test with your Modem.

Your Modem must in the on-line state prior to issuing the test command.

Example 1

Terminal:	+ + +	Escape Sequence
Modem:	OK	Acknowledges + + +
Terminal:	ATS 18=0&T3	Start test
Modem:	CONNECT	Loopback ON

When the remote operator notifies you (e.g. by voice telephone) that the test is complete, you then use the following command to terminate the digital loopback:

Terminal:	AT&T0	End test
Modem:	OK	Test terminated

&T4 Grant Remote Digital Loopback Request

Condition your Modem to grant a request from the remote modem for a remote digital loopback test (default setting).

&T5 Deny Remote Digital Loopback Request

Prevent your Modem from granting a request from a remote digital loopback test.

&T0 Ending a Test

A test may be terminated from the command mode at any time by issuing the &T0 command to your Modem. If the Local Analogue Loopback or Remote Digital Loopback test are being performed, it is necessary to issue the escape sequence to return to the command mode prior to sending the &T0 command. Commands which follow &T0 in a command line are ignored.

CHAPTER 9

STATUTORY INFORMATION FOR THE MODEMS

The purpose of these modems is to allow terminals, PCs and other computers to interconnect via the Public telecommunications network.

The modems are equipped with the following ports:-

Description of Port Types (PC-card Modem):

Type of	Circuit	Port Location	Port Description
TNV		Rear Panel	PSTN (NTTP) Line connection
TNV		Rear Panel	Associated Handset Connection
SELV		PC Edge Connector	PC Bus and Power connections

Description of Port Types (Desktop Modem):

Type of	Circuit	Port Location	Port Description
TNV		Rear Panel	PSTN (NTTP) Line connection
TNV		Rear Panel	Associated Handset Connection
SELV		Rear Panel	DTE (PC) connection

Do not connect unapproved telephone handsets to the Associated Handset connection.

Do not operate the modem in modes which are not intended for use outside the UK. The UK configuration for the appropriate commands are ATB0, AT&G2 and, refer to these commands in chapter 6 for more detail.

These modems have been approved for use with direct exchange lines and compatible PABXs. The user should be aware that it is the modem and not the host which has been approved.

Ringer Equivalence Number (REN)

REN is a value given to all apparatus which can be connected to the PSTN.

The REN is used to calculate the number of pieces of apparatus which may be connected simultaneously to a single PSTN line, without impairing the performance of the standard bell circuit.

The RENs of all simultaneously connected apparatus should not exceed 4.0 on any single PSTN line.

B.T. telephones can be assumed to have an REN of 1.0 unless otherwise marked.

These modems have a REN of 1.0.

APPENDICES

Appendix A	Data Communications for Beginners
Appendix B	Technical Specifications
Appendix C	Cable Specification
Appendix D	Troubleshooting Tips
Appendix E	Glossary
Appendix F	PABX Notes
Appendix G	Command Summary
Appendix H	Fax Operation

APPENDIX A

Data Communications For Beginners

Here is a brief summary of key data communications concepts that you should understand.

Equipment

Data Communications is the exchange of information between two or more locations. Typically, one of the locations is a computer and the other locations are computer terminals. In the case of a PC, both locations - the PC and the host - are computers. (From here on we'll call it the "terminal", whether it is a PC or a non-intelligent terminal.)

There are two ways to connect computers for communication:

1. "Hard Wire" (sometimes called Direct Connect) -- where the computer and the terminal are in relatively close proximity (within 15 metres). With a hard wire connection the computers are connected by a cable.
2. Remote, telephone or modem connection - where the computers are connected via a telephone line. A modem is needed for this type of connection so that the digital data can be transmitted over the telephone lines.

When connection is via a modem,

- The modem converts the digital data that comes to it from the computer into analog (sound) signals that can travel over the telephone line, and converts the analog signals that come to it from the telephone lines into digital data that can be received by the computer.
- Telephone lines carry the data, in the form of analog (sound) signals, from one modem to another. The telephone lines may be standard (switched), leased, or privately owned. Telephone lines may also interconnect to "digital packet" data networks.

Protocols

There are several sets of rules for how to communicate with the host. Each set of rules is called a protocol. The protocol determines how data is sent across the communications line between two locations. The PC is able to communicate with the host by emulating (imitating) the protocol used by terminals normally connected to the host.

The signal coming from the PC then looks like the signal from any other terminal.

Asynchronous protocols generally transmit the data as it is entered from the keyboard. "Bits" are wrapped around the data to tell the modem to start (prepare) for the character to come, and to stop (and wait) for the next.

Some protocols communicate interactively, others transfer files. When you use an interactive protocol, each character is transmitted as you type it or when you press RETURN or ENTER.

When you use file transfer protocols, you must prepare the data in advance and save it in files on disk, then transmit them as a batch to the host.

You can use file transfer protocols to send one or a series of files from one personal computer to another. The data in each file must still be prepared in advance by your word processor, spreadsheet or database program.

With synchronous protocols, the equipment at both ends of the communications line must synchronize with each other before data can be transmitted or received. This makes it possible for the equipment at the receiving end to distinguish individual data bits in the continuous stream of data sent by the equipment at the other end.

Serial and Parallel

Peripheral devices can receive data sent in two ways:

1. Serial data has the bits that represent each character, following one after another.
2. Parallel data is sent with all the bits for one character going in parallel down different pins on the connector.

Nearly all data communication uses serial transfer; this is always so where you use modems to connect over the telephone network.

Some computers come with serial ports built-in and some do not. You must determine if your computer has such a serial port; check if there is a serial connector on the back of your machine.

If you cannot find this connector on your PC, it is likely that you will have to buy one separately. For example, the IBM PC and the APPLE may not come with an RS-232 port. You may need to buy add-on cards that provide this facility.

Nearly every terminal or 'glass teletype' has a DB25/RS232 connector plus a facility to select various options for the RS232 serial output.

DTE & DCE

Also, there are two types of RS-232 connections. One type, called the Data Communications Equipment (DCE) and the other is called Data Terminal Equipment (DTE). It will be necessary for you to know which type is fitted to your computer so that you can purchase or construct the proper type of cable. The cable will be used to connect your machine to your modem.

WARNING: PCs often use a female DB25 connector as their parallel printer connection point. Never connect your modem to the parallel printer port of a PC as you run the risk of damaging your equipment.

APPENDIX B

Technical Specifications

Characteristic	Description
Data Format	Serial, binary, asynchronous; 7 or 8 data bits parity - odd, even, none.
DTE Interface Speed	300, 600, 1200, 2400, 4800, 9600, 19200 also 1200/75. 38400 and 57600 16800, 21600, 24000, 26400, 28800 & 115200 (on 288/336 only)
Operating Modes	The operating modes are as follows: Manual originate. Automatic originate. Manual answer. Automatic answer. Manual dial. Automatic dial.
Dialling	Touch-tone (DTMF) dialling.
Communication Mode	Full & half duplex on two-wire switched telephone channels.
Visual Monitor (Desktop versions only)	9 lights (LED = Light Emitting Diodes) to display: MR = Modem Ready (DSR signal) TR = Terminal Ready (DTR signal) CD = Carrier Detect (DCD signal) SD = Send Data RD = Received Data HS = High Speed AA = Auto Answer OH = Off Hook TST = Self Test Mode
Audio Monitor	In-built speaker
Intelligence	Microprocessor with integrated ROM & RAM.
Modulation & Compatibility	ITU V.21 (FSK) ITU V.22 Mode A (i, ii) and Mode B (i, ii, iii, iv) (DPSK)

ITU V.23 Mode 1 & 2 (FSK)
ITU V.22 bis (QAM)
ITU V.32 & V.32bis with or
without Trellis
CCITT V.34

Asynchronous signalling rates at
1200 & 2400 are +1% and -2.5%.

NOTE:

FSK = Frequency Shift Keying
DPSK = Differential Phase Shift Keying
QAM = Quadrature Amplitude
Modulation

Receiver Dynamic Range	0 to -45 dB full-duplex.
Transmitter Level	-11 dB.
Line Synchronisation	Automatic Adaptive Equalisation (receiver), Fixed Compromise Equalisation (transmitter)
Self-test and Loopbacks	Modem performs Local Analog & Digital Loopback test or Remote Digital Loopback test on command or from the V24/RS-232 interface.
Telephone Line	600-ohm, balanced dial-up telephone interface meeting British Telecom specifications. One BS6312 type plug.
REN	1.0
Telephone Handset	4-wire 600-ohm, balanced telephone interface meeting British Telecom specifications. One BS6312 type socket.
Serial Data Interface (Desktop versions)	25 pin RS232/V.24 interface with female DB-25 connector on modem rear panel, wired as a DCE.
Power Supply (Desktop versions)	Plug--top 240 V AC, 50 Hz, supplying 9Vac 700mA
Physical Dimensions	116 mm wide x 32 mm high x 170mm deep (Desktop). 20mm wide x 106mm high x 135mm deep (PC Cards).
Environmental	The modem meets specification requirements, when operated under the following conditions:
Operating:-	Ambient temperature: 0 to 40 deg. Celsius.
Relative humidity:	80% max. with no condensation.
Storage:-	Ambient temperature: -20 to +65 deg. Celsius.

Relative humidity: 95% max. with no condensation.

APPENDIX C

REAR PANEL CONNECTIONS

V.24/RS232

On desktop modems, the port labelled V.24/RS232 is a 25-pin 'D' socket which provides the main serial interface for connection to asynchronous terminals or PCs

PIN	SIGNAL	ACRONYM	DIRECTION
2	Transmit Data	TxD	Input from terminal
3	Receive Data	RxD	Output to terminal
4	Request to Send	RTS	Input from terminal
5	Clear to Send	CTS	Output to terminal
6	Data Set Ready	DSR	Output to terminal
7	Signal Ground	GND	N/A
8	Data Carrier Detect	DCD	Output to terminal
20	Data Terminal Ready	DTR	Input from terminal
22	Ring Indicator	RI	Output to terminal

Composite connector for mic/speakers or for combined earpiece/mic:-

tip	mic input
1st ring	speaker/earpiece output
2nd ring	common

APPENDIX D

Troubleshooting Tips

Most of the problems with your modem will occur during installation. Check this carefully.

IMPORTANT: This is not a repair procedure. Modems requiring adjustments not covered below should be returned to your dealer for service.

WARNING: Do not remove the modem from its case. The modem has no parts within the case that you can service. Removing the modem from its case will invalidate your warranty and approval to connect.

Sending and receiving data requires more than a modem. Your PC is part of a system that includes a telephone line and another computer system. You can solve some operating problems by checking your programs and adjusting your modem - you cannot solve problems caused by the telephone line or the other computer system.

The Quick Fix List

You can solve most problems by checking the following things:

Recheck each cable, even though you may be sure that they are plugged in properly. Do not try to clean jacks or connectors

1. Check to see that all cables connected to the modem are securely connected at both ends.
 - * RS232 cable - connected to the modem and to the correct serial port on your PC or terminal?
 - * Modem Power cable - connected to the modem and the plug pack plugged into the wall power outlet? Is the wall plug switched on?
 - * Telephone cable (the one supplied with the modem) - connected to the modem and the telephone wall socket ?
2. Check to see that the PC program and the remote computer system have each selected the same data bit selection (either 7 or 8 bits) and parity.
3. Check the following:
 - Does the modem turn on? Does the MR LED light ?
 - Does it accept any commands? Does it respond to the "A/" command?
 - Does it display messages?
 - Does it send or receive data?
 - Does the problem repeat, or is it intermittent?

Can the modem continue to process commands?

What happens to the command, message or data that fails to work correctly?

What was the last correct action just before failure?

What was the last screen message displayed?

Check over what you've learned about the problem. Do you have a modem problem - or is it really a problem with something else? You will solve most problems by checking all the cables, and by checking the PC program.

APPENDIX E

GLOSSARY

analogue signal	-	A signal that varies continuously over time.
ASCII code	-	American Standard Code for Information Interchange. A standard way of representing each letter, number, special character and control character as a 7-bit binary number.
asynchronous	-	A method of data transfer that uses START and STOP bits to separate individual characters within the data stream.
auto-answer	-	The ability of a modem to detect 'ring' signals on the telephone line and thereby answer incoming calls without manual intervention.
auto-dial	-	The ability of a modem to dial telephone numbers under software control and thereby originate telephone calls without manual intervention.
baud rate	-	The term baud rate refers to the rate at which a modem modulates the digital signal for transmission. This rate is often confused with the bits per second transfer rate though the two may be different. The term is taken from the name of Frenchman Louis Baudot.
binary synchronous communications (BSC)-	-	A type of protocol that synchronises both ends of the communication line, then transmits binary data across the line.
bit	-	The name given to the smallest unit of information that can be stored in

a computer. An acronym derived from binary digit.

- break
- This is a signal that is used by communicating devices to interrupt normal operation. The signal consists of a series of 0 bits which must be present for longer than the period of a normal character.

British Approvals Board
for Telecommunications
(BABT)

- Is the body that is licensed by the Department of Trade and Industry to administer the approval of equipment designed for connection to the PSTN. This includes modems, telephones, PBXs etc.

buffer

- An area of memory inside a computer or other electronic device that is used to store data temporarily.

byte

- Unit of information stored within a computer, usually consists of 8 bits.

carrier signal

- A single frequency tone which is generated by a modem during communication to 'carry' the data and to inform the remote modem of the correct speed at which to operate.

Clear To Send (CTS)

- A V.24/RS232C interface signal that is generated by Data Communications Equipment to indicate that it is ready to receive data from the DTE to which it is attached. Used to provide hardware flow control.

communications
software

- The term used to describe a program running on a personal computer that allows it to be used as if it were a terminal connected to another computer.

Data Carrier Detect
(DCD)

- An RS232C interface signal used by modems to inform the terminal to which they are attached that they have connected to a carrier signal from a remote modem.

Data Communications
Equipment (DCE)

- A term used to describe communications equipment through which data passes, usually a modem.

data compression

- The generic term describing the use of various techniques to reduce the size of a computer file for storage or transmission purposes. MNP5 and V.42bis are both methods of compression that can be incorporated into intelligent modems.

Data Set Ready
(DSR)

- A V.24/RS232C signal that is generated by modems when they are ready to communicate.

- Data Terminal
Equipment (DTE) - A term used to describe
 communications equipment which
 either originates data or receives
 data for its own use, usually a
 terminal.
- Data Terminal Ready
(DTR) - An RS232C signal that is generated by
 DTEs when they are ready to
 communicate.
- downloading - The process of receiving a file from
 a remote information service or
 computer.

- EBCDIC code - Extended Binary Coded Decimal Interchange Code. A code used by IBM that represents each letter, number, special character, and control character as an 8-bit binary number.

- error control - A term used to describe the process of adding extra information to transmitted data in order that the receiver can detect that errors have occurred and thereby request re-transmission of the affected data.

- file transfer protocol - A protocol that only exchanges disk files with the host. This type of protocol does not allow you to communicate interactively with the host.

- flow control - A term describing the use of software or hardware signals to control the flow of data between two devices. Also known as handshaking.

frequency modulation	-	An early modulation technique that uses different signal frequencies to represent binary data.
full duplex	-	The term used to describe two-way simultaneous communication.
half duplex	-	The term used to describe systems that allow communication in two directions but not at the same time.
hardware handshaking	-	The use of hardware signals such as RTS and CTS to provide flow control during communication.
host	-	The computer that is in control in a data communications network. The host may be a mainframe, mini, or micro computer.
intelligent modem	-	A type of modem which, by virtue of having its own micro-processor, can be controlled by software commands from the terminal to which it is attached rather than manually by switches.
interactive protocol	-	A protocol that lets you communicate interactively with the host. In this kind of protocol, part or all of the contents of the screen display are sent to the host when you press RETURN; you do not have to communicate with the host by sending it disk files.
International Telecommunications Union (ITU)	-	Is the international body that governs the definition of standards such as the 'V' series, for use in international telecommunications. Formally CCITT.
Kermit	-	An error control protocol developed for use in connecting micro-computers to mainframes. The protocol has various levels and the particular level used is determined by negotiation when the two devices connect.
Microcom Networking Protocol (MNP)	-	An error control protocol developed by Microcom for use on network systems but now commonly used in modems.

modem - The name modem is derived from the two words, modulator and demodulator, and describes the action of a modem during the transfer of data. In simple terms, a modem converts (modulates) digital signals from a computer to produce an analogue signal that can be transmitted over the telephone system. The receiving modem demodulates the analogue signal to reproduce the digital data that was originally transmitted.

- parallel interface - A type of interface, such as Centronics, that permits the transmission of data parallel fashion i.e. two or more bits at a time with as many wires as necessary for the number of data bits per unit of data transmitted, usually 8.
- parity bit - An extra bit that may be appended to each character during asynchronous data transmission to provide a primitive form of error detection.
- Prestel - British Telecom's Videotex/Viewdata service and the name of all services that use the BT protocol.
- Private Automatic Branch Exchange (PABX) - The term used to describe the central control equipment used to manage internal telephone systems.
- protocol - A set of rules for sending and receiving data on a communications line.
- Public Switched Telephone Network (PSTN) - This is the technical term used to describe the dial-up telephone networks run by British Telecom and Kingston Communications.
- Request To Send (RTS) - An RS232C interface signal that is generated by Data Terminal Equipment to indicate that it has data ready for transmission. Used to provide hardware flow control.
- Ring Indicator (RI) - An RS232C signal that is generated by DCEs when they detect an incoming RING signal on the telephone line.
- RS232 cable - Any cable that is wired in accordance with the RS232 (or ITU V.24) standard, which is the world-wide standard data communications interface standard.
- serial interface - A type of interface, such as RS232C, that permits the transmission of data in serial fashion i.e. one bit after another down a single wire. Other wires may also be used to provide control signals and a return data path.
- simplex - The term used to describe systems which allow communication in one direction only.

- software
handshaking - The use of software signals such as
 XON and XOFF to provide flow control
 during communication.

- start bit - A high bit that is inserted at the
 beginning of each character
 transmitted during asynchronous
 communication to indicate the start
 of that character.

stop bit	-	A low bit that is inserted after each character transmitted during asynchronous communication to indicate the end of that character. One or two stop bits may be used.
synchronous mode	-	A method of transmitting data without the use of start and stop bits to delineate characters within the data stream. Instead, timing information is superimposed on the data in order that the receiving device can correctly separate incoming characters.
Teletex	-	A videocast (TV transmitted) Videotex system that generally lacks the interactive nature or high volume data base aspects of Videotex.
uploading	-	The process of transmitting a file to a remote information service or computer.
Videotex/Viewdata	-	On-line interactive colour graphic information retrieval system. Users complete enquiries by entering simple commands and by accepting options displayed on menus. Now frequently linked ("gateways") to other computer data base systems.
word length	-	The number of data bits making up the characters transmitted during asynchronous communication. This can usually be set to 7 or 8 and does not include the start and stop bits.
Xmodem	-	An error control protocol for file transfer often found in communications programs for microcomputers. Files for transmission are split into fixed length blocks which are checksummed, and requests re-transmission of the block concerned if errors have occurred. See Zmodem.
XON/XOFF	-	ASCII characters (usually 17 and 19) which are used to provide software flow control.
Ymodem	-	An error control protocol for file transfer often found in communications programs for microcomputers.
Zmodem	-	An error control protocol for file transfer often found in communications programs for microcomputers. Similar to XMODEM

but more advanced because it uses
variable length blocks.

APPENDIX F

PABXs, & Switchboards

1. Always use a direct outside telephone line if you can. They are much cleaner, e.g. no operator interrupts, disconnects, etc.
2. If you must go through a PABX or Switchboard then you need to bear these points in mind:
 - a) Don't forget to put the "0" or "9" at the front of the number you're dialling, if required.
 - b) If it takes a while to get an outside line, put in a delay (comma in the dial string) to make sure that you get a line before dialling.

e.g. ATD9,1234567<CR>.

The comma indicates to the Modem that a pause of approximately three (default) seconds is required.

APPENDIX G

AT Command Summary

+ + +	Data Mode Escape		
A	Manual Answer		
\A	MNP Max block size		
	0 =	64 Characters	
	1 =	128 Characters	
	2 =	192 Characters	
	3 =	256 Characters	
A/	Repeats Last Command		
AT	Attention Characters		
\B	Transmits Break		
	1 - 9	Break length in 100ms units (length can be specified only on non-EC calls)	
%C	Compression	0 =	Disable EC and Data compression
		1 =	Enable MNP negotiation
		2 =	Enable V.42bis
		3 =	Enable V.42bis, and MNP
&C	DCD Options	0 =	DCD always ON
		1 =	DCD determined from line
*C	Remote password (n/a in 288/336 modem). Enter the remote configuration password for this modem.		
D	Dial		
	Dial modifiers:-		
	,	Pause	
	;	Return to Command Mode after dialling	
	T	Touch-Tone Dialling	
	W	Wait for a Second Dial Tone	
	L	Redial Last number	
	^	Disable 'Call Tone'	
&D	DTR Options	0 =	Ignores DTR
		1 =	Go to Command State when DTR ON-OFF
		2 =	Hang-up, Go to Command State when DTR ON-OFF
		3 =	Power Up Reset when DTR ON -OFF
E	Echo	0 =	No Command Echo
		1 =	Command Echo

%E	Retrain	0 =	Disable auto-retrain
		1 =	Enable auto-retrain

F	Line Modulation	0 =	Auto-mode
		1 =	V.21 (300bps)
		2 =	ignored, OK response
		3 =	V.23 (1200/75 bps)
		4 =	V.22 A/B(1200bps)
		5 =	V.22bis (2400bps)
		6 =	V.32 fallback (4800bps)
		7 =	V.32bis fallback (7200bps)
		8 =	V.32 (9600bps)
		9 =	V.32bis (12000bps)
		10 =	V.32bis (14400bps)

ATF not supported on 288/336 modem, use AT+MS= instead

&F	Restores Factory Defaults	0 =	Restore Factory Profile 0
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&G	Guard Tone	0 =	Disable Guard Tone
		1 =	Same as 0
		2 =	Select 1800Hz guard tone

\G	Modem-Modem Flow control	0 =	Disable
		1 =	Enable (non-EC connections only)

H	On/Off Hook	0 =	Hang up
		1 =	Go off hook

I	Indentification	0 =	Product code
		1 =	Pre-computed checksum from firmware
		2 =	Firmware checksum calculation and comparison with pre-computed value - returns OK or ERROR
		3 =	Base Firmware revision level
		4 =	Overall level of firmware
		6 =	DSP hardware type and revision level

&K	Flow Control	0 =	Disable Flow Control
		3 =	Enable RTS/CTS flow control
		4 =	Enable XON/XOFF flow control
		5 =	Enable transparent XON/XOFF flow control
		6 =	Enable both RTS/CTS and XON/XOFF

\K	Break handling		
-K	MNP-10 Extended Service		
		0 =	Disable V.42 to MNP conversion
		1 =	Enable V.42 to MNP conversion
L	Volume		
		0 =	Low speaker volume
		1 =	Medium speaker volume
		2 =	High speaker volume
%L	Shows the Rx signal level		

\L	MNP mode	0 =	Stream mode for MNP connections
		1 =	Block mode
M	Loudspeaker	0 =	Speaker off
		1 =	Speaker ON until carrier detect
		2 =	Speaker ON continuously
		3 =	Speaker ON only during answering
&M	Operating Modes	0 =	Async mode 1, AT commands
		1 =	Sync mode 1, with async command dialling until connection established. Call dropped and return to async when DTR lowered.
		2 =	Sync mode 2, when DTR is raised, modem calls the first stored number in memory. When DTR goes low, modem returns to async command mode.
		3 =	Sync mode 3, where DTR acts as a Talk/Data switch. A call is dialled manually, then DTR is raised to start handshake/ training sequence. Modem hangs when DTR goes low.
)M	MNP-10 Power	0 =	Power level not adjusted during link negotiation
		1 =	Power Level adjusted
+MS	Modulation mode (288-modems only)		
	+MS=<mod>,<automode>,<min_rate>,<max_rate><CR>		
<mod>	Modulation	Possible rates (bps) (see note 1.)	
0	V.21	300	
1	V22	1200	
2	V22bis	2400 or 1200	
3	V23	1200 (see note 2.)	
9	V32	9600 or 4800	
10	V32bis	14400, 12000, 9600, 7200, 4800	
11	V34	33600,31200,28800, 26400, 24000, 21600, 19200, 16800, 14400, 12000, 9600, 7200, 4800, or 2400 see note 3	

64	Bell 103	300 (not UK)
69	Bell 212	1200 (not UK)
74	V.Fast	28800, 26400, 24000, 21600, 19200, 16800, or 14400

Note

1. See optional <automode>, <min_rate> and <max_rate> parameters
2. For V.23, originate is 75Tx, 1200Rx answer is 75Rx, 1200Tx.
3. <mod> 11 is the default.

N	Automode	0 =	No Automode, fixed handshake to Fn command
		1 =	Automode detection enabled

\N	EC Mode	0 =	Buffered connection no EC
		1 =	Unbuffered, no EC
		2 =	Enable V.42 or MNP EC connection
		3 =	Enable V.42, MNP or non-EC connection
		4 =	Enable V.42 only
		5 =	Enable MNP only
O	On line	0 =	Go back online
		1 =	Initiate retrain
Q	Responses	0 =	Send command responses
		1 =	No responses
%Q	Shows the Line Quality value	0 - 128	0 - 7 = good line
&Q	Sync/Async Mode	0 - 3	See &M0-3
&R	RTS/CTS	0 =	CTS follows RTS by delay in S26
		1 =	Ignore RTS, CTS remains ON
Sr?	Reads Register		
Sr=n	Sets Register to Value n		
&S	DSR Options	0 =	DSR always on
		1 =	DSR follows RS232C specification
\S	Shows active modem configuration (144/v32bis modem only).		
&T	Test Modes	0 =	End test mode
		1 =	Local analogue loopback
		3 =	Local digital loopback
		4 =	Grant RDL request
		5 =	Deny RDL request
		6 =	Remote digital loopback
		7 =	Remote digital with self test
		8 =	Local analogue loop with self test
V	Responses	0 =	Send numeric digit responses
		1 =	Send word responses
&V	Shows Profiles		
W	EC Messages	0 =	CONNECT message indicates the DTE speed
		1 =	Modem reports line speed, protocol and DTE speed when a connection is made
		2 =	CONNECT message indicates line speed
&W	Stores Profile	0 =	Store active configuration as profile 0
		1 =	Store active configuration as profile 1

\W	Split Speed	0 = Disable split speed 1 = Enable split speed and V.23 (sets ATF3) (144 only)
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X	Result Codes	0 = Basic result code set (code 0 - 4).
		1 = Principal result codes (0 - 5, 8 - 23)
		2 = Principal codes and dialtone detection
		3 = Principal codes with BUSY signal detection
		4 = Extended (0 - 80) codes with BUSY signal and dialtone detection
Y	Long Space	0 = Disable long space disconnect
		1 = Enable long space disconnect
&Y	Select Profile	0 = Profile 0 loaded after hard reset
		1 = Profile 1 loaded after hard reset
Z	Fetch Profile	0 = Profile 0
		1 = Profile 1
&Zm=nnnn	Store Number 'nnnn' in memory store 'm'	m can be 0 - 3, nnnn can be up to 40 digits

WORD RESPONSE	DIGIT RESPONSE	MEANING	
OK	0	Command line executed successfully.	
CONNECT	1	Remote carrier detected.	
RING	2	Incoming ring detected.	
NO CARRIER	3	Remote carrier lost or not detected.	
ERROR	4	Command line contains error. The modem cannot recognise the command.	
CONNECT 1200	5	Remote carrier detected	
NO DIALTONE	6	A dialtone was expected but not found.	
BUSY	7	Remote line is busy.	
NO ANSWER	8	The remote modem did not answer the call, or answered incorrectly.	
CONNECT 600	9	Connection established at 600bps	
CONNECT 2400	10	Connection established at 2400bps	
CONNECT 4800	11	Connection established at 4800bps	
CONNECT 9600	12	Connection established at 9600bps	
CONNECT 7200	13	Connection established at 7200bps	
CONNECT 12000	14	Connection established at 12000bps	
CONNECT 14400	15	Connection established at 14400bps	
CONNECT 19200	16	Connection established at 19200bps	
CONNECT 38400	17	Connection established at 38400bps	
CONNECT 57600	18	Connection established at 57600bps	
CONNECT 75TX/1200RX	22	V.23 connection established	
CONNECT 1200TX/75RX	23	V.23 connection established	
CARRIER 300	40	Remote carrier detected at V.21	
CARRIER 75/1200	42	Remote carrier detected at V.23	
CARRIER 1200/75	43	Remote carrier detected at V.23	
CARRIER 1200	46	Remote carrier detected at V.22	
CARRIER 2400	47	Remote carrier detected at V.22bis	
CARRIER 4800	48	Remote carrier detected at V.32	
CARRIER 7200	49	Remote carrier detected at V.32	
CARRIER 9600	50	Remote carrier detected at V.32	
CARRIER 12000	51	Remote carrier detected at V.32bis	
CARRIER 14400	52	Remote carrier detected at V.32bis	
CARRIER 16800	53	Remote carrier detected at V.34	
CARRIER 19200	54	Remote carrier detected at V.34	
CARRIER 21600	55	Remote carrier detected at V.34	
CARRIER 24000	56	Remote carrier detected at V.34	
CARRIER 26400	57	Remote carrier detected at V.34	
CARRIER 28800	58	Remote carrier detected at V.34	
CARRIER 31200		Remote carrier detected at v.34	
CARRIER 33600			
COMPRESSION: CLASS 5	66	MNP-5 Data Compression in operation	
COMPRESSION: V.42BIS	67	V.42bis Data Compression in operation	
COMPRESSION: NONE	69	No Data Compression	
PROTOCOL: LAPM	77	LAPM (V.42) Error Correction Protocol	
PROTOCOL: ALT	80	MNP-4 Error Correction Protocol	
PROTOCOL: ALT-CELLULAR	81	MNP 10 Cellular Power Protocol	
REGISTER	RANGE	DEFAULT	FUNCTION
S0	0 - 255 (rings)	0	Ring number to auto answer calls.

S1	0 - 255 (rings)	0	Count number of incoming rings.
S2	0 - 127 (ASCII)	43	Escape character.
S3	0 - 127 (ASCII)	13	Carriage return character.
S4	0 - 127 (ASCII)	10	Line feed character.
S5	0 - 127 (ASCII)	8	Backspace character.
S6	5 - 6 (seconds)	5	Wait for dial tone period.
S7	0 - 58 (seconds)	50	Wait for remote carrier period.
S8	3 - 10 (seconds)	3	Wait for dial pause.
S9	0 - 255 (100ms)	6	Carrier detect reponse time.
S10	0 - 255 (100ms)	14	Carrier loss reponse time.
S12	0 - 255 (20ms)	50	Escape guard time.
S18	0 - 255 (seconds)	0	Test Timer.
S25	0 - 255 (seconds)	5	DTR off timer.
S26	0 - 255 (10ms)	1	CTS delay.
S29	5 - 9 (seconds)	5	Hook Flash delay.
S30	0 - 255 (minutes)	0	Inactivity timer.
S37	bit-mapped	0	Desired modem-modem speed.
S38	0 - 255 (seconds)	20	Delay before forced hangup.
S48	0,7,128	7	V.42 negotiation control.

APPENDIX H

Fax Operation

These Modems are able to send and receive CCITT Group 3 fax images.

The fax interface conforms to EIA 578 (Class 1) and EIA 592 (Class 2)(certain modems only). The interface operates at 19200bps when in fax mode. All models are able to negotiate fax speeds through 14400 (V.17), 9600 (V29), 4800 (V.27ter) and 2400 (V.22bis).

To determine if your modem has the Class 2 commands, issue the AT command

```
AT+FCLASS=?
```

If the modem's response includes '2', then class 2 is available.

In order to take advantage of the fax facilities on the modem, it is necessary to use an applications package (on your computer) which expects a fax modem conforming to either Class 1 or Class 2. The applications package will perform the T.30 (fax control signalling and negotiation) and T.4 (fax encoding) tasks, thus allowing you to send and receive faxes from directly from a terminal.

Choose either Class 1 on you fax applications package in order to operate with the modem. Certain applications packages do not specifically mention class 1 or 2, in which case the Rockwell TR29 interface should be

selected.

APPENDIX I

Voice Operation

Certain of the Modems are able to send and receive voice messages when used with a computer and suitable software.

To determine if your modem has the voice facility, issue the AT command

AT+FCLASS=?

If the modem's response includes 80, then voice facilities are available.

The voice command interface conforms to 'Rockwell' standard, so ensure that any voice software which you plan to use is able to operate with 'Rockwell' voice modems.