

# **Mayze 24 and 24R Reference Manual**

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## STATUTORY NOTICES

APPROVED for connection to telecommunication systems specified in the instructions for use subject to the conditions set out in them.

NS/1404/23/K/601145  
NS/1404/23/K/601146

All users must make themselves familiar with the statutory notices in the front of this manual and in the Appendix entitled Country-Specific Information.

### LITHIUM BATTERY

The lithium used in the battery of this unit will react violently with water and most gases. Discharged batteries must not be crushed, incinerated or disposed of in the normal waste. Used batteries should be collected and disposed of in an approved land fill. The manufacturer and your local waste authority will provide more detailed information about their disposal.

Accidental charging and short circuiting of the battery may cause overheating and possible rupture. Replace only with the same or equivalent type recommended by the modem supplier.



Case Communications Ltd declare that this product conforms with the protection requirements of Council Directive 89/336/EEC on the approximation of the laws of the member states relating to electromagnetic protection.

Case Communications Ltd declare that this product conforms with the requirements of the European Communities Council directive of 73/23/EEC on the harmonisation of the laws of Member States to electrical equipment designed for use within certain voltage limits.

This equipment has been tested using shielded DTE cables supplied by Case Communications Ltd. These cables, or equivalents, must be used to ensure compliance with this declaration

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# Preface

The Mayze 24 is available in two versions:

Mayze 24        Standalone modem.

Mayze 24R      Rackmount modem for use in the Network  
16 Rack System.

This manual provides full information for installing, configuring and using the Mayze 24 and Mayze 24R modems as supplied for use in the United Kingdom.

PART 1 of the manual has been laid out in a sequence that will allow you rapidly to become familiar with the essential features of the modem and to get it operational for straightforward use on the PSTN.

PART 2 takes you step-by-step through the many features of the modem that allow it to carry out complex tasks in a variety of environments.

Throughout this manual the Mayze 24 and Mayze 24R are described as 'the modem' where features are common to both. Where necessary they are differentiated by 'standalone' or 'rackmount' respectively.

The Network 16 Rack System which houses the rackmount version is referred to as 'the rack system', and the Network 16 Controller Card is referred to as 'the controller card'. Both these items are described in separate manuals.

# Terms and Conventions

This manual uses the following terms and conventions:

- DTE        'Data Terminal Equipment', e.g. the computer or terminal attached to the modem.
- DCE        'Data Communications Equipment', e.g. the modem.
- <CR>      represents a carriage return.
- <LF>      represents a line feed.
- <Ctrl>     represents a control character (hold down the **CONTROL** key whilst pressing the required character).

Commands entered at the keyboard are shown in 'Modern Bold' font, for example, **ATDP123**.

Responses from the modem that are displayed on the screen are shown in 'Modern' font, for example, ERROR.

For an explanation of terms used in this manual, see the Pocket Books of Telecommunications and Computer Communications.

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# **PART 1**

## **BASIC OPERATION**

Chapter 1	Introduction
Chapter 2	Installation
Chapter 3	Getting Started



## 1.1 The Mayze 24 Modem

The Mayze 24 is a quad-standard autodial modem capable of passing asynchronous data at up to 19,200 bps, and synchronous data at up to 2400 bps. It can operate over PSTN (dial-up) or leased (private wire) lines.

The modem complies with the following ITU-T Recommendations:

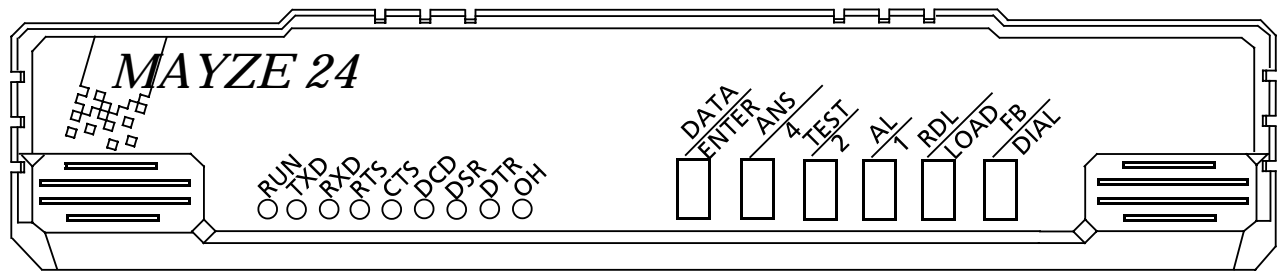
V.22 <i>bis</i>	2400 synchronous or asynchronous operation.
V.22	1200 or 600 bps synchronous or asynchronous operation.
V.23	1200/75, 75/1200 bps full-duplex or 1200/1200 half-duplex asynchronous operation.
V.21	300 bps asynchronous operation.

The other principal features of the modem are:

- Automatic dialling using AT or V.25*bis* commands.
- An electronic storage system for telephone numbers. Numbers are stored, and subsequently retrieved, by using the numbered buttons on the front panel, or by AT commands.
- Automatic answering of incoming calls. Disconnection of calls is always completed 'cleanly' so that the modem is ready for the next call.
- Storage of up to 16 pre-set configurations.
- The modem supports V.42 error correction and V.42*bis* data compression, giving an asynchronous throughput of up to 19,200 bps. For compatibility with other modems, error correction and data compression conforming to the MNP (Classes 1 to 5) de-facto standard are also supported.
- Comprehensive modem configuration using AT commands, which can be from a Mayze 24 modem at a remote site, with security controls to prevent unauthorised use of this facility.
- A port conforming to ITU-T V.24/V.28 (EIA RS-232-C) standards for connecting the DTE.

- A separate command port for connection to a terminal or PC, so that commands may be entered or calls monitored while the modem is in use.
- Comprehensive V.54 test functions initiated by AT command, or by front panel switches.
- Modem Management. The modem may be controlled by the Network 16 Controller Card or Network 6, and managed as part of a network using a high-level network management system.

## 1.2 Physical Description of the Standalone Modem



**Figure 1-1 The Standalone Modem Front Panel**

### 1.2.1 The Indicators

The indicators are on the front panel of the modem, which is shown in Figure 1-1.

<b>RUN</b>	A continuous light means that power is on and the modem is functioning correctly. A flashing red light indicates that a test is being performed.
<b>TXD</b>	Transmit Data. A flashing light indicates that data is being transferred from the local DTE.
<b>RXD</b>	Receive Data. A flashing light indicates that the modem is sending data to the local DTE.
<b>RTS</b>	Request To Send. A continuous light indicates that the local DTE is ready to send data. In full-duplex mode this is normally lit at all times, but in half-duplex mode, only when data is ready to be transmitted.
<b>CTS</b>	Clear To Send. A continuous light indicates that the modem is ready to transmit data to a remote modem. In full-duplex mode this is normally lit at all times, but in half-duplex mode, lights shortly after the <b>RTS</b> indicator.
<b>DCD</b>	Data Carrier Detect. Lit to indicate recognition of a carrier signal from the remote modem. In full-duplex mode this is normally lit at all times, but in half-duplex mode, only when the remote modem has control for transmitting.

<b>DSR</b>	Data Set Ready. Lit to indicate that the modem has control of the line and is in data transmit mode. During a self-test with signal injection, indicates errors.
<b>DTR</b>	Data Terminal Ready. Lit to indicate that the local DTE is ready to begin communications.
<b>OH</b>	Off Hook. Lit when the modem has connected to the telephone line.

### 1.2.2 The Controls

The controls are on the front of the modem, which is shown in Figure 1-1. The names above the line are for on-line operation of the modem. The names below the line are for configuration loading, or dialling on the PSTN. The left-hand button is a non-latching switch. The other five have a latching action.

<u><b>DATA</b></u> <b>ENTER</b>	Use as <b>DATA</b> to go into data mode when manually connecting a call, and press again to revert to command mode. Use as <b>ENTER</b> to load a configuration or dial a telephone number.
<u><b>ANS</b></u> <b>4</b>	Use as <b>ANS</b> to cause the modem to go into answer mode; release the button to put the modem into originate mode. (Note that when your modem answers a call it will default to answer mode, irrespective of the state of this button.) Use as <b>4</b> in conjunction with the <b>DIAL</b> , <b>2</b> and <b>1</b> buttons to select a configuration or telephone number.
<u><b>TEST</b></u> <b>2</b>	Use as <b>TEST</b> to activate a test sequence for local or remote tests with your modem. Use as <b>2</b> in conjunction with the <b>DIAL</b> , <b>4</b> and <b>1</b> buttons to select a configuration or telephone number.
<u><b>AL</b></u> <b>1</b>	Use as <b>AL</b> to select an analogue loopback. Use as <b>1</b> in conjunction with the <b>DIAL</b> , <b>4</b> and <b>2</b> buttons to select a configuration or telephone number.
<u><b>RDL</b></u> <b>LOAD</b>	Use as <b>RDL</b> to select a remote digital loopback. Use as <b>LOAD</b> to select a load configuration option.



**FB**  
**DIAL**

Use as **FB** to revert to the selected fallback speed.  
Use as **DIAL** to select a stored telephone number to dial.

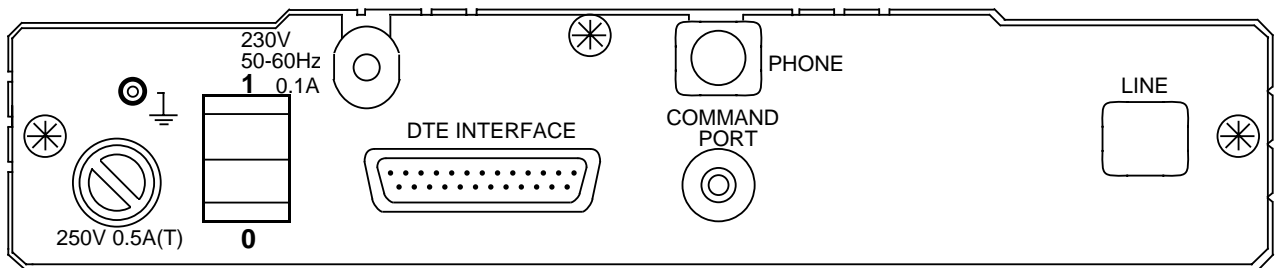
It is also used in conjunction with the 4, 2 and 1 buttons to load a factory or user configuration.

More-detailed descriptions of the uses of the buttons are given in the descriptions of the functions for which they are needed.


### 1.2.3 The Connections

The connections are made from the rear panel of the modem. The 230 volt version is shown in Figure 1-2.

Pin assignments and suggested cable configurations are detailed in Appendix B.



**Figure 1-2 The Standalone Modem Rear Panel**

- |   |   |
|---|---|
| <b>DTE INTERFACE</b>  | Female 25-way D-type connector (ISO 2110) to connect the modem to your local DTE.   |
| <b>COMMAND PORT</b>   | 3.5 mm stereo jack socket to accept the command port adapter.   |
| <b>EARTH</b><br> | For connecting the modem to external earth. If this is not used, then the modem must be earthed through the mains cable, which must be plugged in <b>before</b> the line cord is connected.                                       |
| <b>POWER</b>  | 2-metre mains cable fitted with a moulded plug for connection to a standard power outlet. To isolate the modem from the power source, <b>first</b> remove the line cord, <b>then</b> remove the mains plug from the power outlet. |

<b>FUSE</b>	500 mA (T) anti-surge 250 V mains fuse. You must <b>first</b> disconnect the modem from the line and <b>then</b> from the power supply before replacing this fuse. Always replace the fuse with one of the same rating.
<b>SWITCH</b>	Modem power ON (1) or OFF (0).
<b>LINE</b>	3-metre 4-way line cord fitted with a standard British Telecom plug to connect to the dial-up network.
<b>PHONE</b>	Socket for a telephone handset. A telephone connected to this socket may be used to manually dial calls. For safety a blanking plug is fitted in this socket before shipping. The Appendix entitled 'Technical Guide' contains instructions for removing the blanking plug. See also the Appendix entitled 'Country-Specific Information'.

## 1.3 Physical Description of the Rackmount Modem



**Figure 1-3 The Rackmount Modem Front Panel**

### 1.3.1 The Indicators

The indicators have the same meanings as for the standalone modem (Section 1.2.1).

### 1.3.2 The Controls

The control buttons have the same function as the equivalent buttons in the standalone modem (Section 1.2.2). The names on the **left** of the buttons are for configuration loading or telephone dialling. The names on the **right** of the buttons are for on-line operation of the modem.

### 1.3.3 The Connectors

The plug-in modem card connects with sockets on the rack system. The interfaces on the rack are described in the rack manual.



## **2.1 Pre-Installation**

In addition to your DTE, and depending on the way you set up and intend to use your modem, you may need:

- A 25-pin male D-type (ISO 2110) cable to connect the modem to the DTE (your computer or terminal). See Appendix B for details of the pin connections.
- A telephone line (PSTN or leased), terminated with a standard socket (see the postcard at the rear of this manual if you need to order one from BT).
- For asynchronous command of your modem:
  - The capability of sending asynchronous AT commands via the V.24/RS-232-C serial port on your DTE to your modem, or
  - A separate asynchronous command terminal with a V.24/RS-232-C serial port.
- For the standalone modem, a mains power socket outlet installed near the modem, easily accessible, and capable of supplying 1.0 amps at the nominal voltage and frequency.

Please refer to Appendix C for country-specific information.

The modem is designed for use in a domestic, office or computer room environment. The standalone modem should be sited:

- Sufficiently close to the mains power outlet so as not to cause strain on the connecting cable.
- Sufficiently close to the PSTN or leased line termination so as not to cause strain on the connecting cord.
- Away from sources of heat such as radiators or direct sunlight.
- Away from sources of radiation such as motors and video displays.

## **2.2 DTE Requirements**

Your data DTE will probably be one of the following:

- A 'dumb' terminal (VDU) connected directly to the modem.
- A PC containing a software package which facilitates communication with the modem, or which puts the PC in "terminal emulation" mode.
- A terminal connected to a computer which is able to communicate with the modem.

It will transmit and receive data in one of the following ways:

- Asynchronous mode only.
- Synchronous mode only.
- Asynchronous or synchronous mode (switchable).

Consult the DTE's manual for the relevant information.

### **2.2.1 Controlling the Modem**

To control your modem, you will need to send AT commands to it. (*V.25bis* commands are a special case, discussed in Chapter 10.)

If your DTE works in asynchronous mode, you can connect it to the modem's DTE port and enter commands via its keyboard.

A separate command terminal may be used to control the modem when:

- The main DTE operates in synchronous mode only.
- The main DTE does not include an AT-compatible communications package.
- It is necessary to avoid switching the main DTE between synchronous and asynchronous modes.

### **2.2.2 DTE for Commands via the DTE Port**

The DTE may communicate in either of the following character formats:

- 1 start bit, 7 data bits, odd or even parity, 1 stop bit, or
- 1 start bit, 8 data bits, no parity bit, 1 stop bit.

and at any one of the following baud rates:

- 19200, 9600, 4800, 2400, 1200, 600 or 300 bps.

The modem will automatically set itself to suit the DTE settings. (Other DTE formats and speeds can be accommodated, but the modem must be set to match the DTE by using the "U and /U commands.)

If you intend to use the same (local) DTE for both asynchronous data communication and for commands entered directly from the keyboard, it should be set to suit the requirements of the remote DTE with which you wish to communicate. (If these are not known, or if you want to access a number of different remote DTEs, set your DTE initially to 2400 bps, 7 data bits, even parity and 1 stop bit.)

### **2.2.3 DTEs for Commands via the Command Port**

In this configuration your **data DTE** may be synchronous or asynchronous, and will be connected to the modem's DTE port. It should be set as in Section 2.2.2 above.

For controlling the modem, you require a separate asynchronous **command terminal** with the following character format:

1 start bit, 7 data bits, even parity, 1 stop bit.

The data rate must be 2400 bps for a standalone modem or 1200 bps for a rackmount modem.

This terminal will be connected to the standalone modem's command port.

The command port for the rackmount modem is normally routed to the rack Controller Card. Appendix B contains details of how to route the command port via the DTE connector.

## **2.3 Installing the Standalone Modem**

### **2.3.1 Power Supply Connection**

**WARNING: Do not connect the modem to the mains socket or to the telephone line at this stage.**

The standard modem is supplied for use on 230 VAC 50-60Hz mains supplies. The voltage for which it is set is shown on the rear panel. Check that the voltage shown is correct for your mains supply before proceeding further. If it is not, refer to your supplier.

The mains cable from the modem is provided with a moulded plug for connection to a standard UK mains socket outlet. If this plug is not suitable for your socket, refer to the Appendix entitled 'Country-Specific Information' for details of how to change it. Do not use an adapter.

A special version of the modem is available for use on 24 to 48 VDC supplies. Details are given in the Appendix entitled 'Technical Guide'.

When you are sure the modem is correctly rated for your mains supply, ensure that the modem is switched off (0 position) then plug the mains lead into the mains supply. Do not switch on until all other connections have been made.

### **2.3.2 DTE Port Connection**

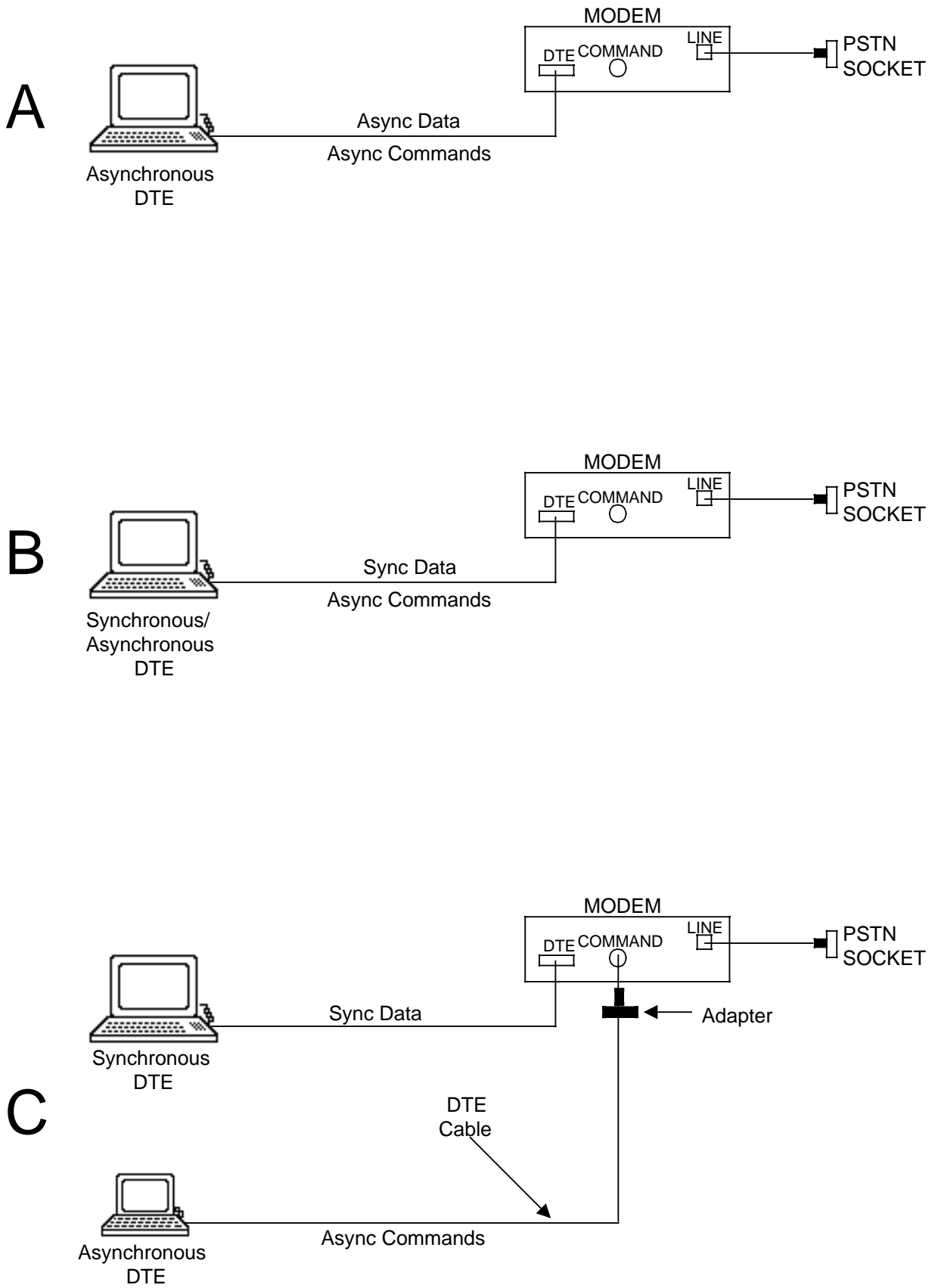
The way that you connect and use your DTE will depend on whether it operates asynchronously or synchronously, and whether you will use a separate command terminal.

#### **DTE for Asynchronous Data and Asynchronous Commands**

If you are transmitting data asynchronously, and intend to use the same DTE for both transmitting data and controlling the modem, see Figure 2-1A.

The DTE's serial port connection is usually via a 25-way D-type plug or socket (ISO 2110). You may need a cable to connect to the modem's DTE interface socket. Usually a straight-through (pin-to-pin) cable is suitable. If you have problems, you can determine the connection required by referring to the serial port information provided in the DTE's manual, and Appendix B of this manual.





**Figure 2-1 Standalone Modem Connections**

## **DTE for Synchronous Data and Asynchronous Commands**

To configure the modem, AT commands must be entered asynchronously. If the DTE can operate in both synchronous and asynchronous modes, it can be used for both transmitting data and controlling the modem, provided you switch it between modes when you swap between data and commands. See Figure 2-1B.

Connection is similar to the paragraph above.

## **DTE for Synchronous Data, and Command Terminal for Asynchronous Commands**

If you do not want to keep switching between modes, or if the DTE is a synchronous-only device, the separate command port must be used for entering commands. See Figure 2-1C and Section 2.3.3.

The synchronous data DTE must be connected via a cable to the modem's DTE interface connector. A straight-through 25-way cable as described for asynchronous data will be suitable for many synchronous terminals, but there are some which require a cross-over cable. If in doubt, consult the DTE's manual for connection details and compare with information in Appendix B of this manual.

This configuration can, of course, also be used for an asynchronous DTE plus a command terminal.

### **2.3.3 Command Port Connection**

The command port allows you to connect a separate asynchronous command terminal for entering commands, as shown in Figure 2-1C.

The port is provided on a stereo jack socket. An adapter cable to convert this to a standard 25-way D-type socket (ISO 2110) is provided (see Appendix B for details).

The data format and speed for the command port is fixed at 7 data bits, even parity, 2400 bps.

### **2.3.4 Telephone Line Connection**

The modem is supplied with a cord and standard plug ready for connection to a PSTN circuit. If the PSTN line is terminated with a different style socket, or a terminal block, contact the network provider to obtain a suitable socket (see the postcard at the rear of this manual).

Unless the separate earth connection has been used, the mains plug must **first** be inserted in a power outlet (to earth the modem), **before** connecting the modem to the PSTN line.

All connections to the PSTN network must be via a standard plug and socket, and must not be hard wired. See Figure 2-1.

If you want to use the modem on a leased line, refer to the Appendix entitled 'Technical Guide' for details of how to modify the modem. The modem configuration must also be changed for leased line operation: see Chapter 4 for details (AT command &L).

## **2.4 Installing the Rackmount Modem**

The modem should only be used in a rack system for which it has been designed and approved. Full installation details are given in the manual for the rack system.

### **2.4.1 Power Supply Connection**

The rackmount modem draws its power from the rack power supply. There is no power switch on the modem.

### **2.4.2 DTE Port Connection**

The connections for the modem's DTE port are via the 96-way connectors between the modem circuit board and the rack system. Connections to the DTE are made from the back of the rack. See the rack system manual for details of the pin allocations.

### **2.4.3 Command Port Connection**

The connections for the modem's command port are via the 96-way connectors between the modem circuit board and the rack system. Connections to the command terminal are made from the back of the rack. See the rack system manual for details of the pin allocations.

The format and speed for the command port is fixed at 7 data bits, even parity, 1200 bps.

### **2.4.4 Telephone Line Connection**

The modem's connections for the telephone line are via the 96-way connectors between the modem circuit board and the rack system. Connections to the telephone line are made from the back of the rack. See the rack system manual for details.

Note that in order to meet the EMC requirements for CE marking the ferrite core supplied with the card (Cray part number A172-000002) must be looped twice through the line cord at the rear of the frame corresponding to the slot into which the rackmount is fitted, and secured with a Tyrap. The core should be located approximately five inches from the end of the linecord nearest the frame.

## 2.5 Confidence Check

When the modem installation is complete, a brief confidence check may be carried out to check that the modem is functioning.

### 2.5.1 Standalone Modem

1. Ensure that the modem power switch is off.
2. Check that all the front panel buttons are out.
3. Push in and hold in the **DATA** button.
4. Switch on the modem power switch (while holding in the **DATA** button).
5. Keep the **DATA** button held in for 3 seconds then release it. The modem is now in its factory default condition. It will send a **RESTART** message to the command terminal.
6. Press in the **TEST** button and then the **AL** button. The modem will perform a self-test and the **RUN LED** will begin to flash.
7. Check the **DSR LED**. It should stay off permanently. If it flashes on, an error has been detected. In this case recheck the installation: if no mistakes are found refer to your supplier.
8. Press the **AL** and **TEST** buttons to release them.

### 2.5.2 Rackmount Modem

1. Fit the modem in the card guides of the rack, but not pushed fully home.
2. Check that all the front panel buttons are out.
3. Push in and hold in the **DA** button.
4. Push the modem firmly into the rack (while holding in the **DA** button).
5. Keep the **DA** button held in for 3 seconds then release it. The modem is now in its factory default condition. It will send a **RESTART** message to the command terminal.
6. Press in the **TE** button and then the **AL** button. The modem will perform a self-test and the **RUN LED** will begin to flash.
7. Check the **DSR LED**. It should stay off permanently. If it flashes on, an error has been detected. In this case recheck the installation: if no mistakes are found refer to your supplier.

8. Press the **AL** and **TE** buttons to release them.
9. Secure the modem in the rack.

This chapter covers basic details of how to set up your modem in a straightforward environment: how to control the modem from your DTE, and how to use the AT command language to make a call whilst the modem is in its default condition.

### 3.1 Starting Up

Before using the modem, ensure that it has been installed correctly as described in Chapter 2.

The factory default is configuration 0 (described in Section 4.1). As this is suitable for many uses on PSTN lines, you may not need to reconfigure the modem. If this is so, follow the procedure below, checking that the modem and command terminal (which may be the data DTE) respond as indicated.

1. Switch on the DTE and the command terminal.
2. Switch on the modem. The LED indicators on the front panel will reflect the status of the DTE interface. **TXD**, **RXD** and **OH** should be off.
3. Load the default factory configuration 0, as follows. Make sure all the buttons on the modem's front panel are **OUT**. Press the **LOAD (L)** button, press and release the **ENTER (I)** button, then release the **LOAD (L)** button.
4. Type the command **AT** on the command terminal keyboard and press **RETURN**. The message **OK** should be displayed on the screen.

If factory configuration 0 is not suitable for your operation, go to Chapter 4 to choose a more suitable configuration, and repeat the procedure above, using the buttons shown in Table 4-1 during step 3.

For example, to load configuration 10 (for a leased line), ensure that buttons **2** and **DIAL (D)** are in, and that all other buttons are out, before pressing **LOAD (L)**. After pressing **ENTER (I)**, release **LOAD (L)**, **2** and **DIAL (D)**.

## **3.2 Commanding the Modem**

### **3.2.1 The AT Command Set**

Your modem uses the 'AT' command set. These commands are used to exercise the powerful features of your modem, such as:

- Making user configurations.
- Saving telephone numbers in the modem's directory.
- Auto-dialling telephone numbers.
- Performing modem tests.

Section 3.3 provides an explanation of the AT command language with simple working examples. We recommend you to read this even if you have used AT commands before.

The AT commands are listed alphabetically in Chapter 8.

### **3.2.2 The V.25*bis* Command Set**

ITU-T has defined the V.25*bis* Recommendation for commands. However, it is much more limited than the AT command set, as it only covers dialling a telephone number. Your modem has been equipped with a V.25*bis* command set to make it compatible with hosts using software based on this language. Details are in Chapter 10.



## **3.3 The AT Command Format**

### **3.3.1 Basic Format**

AT (attention) is the prefix to commands to the modem. It must be typed:

**AT or at**

in all upper or all lower case (not mixed cases).

Carriage return (<CR>) is the terminator to commands, causing the modem to action them. It is produced by the **RETURN**, **ENTER** or | key on your DTE.

For example, if from your keyboard you type:

**AT<CR>**

the modem will respond with:

**OK**

AT by itself (followed by <CR>) is a command without any required action. Your modem responding with OK indicates that it has recognised the AT. This sequence is useful for checking that the modem is responding correctly.

### **3.3.2 Example Commands**

A useful command is \*C, which will display a summary of your modem's configuration. To execute this command, type:

**AT\*C<CR>**

Another useful command is \*S, which will display a summary of your modem's S-register settings (S-registers are discussed in Chapter 9). To execute this command, type:

**AT\*S<CR>**

### **3.3.3 Combining Commands**

If you wish to enter two or more commands, they can be combined on a single command line up to a maximum of 80 characters, for example:

**AT\*C\*S<CR>**

will display your modem's configuration and then the S-register summary.

You can use space characters between commands to increase their legibility, for instance:

```
AT *C *S<CR>
```

will give an identical response to the previous sequence.

The only commands that cannot form part of a command string are %D, %W, %X and %Z.

### **3.3.4 Repeating Commands**

You can cause the modem to repeat the last command sequence entered. If you now type:

```
A/
```

this will cause the previous AT \*C \*S sequence to be repeated. Note that this is an exception to the rule: it requires neither the AT prefix nor the <CR> terminator.

### **3.3.5 Editing a Command Line**

If you make a mistake when entering a command line, you can use the backspace key to reposition the cursor and you can then correct the mistake by overtyping.

### **3.3.6 Command Option Numbers**

Some commands require you to enter a number (often referred to as n) to specify one of a list of options (e.g. ATF4). If you omit the number, 0 is assumed (for example ATF is the same as ATF0).

### **3.3.7 The OK Response**

When a "configuration" command is successfully executed, the message OK is returned by the modem. No messages are generated with "dialling" commands.

### **3.3.8 Response Codes**

The result of entering commands can be sent to the terminal in various forms, as selected by certain commands (X and /S).

## 3.4 Making a Call

When you have successfully followed the start-up procedure in Section 3.1, the modem should be ready to make a call. (This section assumes the default values for all commands and S-registers.)

### 3.4.1 Dialling

To dial a number from your terminal, type **ATD** followed directly by the number you want to dial, then press **RETURN**. For example, to dial 0123 456789 type **ATD0123456789 <CR>**.

If you are connected to a PBX line, the number for an outside line (for example 9), must be inserted immediately before the number you want to dial. On some older PBXs you may need to insert a comma after the number for an outside line, to cause a delay before the modem continues dialling, for example **ATD9,0123456789 <CR>**.

### 3.4.2 Call Progress

The standalone modem includes a loudspeaker to enable you to monitor the progress of the connection. You will hear dial tone, followed by silence. If a modem answers the call, it will send answer tone (a continuous whistle). Once a connection is established, the speaker is automatically muted.

If the call is unsuccessful, you will hear the engaged or unobtainable tone, or the call being answered by a person speaking.

During the progress of the connection, various messages may appear on the screen:

**RINGING**                      while the ringing tone can be detected from the remote end.

**CONNECT**                    after successful connection to the number you are calling.

If there are problems, the following messages may appear:

**DIALTONE**                    if the modem detects dial tone when it is not expected. The modem then disconnects the call.

**NO DIALTONE**                if dial tone is not detected when the modem goes on line.

NO ANSWER	if the number you are calling does not answer. The modem disconnects automatically.
VOICE	if the call is answered but answer tone is not detected. This usually means that the call has been answered by a person rather than a modem.
NO CARRIER	if the modem you are calling 'answers' but cannot communicate with your modem.
BUSY	indicates that the modem has detected either an equipment- or number-busy tone. You can attempt to redial after a period.

While the modem is going through the connection procedure, the default configuration will cause the call to be aborted if you press any key.

### **3.4.3 Connection**

A successful connection allows your DTE to transfer data to and from the remote DTE.

If the call has connected you to a data service, a sign-on message should appear on the screen. For advice on what to do next, consult the documentation for the service accessed. Alternatively, disconnect the call as described below.

### **3.4.4 Disconnection**

If you are controlling the modem via an asynchronous DTE connected to the DTE port, two actions are required to disconnect a call:

1. Type **+++** (the escape sequence). This produces the message OK.
2. Now type **ATH** and press **RETURN**. This produces another OK.

If you are controlling the modem with a command terminal connected to the command port, commands (such as ATH) can be entered without having to use the **+++** escape sequence, so you can omit step 1 above.

After receiving OK to ATH, you can dial further numbers or activate any of the modem's other facilities.

## **3.5 Receiving Calls**

The modem is configured so that it will automatically answer an incoming call after two rings, and connect to the data DTE. When the call is completed, the modem will be ready to receive further calls, or for you to make outgoing calls.



# **PART 2**

## **ADVANCED OPERATION**

Chapter 4	Modem Configurations
Chapter 5	Advanced Configuration
Chapter 6	Operational Facilities
Chapter 7	Diagnostic Facilities
Chapter 8	The AT Commands
Chapter 9	The S-Registers
Chapter 10	V.25 <i>bis</i> Commands





## 4.1 Factory Configurations

### 4.1.1 Introduction

In order to be able to match a wide variety of situations, your modem incorporates very versatile communications capabilities, user features, and automatic facilities. These include, for example:

- data transmission speeds,
- data transmission methods (e.g. synchronous/asynchronous),
- data transmission protocols (e.g. methods of checking for errors),
- operational facilities (e.g. automatic dialling).

To simplify the task of configuring your modem, you can choose one of the twelve pre-configured "factory configurations" that cover standard applications. They are described in this section.

Should the factory configurations not be exactly what you need, you can choose the one nearest to your requirements, modify it as necessary, and store it as a "user configuration" in non-volatile memory, as described in Section 4.2.

Then, to configure your modem, you only need to load the appropriate configuration, either from the front panel as described in Section 4.3, or by command (&F) as described in Section 4.4.

## 4.1.2 Factory Configuration List

The following standard factory configurations are provided:

<b>Configuration</b>	<b>Description</b>
0	PSTN; asynchronous operation; DCD, DSR and CTS forced on; DTR ignored; active DTE port.
1	PSTN; asynchronous operation; DCD, DSR and CTS normal; DTR ignored; active DTE port.
2	PSTN; synchronous operation; DTR ignored; active command port.
3	PSTN; asynchronous operation; V.25 <i>bis</i> asynchronous commands; active command port (for AT).
4	PSTN; asynchronous operation; DTR autodial; active DTE port.
5	PSTN; synchronous operation; DTR autoanswer; active command port.
6	PSTN; synchronous operation; V.25 <i>bis</i> HDLC commands; active command port (for AT).
7	PSTN; synchronous operation; V.25 <i>bis</i> byte synchronous commands; active command port (for AT).
8	PSTN; synchronous operation; DTR autodial; active command port.
9	Leased line; synchronous operation; active command port.
10	Leased line; asynchronous operation; active command port.
11	PSTN; asynchronous operation; DTR autoanswer; active command port.

All configurations are suitable for PSTN operation except 9 and 10, which are only suitable for leased line (private wire) operation.

In most asynchronous applications, the DTE port will be used for both commands and data. However, the command port is enabled and can be used to enter commands at any time.

Configurations 3, 6 and 7 are suitable for DTEs which issue *V.25bis* dialling commands.

In the following explanations, the full specification of each configuration is shown as it would be presented on the DTE screen by use of the \*C command (see Chapter 8). For each parameter it shows the AT command code, the command name, and the selected option.

## **Control Signals**

The connection between the modem and the DTE includes a number of control signals, which are monitored by the front panel indicators (see Section 1.2.1).

The way these signals are used is controlled by the configuration in use. In the following descriptions of the configurations, each control signal is described as being in one of three modes. These are:

- |                  |  |
|------------------|--|
| <b>Normal</b>    | The signal is sent in the normal manner. In this mode, DTE signals must be controlled properly by the originating DTE.   |
| <b>Forced On</b> | This can apply to control signals originated by the modem. The modem sets the signal to the ON state at all times. It therefore has no meaning as a control signal, but is used to make the DTE function correctly.                                  |
| <b>Ignored</b>   | This can apply to control signals originated by the DTE. The modem ignores any changes in the signal state and behaves as if the signal were permanently ON. It is not necessary to have a connection to the signal's pin on the DTE port connector. |

Note that these modes can be changed by AT commands (described in subsequent chapters).

For details of the significance of the control signals, refer to ITU-T Recommendation V.24.

## 4.1.3 Factory Configuration Specifications

### Factory Configuration 0

Operation : PSTN, asynchronous, V.22bis.  
Rates : Primary 2400, fallback 1200.  
V.24 : DCD, DSR, CTS forced on; DTR ignored.  
Commands : Via DTE port.  
Typical Use : PC user to dial into a large database, while controlling the modem from a dumb terminal or PC.

F24	Communications Format	2400 V22bis	%E7	Remote Control	USER & TX/RX
X6	Result Codes	ALL	%F0	Fallback	DISABLED
&C0	DCD/DSR to DTE	FORCED	%K2	Modem Flow Cont	CTS
&G0	Guard Tone	DISABLED	%P0	Pass Through Cont	DISABLED
&I1	Constant Speed I/F	ENABLED	%Q0	Interface Control	DISABLED
&L0	Line Mode	2W DIAL-UP	%R1	RTS/CTS Control	OFF FOR CONNECT
&Q0	Operation Mode ASYNC	DTR IGNORED	%U0	User Flow Control	DISABLED
&S1	Switches	ENABLED	/A0	RTS Timeouts	DISABLED
&V0	Dumb Mode	DISABLED	/B1	Carrier Control	DISABLED
&X0	Timing Source	INTERNAL	/C1	Cable Equaliser	ENABLED
*G0	Calling Tone	DISABLED	/D0	DCD Threshold	-43dB
*H0	Hunt Confirm	DISABLED	/F21	Fallback Format	1200 V22
*O0	Over Speed Select	+1% -2.5%	/G1	T/2 Equaliser	ENABLED
*M0	Data Monitor	DISABLED	/S1	Extra Response	EXTENDED
*T1	DCD Timeouts	LOSS	/T6	Test Pattern	FOX ERR INJ
*V0	Command Mode	AT	/U0	Async Format	AUTOBAUD
*Y0	Breaks	IMMEDIATE	"A1	Lease Line Mode	ORIGINATE
%B0	Pin 23 Fallback	DISABLED	"U0	DTE Rate	AUTOBAUD
%C1	Compression	ENABLED	-E0	Error Correction	DISABLED

## Factory Configuration 1

Operation : PSTN, asynchronous, V.22bis.  
Rates : Primary 2400, fallback 1200.  
V.24 : DCD, DSR, CTS normal; DTR ignored.  
Commands : Via DTE port.  
Typical Use : With a computer system that does not require control signals to be forced on.

F24	Communications Format	2400 V22bis	%E7	Remote Control	USER & TX/RX
X6	Result Codes	ALL	%F0	Fallback	DISABLED
&C1	DCD/DSR to DTE	NORMAL	%K2	Modem Flow Cont	CTS
&G0	Guard Tone	DISABLED	%P0	Pass Through Cont	DISABLED
&I1	Constant Speed I/F	ENABLED	%Q0	Interface Control	DISABLED
&L0	Line Mode	2W DIAL-UP	%R0	RTS/CTS Control	ON FOR DATA
&Q0	Operation Mode ASYNC	DTR IGNORED	%U0	User Flow Control	DISABLED
&S1	Switches	ENABLED	/A0	RTS Timeouts	DISABLED
&V0	Dumb Mode	DISABLED	/B1	Carrier Control	DISABLED
&X0	Timing Source	INTERNAL	/C1	Cable Equaliser	ENABLED
*G0	Calling Tone	DISABLED	/D0	DCD Threshold	-43dB
*H0	Hunt Confirm	DISABLED	/F21	Fallback Format	1200 V22
*O0	Over Speed Select	+1% -2.5%	/G1	T/2 Equaliser	ENABLED
*M0	Data Monitor	DISABLED	/S1	Extra Response	EXTENDED
*T1	DCD Timeouts	LOSS	/T6	Test Pattern	FOX ERR INJ
*V0	Command Mode	AT	/U0	Async Format	AUTOBAUD
*Y0	Breaks	IMMEDIATE	"A1	Lease Line Mode	ORIGINATE
%B0	Pin 23 Fallback	DISABLED	"U0	DTE Rate	AUTOBAUD
%C1	Compression	ENABLED	-E0	Error Correction	DISABLED

## Factory Configuration 2

Operation : PSTN, synchronous, V.22bis.  
Rates : Primary 2400, fallback 1200.  
V.24 : Normal.  
Commands : Via command port.  
Typical Use : In a system where data is passed in synchronous format, and a separate command terminal initiates commands in asynchronous format via the command port.

F24	Communications Format	2400 V22bis	%E7	Remote Control	USER & TX/RX
X6	Result Codes	ALL	%F0	Fallback	DISABLED
&C1	DCD/DSR to DTE	NORMAL	%K0	Modem Flow Cont	DISABLED
&G0	Guard Tone	DISABLED	%P0	Pass Through Cont	DISABLED
&I0	Constant Speed I/F	DISABLED	%Q0	Interface Control	DISABLED
&L0	Line Mode	2W DIAL-UP	%R0	RTS/CTS Control	ON FOR DATA
&Q1	Operation Mode SYNC	ASYNC DIAL	%U0	User Flow Control	DISABLED
&S1	Switches	ENABLED	/A0	RTS Timeouts	DISABLED
&V2	Dumb Mode	ENABLED	/B1	Carrier Control	DISABLED
&X0	Timing Source	INTERNAL	/C1	Cable Equaliser	ENABLED
*G0	Calling Tone	DISABLED	/D0	DCD Threshold	-43dB
*H0	Hunt Confirm	DISABLED	/F21	Fallback Format	1200 V22
*O0	Over Speed Select	+1% -2.5%	/G1	T/2 Equaliser	ENABLED
*M0	Data Monitor	DISABLED	/S1	Extra Response	EXTENDED
*T1	DCD Timeouts	LOSS	/T5	Test Pattern	511 ERR INJ
*V0	Command Mode	AT	/U0	Async Format	AUTOBAUD
*Y0	Breaks	IMMEDIATE	"A1	Lease Line Mode	ORIGINATE
%B0	Pin 23 Fallback	DISABLED	"U0	DTE Rate	AUTOBAUD
%C1	Compression	ENABLED	-E0	Error Correction	DISABLED

### Factory Configuration 3

- Operation : PSTN, asynchronous, *V.22bis*.  
Rates : Primary 2400, fallback 1200.  
V.24 : DTR conforms to ITU-T 108/2 (call disconnected on loss of DTR).  
Commands : *V.25bis* via DTE port, AT via command port.  
Typical Use : Where the DTE operates the *V.25bis* call control protocol in asynchronous mode.

F24	Communications Format	2400 V22bis	%E7	Remote Control	USER & TX/RX
X4	Result Codes	ALL	%F0	Fallback	DISABLED
&C1	DCD/DSR to DTE	NORMAL	%K2	Modem Flow Cont	CTS
&G0	Guard Tone	DISABLED	%P0	Pass Through Cont	DISABLED
&I1	Constant Speed I/F	ENABLED	%Q0	Interface Control	DISABLED
&L0	Line Mode	2W DIAL-UP	%R0	RTS/CTS Control	ON FOR DATA
&Q6	Operation Mode ASYNC	MANUAL DIAL	%U0	User Flow Control	DISABLED
&S1	Switches	ENABLED	/A0	RTS Timeouts	DISABLED
&V0	Dumb Mode	DISABLED	/B1	Carrier Control	DISABLED
&X0	Timing Source	INTERNAL	/C1	Cable Equaliser	ENABLED
*G0	Calling Tone	DISABLED	/D0	DCD Threshold	-43dB
*H0	Hunt Confirm	DISABLED	/F21	Fallback Format	1200 V22
*O0	Over Speed Select	+1% -2.5%	/G1	T/2 Equaliser	ENABLED
*M0	Data Monitor	DISABLED	/S1	Extra Response	EXTENDED
*T1	DCD Timeouts	LOSS	/T6	Test Pattern	FOX ERR INJ
*V1	Command Mode	V25bis ASYNC	/U7	Async Format	8/N/1
*Y0	Breaks	IMMEDIATE	"A1	Lease Line Mode	ORIGINATE
%B0	Pin 23 Fallback	DISABLED	"U0	DTE Rate	AUTOBAUD
%C1	Compression	ENABLED	-E0	Error Correction	DISABLED

## Factory Configuration 4

Operation : PSTN, asynchronous, V.22bis.  
Rates : Primary 2400, fallback 1200.  
V.24 : Normal.  
Commands : Via DTE port.  
Typical Use : Dialling is initiated when the terminal raises DTR: the telephone number to be used must be stored in location N0, and the modem will disconnect on loss of DTR.

F24	Communications Format	2400 V22bis	%E7	Remote Control	USER & TX/RX
X4	Result Codes	ALL	%F0	Fallback	DISABLED
&C1	DCD/DSR to DTE	NORMAL	%K2	Modem Flow Cont	CTS
&G0	Guard Tone	DISABLED	%P0	Pass Through Cont	DISABLED
&I1	Constant Speed I/F	ENABLED	%Q0	Interface Control	DISABLED
&L0	Line Mode	2W DIAL-UP	%R0	RTS/CTS Control	ON FOR DATA
&Q5	Operation Mode ASYNC	DTR DIAL	%U0	User Flow Control	DISABLED
&S1	Switches	ENABLED	/A0	RTS Timeouts	DISABLED
&V0	Dumb Mode	DISABLED	/B1	Carrier Control	DISABLED
&X0	Timing Source	INTERNAL	/C1	Cable Equaliser	ENABLED
*G0	Calling Tone	DISABLED	/D0	DCD Threshold	-43dB
*H0	Hunt Confirm	DISABLED	/F21	Fallback Format	1200 V22
*O0	Over Speed Select	+1% -2.5%	/G1	T/2 Equaliser	ENABLED
*M0	Data Monitor	DISABLED	/S1	Extra Response	EXTENDED
*T1	DCD Timeouts	LOSS	/T6	Test Pattern	FOX ERR INJ
*V0	Command Mode	AT	/U7	Async Format	8/N/1
*Y0	Breaks	IMMEDIATE	"A1	Lease Line Mode	ORIGINATE
%B0	Pin 23 Fallback	DISABLED	"U0	DTE Rate	AUTOBAUD
%C1	Compression	ENABLED	-E0	Error Correction	DISABLED



## Factory Configuration 5

Operation : PSTN, synchronous, V.22bis.  
Rates : Primary 2400, fallback 1200.  
V.24 : Normal.  
Commands : From separate terminal via command port.  
Typical Use : Mainly suitable for use at an answering site, where the host controls autoanswer by DTR.

F24	Communications Format	2400 V22bis	%E7	Remote Control	USER & TX/RX
X6	Result Codes	ALL	%F0	Fallback	DISABLED
&C1	DCD/DSR to DTE	NORMAL	%K0	Modem Flow Cont	DISABLED
&G0	Guard Tone	DISABLED	%P0	Pass Through Cont	DISABLED
&I0	Constant Speed I/F	DISABLED	%Q0	Interface Control	DISABLED
&L0	Line Mode	2W DIAL-UP	%R0	RTS/CTS Control	ON FOR DATA
&Q3	Operation Mode SYNC	MANUAL DIAL	%U0	User Flow Control	DISABLED
&S1	Switches	ENABLED	/A0	RTS Timeouts	DISABLED
&V2	Dumb Mode	ENABLED	/B1	Carrier Control	DISABLED
&X0	Timing Source	INTERNAL	/C1	Cable Equaliser	ENABLED
*G0	Calling Tone	DISABLED	/D0	DCD Threshold	-43dB
*H0	Hunt Confirm	DISABLED	/F21	Fallback Format	1200 V22
*O0	Over Speed Select	+1% -2.5%	/G1	T/2 Equaliser	ENABLED
*M0	Data Monitor	DISABLED	/S1	Extra Response	EXTENDED
*T1	DCD Timeouts	LOSS	/T6	Test Pattern	511 ERR INJ
*V0	Command Mode	AT	/U7	Async Format	AUTOBAUD
*Y0	Breaks	IMMEDIATE	"A1	Lease Line Mode	ORIGINATE
%B0	Pin 23 Fallback	DISABLED	"U0	DTE Rate	AUTOBAUD
%C1	Compression	ENABLED	-E0	Error Correction	DISABLED

## Factory Configuration 6

Operation : PSTN, synchronous, *V.22bis*.  
Rates : Primary 2400, fallback 1200.  
V.24 : Normal.  
Commands : *V.25bis* HDLC via DTE port, AT via command port.  
Typical Use : Where *V.25bis* commands are to be entered synchronously via the DTE port, but AT commands may be entered through the command port. The modem operates synchronously once a call has been established.

F24	Communications Format	2400 V22bis	%E7	Remote Control	USER & TX/RX
X6	Result Codes	ALL	%F0	Fallback	DISABLED
&C1	DCD/DSR to DTE	NORMAL	%K0	Modem Flow Cont	DISABLED
&G0	Guard Tone	DISABLED	%P0	Pass Through Cont	DISABLED
&I0	Constant Speed I/F	DISABLED	%Q0	Interface Control	DISABLED
&L0	Line Mode	2W DIAL-UP	%R0	RTS/CTS Control	ON FOR DATA
&Q3	Operation Mode SYNC	MANUAL DIAL	%U0	User Flow Control	DISABLED
&S1	Switches	ENABLED	/A0	RTS Timeouts	DISABLED
&V1	Dumb Mode	+++ IGNORED	/B1	Carrier Control	DISABLED
&X0	Timing Source	INTERNAL	/C1	Cable Equaliser	ENABLED
*G0	Calling Tone	DISABLED	/D0	DCD Threshold	-43dB
*H0	Hunt Confirm	DISABLED	/F21	Fallback Format	1200 V22
*O0	Over Speed Select	+1% -2.5%	/G1	T/2 Equaliser	ENABLED
*M0	Data Monitor	DISABLED	/S1	Extra Response	EXTENDED
*T1	DCD Timeouts	LOSS	/T5	Test Pattern	511 ERR INJ
*V3	Command Mode	V25Bis HDLC	/U0	Async Format	AUTOBAUD
*Y0	Breaks	IMMEDIATE	"A1	Lease Line Mode	ORIGINATE
%B0	Pin 23 Fallback	DISABLED	"U0	DTE Rate	AUTOBAUD
%C1	Compression	ENABLED	-E0	Error Correction	DISABLED

## Factory Configuration 7

Operation : PSTN, synchronous, V.22bis.  
Rates : Primary 2400, fallback 1200.  
V.24 : Normal.  
Commands : V.25bis byte synchronous via DTE port, AT via command port.  
Typical Use : Where V.25bis commands are to be initiated in V.25bis byte synchronous command format via the main data channel.

F24	Communications Format	2400 V22bis	%E7	Remote Control	USER & TX/RX
X6	Result Codes	ALL	%F0	Fallback	DISABLED
&C1	DCD/DSR to DTE	NORMAL	%K0	Modem Flow Cont	DISABLED
&G0	Guard Tone	DISABLED	%P0	Pass Through Cont	DISABLED
&I0	Constant Speed I/F	DISABLED	%Q0	Interface Control	DISABLED
&L0	Line Mode	2W DIAL-UP	%R0	RTS/CTS Control	ON FOR DATA
&Q3	Operation Mode SYNC	MANUAL DIAL	%U0	User Flow Control	DISABLED
&S1	Switches	ENABLED	/A0	RTS Timeouts	DISABLED
&V1	Dumb Mode	+++ IGNORED	/B1	Carrier Control	DISABLED
&X0	Timing Source	INTERNAL	/C1	Cable Equaliser	ENABLED
*G0	Calling Tone	DISABLED	/D1	DCD Threshold	-43dB
*H0	Hunt Confirm	DISABLED	/F21	Fallback Format	1200 V22
*O0	Over Speed Select	+1% -2.5%	/G1	T/2 Equaliser	ENABLED
*M0	Data Monitor	DISABLED	/S1	Extra Response	EXTENDED
*T1	DCD Timeouts	LOSS	/T5	Test Pattern	511 ERR INJ
*V2	Command Mode	V25Bis BISYNC	/U0	Async Format	AUTOBAUD
*Y0	Breaks	IMMEDIATE	"A1	Lease Line Mode	ORIGINATE
%B0	Pin 23 Fallback	DISABLED	"U0	DTE Rate	AUTOBAUD
%C1	Compression	ENABLED	-E0	Error Correction	DISABLED

## Factory Configuration 8

Operation : PSTN, synchronous, *V.22bis*.  
Rates : Primary 2400, fallback 1200.  
V.24 : Normal.  
Commands : From a separate terminal via the command port.  
Typical Use : Data is entered synchronously at 2400 bps through the DTE port. Dialling is initiated when the terminal raises DTR. The telephone number to be used must be stored in location N0.

F24	Communications Format	2400 V22bis	%E7	Remote Control	USER & TX/RX
X6	Result Codes	ALL	%F0	Fallback	DISABLED
&C1	DCD/DSR to DTE	NORMAL	%K0	Modem Flow Cont	DISABLED
&G0	Guard Tone	DISABLED	%P0	Pass Through Cont	DISABLED
&I0	Constant Speed I/F	DISABLED	%Q0	Interface Control	DISABLED
&L0	Line Mode	2W DIAL-UP	%R0	RTS/CTS Control	ON FOR DATA
&Q2	Operation Mode SYNC	DTR DIAL	%U0	User Flow Control	DISABLED
&S1	Switches	ENABLED	/A0	RTS Timeouts	DISABLED
&V2	Dumb Mode	ENABLED	/B1	Carrier Control	DISABLED
&X0	Timing Source	INTERNAL	/C1	Cable Equaliser	ENABLED
*G0	Calling Tone	DISABLED	/D0	DCD Threshold	-43dB
*H0	Hunt Confirm	DISABLED	/F21	Fallback Format	1200 V22
*O0	Over Speed Select	+1% -2.5%	/G1	T/2 Equaliser	ENABLED
*M0	Data Monitor	DISABLED	/S1	Extra Response	EXTENDED
*T1	DCD Timeouts	LOSS	/T5	Test Pattern	511 ERR INJ
*V0	Command Mode	AT	/U0	Async Format	AUTOBAUD
*Y0	Breaks	IMMEDIATE	"A1	Lease Line Mode	ORIGINATE
%B0	Pin 23 Fallback	DISABLED	"U0	DTE Rate	AUTOBAUD
%C1	Compression	ENABLED	-E0	Error Correction	DISABLED

## Factory Configuration 9

Operation : Leased line, synchronous, V.22bis.  
Rates : Primary 2400, fallback 1200.  
V.24 : Normal.  
Commands : From a separate terminal via the command port.  
Typical Use : The **ANS** button on the front panel controls the answer or originate mode for full-duplex operation. The control signal LEDs indicate the state of the leased line.

F24	Communications Format	2400 V22bis	%E7	Remote Control	USER & TX/RX
X6	Result Codes	ALL	%F0	Fallback	DISABLED
&C1	DCD/DSR to DTE	NORMAL	%K0	Modem Flow Cont	DISABLED
&G0	Guard Tone	DISABLED	%P0	Pass Through Cont	DISABLED
&I0	Constant Speed I/F	DISABLED	%Q0	Interface Control	DISABLED
&L1	Line Mode	2W LEASED	%R0	RTS/CTS Control	ON FOR DATA
&Q3	Operation Mode SYNC	MANUAL DIAL	%U0	User Flow Control	DISABLED
&S1	Switches	ENABLED	/A0	RTS Timeouts	DISABLED
&V2	Dumb Mode	ENABLED	/B1	Carrier Control	DISABLED
&X0	Timing Source	INTERNAL	/C1	Cable Equaliser	ENABLED
*G0	Calling Tone	DISABLED	/D1	DCD Threshold	-33dB
*H0	Hunt Confirm	DISABLED	/F21	Fallback Format	1200 V22
*O0	Over Speed Select	+1% -2.5%	/G1	T/2 Equaliser	ENABLED
*M0	Data Monitor	DISABLED	/S1	Extra Response	EXTENDED
*T1	DCD Timeouts	LOSS	/T5	Test Pattern	511 ERR INJ
*V1	Command Mode	AT	/U0	Async Format	AUTOBAUD
*Y0	Breaks	IMMEDIATE	"A1	Lease Line Mode	ORIGINATE
%B0	Pin 23 Fallback	DISABLED	"U0	DTE Rate	AUTOBAUD
%C1	Compression	ENABLED	-E0	Error Correction	DISABLED

## Factory Configuration 10

Operation : Leased line, synchronous, *V.22bis*.  
Rates : Primary 2400, fallback 1200.  
V.24 : Normal.  
Commands : From a separate terminal via the command port.  
Typical Use : The **ANS** button on the front panel controls the answer or originate mode for full-duplex operation. The control signal LEDs indicate the state of the leased line.

F24	Communications Format	2400 V22bis	%E7	Remote Control	USER & TX/RX
X6	Result Codes	ALL	%F0	Fallback	DISABLED
&C1	DCD/DSR to DTE	NORMAL	%K2	Modem Flow Cont	CTS
&G0	Guard Tone	DISABLED	%P0	Pass Through Cont	DISABLED
&I1	Constant Speed I/F	ENABLED	%Q0	Interface Control	DISABLED
&L1	Line Mode	2W LEASED	%R0	RTS/CTS Control	ON FOR DATA
&Q0	Operation Mode ASYNC	DTR IGNORED	%U0	User Flow Control	DISABLED
&S1	Switches	ENABLED	/A0	RTS Timeouts	DISABLED
&V0	Dumb Mode	DISABLED	/B1	Carrier Control	DISABLED
&X0	Timing Source	INTERNAL	/C1	Cable Equaliser	ENABLED
*G0	Calling Tone	DISABLED	/D1	DCD Threshold	-33dB
*H0	Hunt Confirm	DISABLED	/F21	Fallback Format	1200 V22
*O0	Over Speed Select	+1% -2.5%	/G1	T/2 Equaliser	ENABLED
*M0	Data Monitor	DISABLED	/S1	Extra Response	EXTENDED
*T1	DCD Timeouts	LOSS	/T6	Test Pattern	FOX ERR INJ
*V0	Command Mode	AT	/U0	Async Format	AUTOBAUD
*Y0	Breaks	IMMEDIATE	"A1	Lease Line Mode	ORIGINATE
%B0	Pin 23 Fallback	DISABLED	"U0	DTE Rate	AUTOBAUD
%C1	Compression	ENABLED	-E0	Error Correction	DISABLED

## Factory Configuration 11

Operation : PSTN, asynchronous, V.22bis.  
Rates : Primary 2400, fallback 1200.  
V.24 : Normal.  
Commands : DTE port.  
Typical Use : Suitable for autoanswer applications: the modem will not answer a call without DTR being present.

F24	Communications Format	2400 V22bis	%E7	Remote Control	USER & TX/RX
X6	Result Codes	ALL	%F0	Fallback	DISABLED
&C1	DCD/DSR to DTE	NORMAL	%K2	Modem Flow Cont	CTS
&G0	Guard Tone	DISABLED	%P0	Pass Through Cont	DISABLED
&I1	Constant Speed I/F	ENABLED	%Q0	Interface Control	DISABLED
&L0	Line Mode	2W DIAL-UP	%R0	RTS/CTS Control	ON FOR DATA
&Q6	Operation Mode ASYNC	MANUAL DIAL	%U0	User Flow Control	DISABLED
&S1	Switches	ENABLED	/A0	RTS Timeouts	DISABLED
&V0	Dumb Mode	DISABLED	/B1	Carrier Control	DISABLED
&X0	Timing Source	INTERNAL	/C1	Cable Equaliser	ENABLED
*G0	Calling Tone	DISABLED	/D0	DCD Threshold	-43dB
*H0	Hunt Confirm	DISABLED	/F21	Fallback Format	1200 V22
*O0	Over Speed Select	+1% -2.5%	/G1	T/2 Equaliser	ENABLED
*M0	Data Monitor	DISABLED	/S1	Extra Response	EXTENDED
*T1	DCD Timeouts	LOSS	/T6	Test Pattern	FOX ERR INJ
*V0	Command Mode	AT	/U0	Async Format	AUTOBAUD
*Y0	Breaks	IMMEDIATE	"A1	Lease Line Mode	ORIGINATE
%B0	Pin 23 Fallback	DISABLED	"U0	DTE Rate	AUTOBAUD
%C1	Compression	ENABLED	-E0	Error Correction	DISABLED

## **4.2 User Configurations**

You can create up to four special customised user configurations and store them in the modem's non-volatile memory.

To achieve this:

1. Choose the factory configuration that is closest to the configuration you want (see Section 4.1) and load it as described in Section 4.3.
2. Amend the configuration with the appropriate command(s) – see Chapters 5 and 8.
3. Store the amended configuration as a user configuration, as described in Section 4.4.



### 4.3 Loading a Configuration from the Front Panel

1. Switch on your modem.
2. Press the **LOAD** button.
3. Select your configuration by pressing the appropriate buttons shown in Table 4-1.

CONFIGURATION	BUTTON SELECTION			
	4	2	1	DIAL
Factory 0	Out	Out	Out	Out
Factory 1	Out	Out	In	Out
Factory 2	Out	In	Out	Out
Factory 3	Out	In	In	Out
Factory 4	In	Out	Out	Out
Factory 5	In	Out	In	Out
Factory 6	In	In	Out	Out
Factory 7	In	In	In	Out
Factory 8	Out	Out	Out	In
Factory 9	Out	Out	In	In
Factory 10	Out	In	Out	In
Factory 11	Out	In	In	In
User 0	In	Out	Out	In
User 1	In	Out	In	In
User 2	In	In	Out	In
User 3	In	In	In	In

**Table 4-1 Loading a Configuration**

4. Press and release the **ENTER** button. The **DSR** indicator will flash to confirm that the configuration has been loaded.
5. Return all other buttons to the 'Out' position.

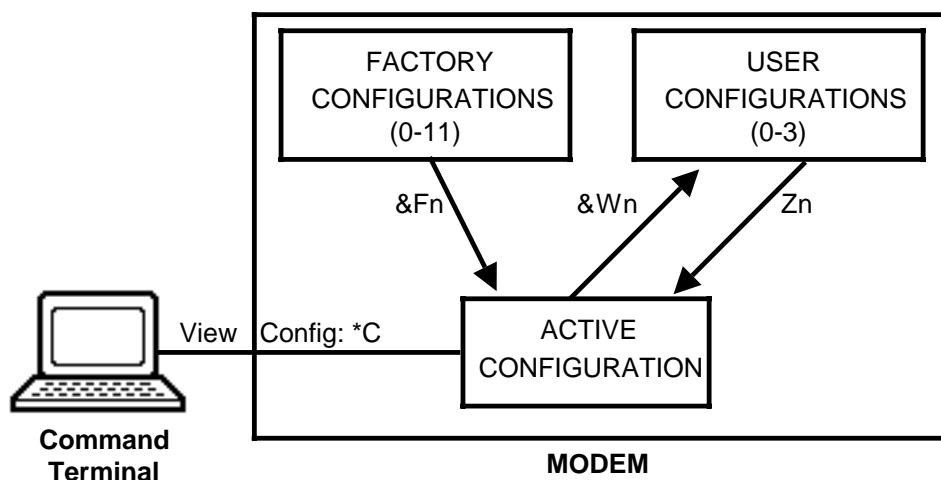
Configurations can also be manipulated by AT commands – see Section 4.4.

## 4.4 Manipulating Modem Configurations

The method of loading a factory or user configuration from the front panel was described in Section 4.3. This section describes how to "recall" and "save" configurations by the following commands.

&F	Recall factory configuration
Z	Recall user configuration
&W	Save user configuration
*C	Display active configuration

A diagrammatic representation of the configurations and commands is given in Figure 4-1.



**Figure 4-1 Modem Software Configurations**

The "active" configuration is the one in operation. It is accessible from the command terminal. The active configuration is automatically retained in non-volatile memory when the modem is switched off.

You can recall a configuration (factory or user) from memory to become the active configuration. You can then change and save the active configuration to become a user configuration (0-3) in memory.

The relevant commands are summarised in Table 4-2.

Examples of displays obtainable by the \*C command were given in Section 4.1.3.

CONFIGURATION	RECALL COMMAND	SAVE COMMAND
Factory 0	&F0	—
Factory 1	&F1	—
Factory 2	&F2	—
Factory 3	&F3	—
Factory 4	&F4	—
Factory 5	&F5	—
Factory 6	&F6	—
Factory 7	&F7	—
Factory 8	&F8	—
Factory 9	&F9	—
Factory 10	&F10	—
Factory 11	&F11	—
User 0	Z0	&W0
User 1	Z1	&W1
User 2	Z2	&W2
User 3	Z3	&W3

**Table 4-2 Configuration Recall and Save Commands**

## 4.5 Resetting the Modem

You can reset the modem to its original default state as follows:

1. Switch off the modem.
2. Hold the **DATA** button depressed.
3. Switch on the modem.
4. Release the **DATA** button after 3 seconds.

The message:

**RESTART**

will be displayed on a terminal connected to the command port.

This clears all user configurations and telephone numbers from memory, makes factory configuration 0 the active configuration, and allows you to start afresh.

This chapter tells you which commands are relevant for various aspects of modem configuration. Each command is fully described in Chapter 8.

## 5.1 Display and Modem Mode Commands

These commands are used to determine the kind of display produced by various functions, and to activate/deactivate various modes in which the modem may operate.

E	Echo commands
"H	Keyboard abort disable
M	Speaker control
Q	Quiet mode
&S	Front panel switch control
X	Response codes
/S	Extra response codes
V	Verbose response codes
&V	Dumb mode

## 5.2 DTE Interface Commands

These commands are used to determine how the modem interacts with the DTE, and with V.24 control signals on the DTE interface.

The commands directly affecting the interface are:

&C	DSR and DCD control
&I	Constant speed interface
&Q	DTR dialling control
%R	RTS/CTS control
/U	User asynchronous commands
"U	DTE rate
*W	DSR control
/O	DSR control while tests active

Various timeout control commands affect the interface:

/A	RTS timeout control
*B	Carrier and RTS timeout period
*M	Inactivity data monitor
*T	Carrier timeouts

## 5.3 Modulation Format

Commands enable you to select suitable primary and fallback modulation formats for your modem.

The commands are:

F	Communications format
/F	Fallback format
%B	Pin 23 fallback request
%F	Enable/disable fallback
&X	Modem timing (synchronous)

### Primary Format

The F command is used to select the communications format that is to be used for the primary data rate.

Using the command F0, your modem can be set to automatically attempt to match the transmission mode of the remote modem. This facility is known as autosense. For autosense to work, the remote modem must be compatible with at least one of the modulation schemes of your modem. Autosense will not work if the remote modem is set to operate at 600 bps (V.22).

If you do not require autosense, you must select another option of the F command to set the transmission mode to the particular requirement.

### Fallback Format

The fallback commands /F, %B and %F are used to select and enable/disable a fallback communications format as an alternative to the main communications format.

Fallback operation may be selected by the following methods:

- Pressing the **FB** button on the front panel.
- Using the %F command.
- Using the %B command to determine the way the modem will react to pin 23 on the V.24 interface.

You can see whether the modem is in primary or fallback mode by using the \*C command and checking the display (%F0 = primary, %F1 = fallback).

## 5.4 Line Commands

These commands are used to select suitable modem/line characteristics.

/C	Cable equaliser
&G	Guard tones
/G	T/2 equaliser
*Y	Break mode control
"R	Manual retrain
*O	Overspeed



## 5.5 Leased Line (Private Circuit) Operation

The modem is supplied ready for use on the PSTN. To use it on a leased line, it is first necessary for a suitably qualified engineer to change some internal connections and switch positions (see the Appendix entitled 'Technical Guide'). These settings must, of course, be reset before reverting to PSTN operation.

&L	Line type
"A	Originate or Answer mode
/D	Carrier threshold

### Originate/Answer Mode

For leased line operation, one modem must be set to 'originate' mode and the other to 'answer' mode. By default, the modems are in originate mode. You must set one to answer mode either with the "A command or by pressing the **ANS** button on the front panel.

(In PSTN mode, originate or answer status is determined automatically according to whether a modem is originating, or answering a call.)

## 5.6 Flow Control

Flow control is the term used to describe procedures which limit the flow of data between two devices to a rate acceptable to the receiving device.

However, the two devices must be in complete agreement over the flow control method used, so that information is not lost or corrupted.

Flow control commands are:

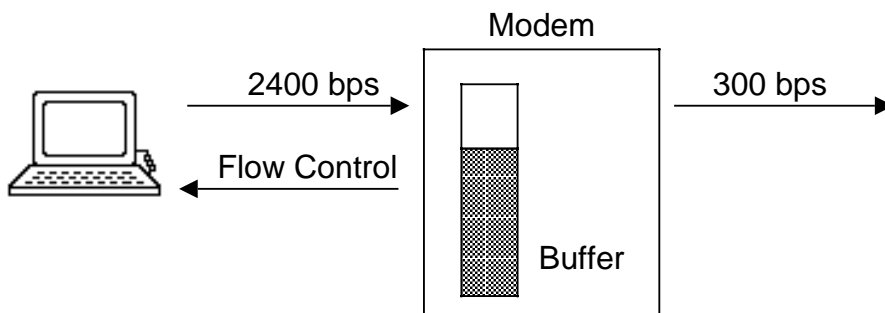
- %K Modem flow control
- %U User flow control
- %P Pass-through flow controls

### Modem Flow Control

Most modems have a buffer which stores data, received from the DTE, waiting to be transmitted. If the rate at which the modem is transmitting is the same as the rate at which data is being received from the DTE, the buffer never overflows and there is no problem.

If, however, the modem's transmission rate is less than the rate at which data is received from the DTE, then without flow control the buffer would soon overflow.

In the following example, the terminal is sending data to the modem at 2400 bps and the modem is transmitting the data on at 300 bps.



With %K enabled, the terminal stops sending data when the modem's buffer is 75% full, and does not resume until the buffer is only 25% full. In this way the buffer never overflows.

There are two main modem flow control procedures commonly used in data communications, both of which are supported by your modem:

XON/XOFF flow control uses two special characters to instruct the sending device to start and stop. This is the most frequently-used

system. The characters used to signal XON/XOFF can be changed to suit special requirements.

RTS/CTS flow control uses hardware signals in the modem/DTE interface to signal the start-sending and stop-sending conditions. This type of control is useful when the data being transmitted is not in ASCII form, to avoid data bytes being misinterpreted as XON/XOFF commands.

In the factory-configured setting, command %K2 is activated. This enables the modem to use CTS, to flow-control data coming from the DTE, so that the DTE speed may be set at a higher rate than the telephone line speed.

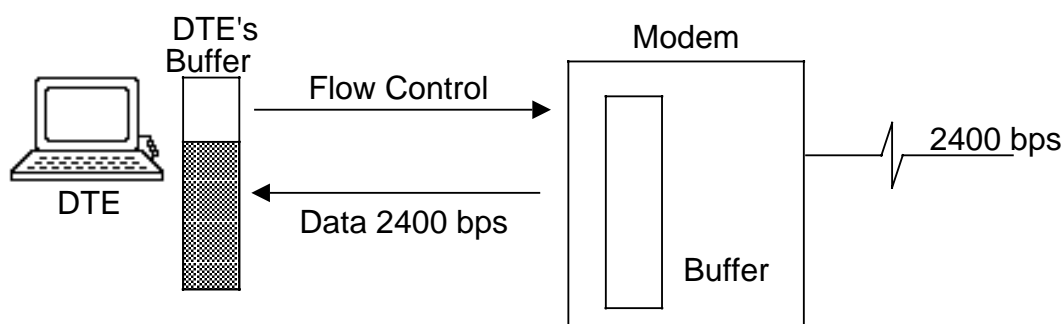
The flow control ON character is held in register S39, and the flow control OFF character is held in register S40.

The factory default for S39 is 11 hex (DC1, Ctrl-Q), and for S40 it is 13 hex (DC3, Ctrl-S). These are the standard XON/XOFF characters which are generally used for modem flow control.

## User Flow Control

User flow control is required when the rate at which data is received from the line is greater than the rate at which the DTE can process it.

In the following example, the modem is receiving data from the line at 2400 bps, but the DTE can only process data at a lower rate.



With %U enabled, the DTE controls when it can accept characters from the modem. However, note that there is no control over data being received by the modem from the line, so if data is being received **continuously** at a greater rate than can be accepted by the DTE, the modem's receive buffer will fill, causing data to be lost.

The flow control ON character is held in register S49, and the flow control OFF character is held in register S50. The factory default for S49 is 11 hex (DC1, Ctrl-Q), and for S50 it is 13 hex (DC3, Ctrl-S). These are the standard XON/XOFF characters which are generally used for user flow control.

## 5.7 Error Correction and Data Compression

In synchronous operation, the data being transmitted/received is protected from the effects of line errors by the data transmission protocol used.

As asynchronous working does not have this built-in protection (although it may include a simple parity check), it is advisable to use error-correction for long distance fast transmission.

In addition to error correction, the modem also provides data compression.

The commands are:

-E	Error correction format
%C	Data compression

### Error Correction

This modem includes error correction options for use when in *V.22bis* or *V.22* modes. The error correction provided is ITU-T V.42 using the new LAPM protocol. It will also support the widely-adopted MNP standard up to Class 4.

LAPM protocol is preferred to MNP because it has the following advantages:

- faster to connect,
- faster response in interactive communications,
- more flexible block sizes,
- an international standard.

ITU-T V.42 error correction, using LAPM protocol, is especially recommended for:

- transmission over long distances or bad lines,
- bulk data transmissions requiring greater throughput.

### Data Compression

Data compression enables certain types of data to be compressed by a ratio of up to 4:1. *V.42bis* will operate with all types of asynchronous data transmission. It intelligently monitors the compression performance, and if it detects a situation where data compression is not effective (for instance a file which has already been compressed), it will automatically

switch off. The monitoring continues and *V.42bis* will switch itself on again when it is able effectively to compress the data being transmitted. The MNP 5 standard is also supported for compatibility with older modems.

The %C command controls the use of *V.42bis* and MNP5. With compression enabled (%C1), the modem will try to use *V.42bis* or MNP5 depending on the setting of the -E command and the capability of the remote modem.

In order to make effective use of data compression, the asynchronous communications package must run at a higher speed than the rate at which data is transferred between the modems. A speed of 19,200 bps is recommended.

The performance of *V.42bis* can be optimised for particular types of data transmission by the S-registers S93 and S94.

## 5.8 Remote Configuration

Remote configuration is available in V.22*bis* or V.22 modes. The commands enable you to obtain a copy of a remote modem's active configuration, alter it, and send it back to become the remote modem's new active configuration. Security control may be used to prevent unauthorised remote configuration (see Section 5.9).

The commands involved are:

<b>%E</b>	Remote configuration control
<b>%X</b>	Remote up-load
<b>%Z</b>	Modify the remote configuration
<b>%W</b>	Stop modifying the remote configuration
<b>%D</b>	Remote down-load

To illustrate the use of the remote configuration commands, the general procedure is given below.

If necessary, use the escape sequence (default **+++**) to enter command mode. You must also ensure that the setting of command **%E** allows remote configuration.

Then, use the following commands:

<b>ATDnnnnn</b>	Dial remote number.
<b>AT%X</b>	Up-load a copy of the remote modem's current active configuration. After the message <b>MONITOR GRANTED</b> is displayed, you may enter the next command.
<b>AT%Z</b>	Allow the remote configuration to be edited.  At this point you may confirm that you are in remote configuration edit mode by using the <b>*C</b> command – the configuration table will be headed <b>REMOTE CONFIGURATION</b> .  You may now change items in the configuration by using the relevant commands, followed by:
<b>AT%W</b>	Return to local configuration and control.
<b>AT%D</b>	Down-load the new configuration to the remote modem.

If the above operation has been successful, the message **RECONFIGURE GRANTED** will be displayed and the line will be disconnected.

## 5.9 Security Control

Your modem incorporates three levels of security: Level 1, Level 2 and Dialback.

The commands involved are:

"E	Security control level
"Z	Password store
"W	Key store
S43=	Enable/disable dialback security

### Level 1 and Level 2 Security

Level 1 security is used to activate security control between a central site modem and a remote modem. The passwords and keys of both modems are exchanged. If the passwords are identical on both modems, the link is authenticated.

Level 2 security is used to activate security control where a modem is being used in conjunction with a Network 16 Controller Card. Having validated the passwords between the two modems, the answering modem then sends it, along with the key, to the Controller Card for further validation before the link is authenticated.

If the password (or key and password) is specified in the dial string using <Ctrl-G> or <Ctrl-I> , then that password will override the stored password for a call made using that dial string.

### Dialback Security

As the implementation of dial-up services increases, the security of those services becomes a greater issue. This modem has addressed the issue by providing dialback security on the modem.

Dialback security offers two distinct benefits to the user:

- A high level of security, achieved by only allowing users who are at pre-determined locations to be connected.
- The ability to control all costs centrally by initiating the call from the host site.

Using dialback security, the answering (central site) modem can verify incoming calls against a list of passwords, and then dial the caller using the number which is stored against the password.



The caller's modem can be any modem compatible with the answering modem. If both are Mayze modems, level 1 security may be invoked. This will provide an additional level of security where the modems will exchange passwords before entering into the dialback security process.

The answering modem must be configured for dialback security (see below) and asynchronous operation, and may also have error correction/compression and/or level 1 security enabled. The passwords and dialback numbers are stored in the normal telephone directory.

### **Enabling Dialback Security**

The dialback security feature is enabled in the central site modem by entering the command:

**ATS43=255**

There are no special commands for the caller's modem.

To disable dialback operation, enter the command:

**ATS43=0**

When dialback is disabled, the modem will accept incoming calls and connect the caller to its DTE without any verification.

### **Setting up the Answering (Central Site) Modem**

Having enabled dialback security, you need to carry out the following procedure to make the necessary directory entries (see also Section 6.1.1):

1. Type: **ATNn&Z** where n is a directory location  
type: **<Ctrl-N>** to specify a callback number  
modem response: Callback No.
2. Type: **nnn** where nnn is the number to call back  
type: **<Ctrl-R>** to specify a password  
modem response: Password
3. Type: **ppppp** where ppppp is a five-character password  
type: **<CR>** to save to directory  
modem response: OK

## Example:

To enter the number 0123 456789 as the callback number for password ABCDE in directory location 1, the sequence is:

```
ATN1&Z<Ctrl-N>  
Callback No. 1234<Ctrl-R>  
Password ABCDE<CR>  
OK
```

To verify that the number has been stored, you can use the &N command. The modem's response should be:

```
N1 <Password> ABCDE <Callback No.> 0123 456789  
OK
```

## 5.10 V.25*bis* Mode

The following commands allow you to select V.25*bis* mode so that you can enter V.25*bis* commands (described in Chapter 10).

*V	Select V.25 <i>bis</i> command mode
%O	Bisync character format



This chapter describes various operational facilities that are provided in your modem, and lists the relevant commands.

## 6.1 The Modem's Telephone Directory

Up to 51 numbers which you may need to use frequently can be stored in a non-volatile memory and accessed at any time. You can also store a modem configuration for use with each number.

### 6.1.1 Storage

The relevant commands are:

Nn&Z	Store a number in directory location n (0-50)
&N	Display/delete telephone directory
Nn?	Display a single directory entry

### Modifiers

The modifiers listed below may be used with the Nn&Z command.

::	Store a remark with a telephone no
< >	Secure telephone no
<Ctrl-F>	Store a modem configuration with a telephone no
<Ctrl-G>	Store a password
<Ctrl-I>	Store a password and a user ID
<Ctrl-R>	Store a dialback security password
<Ctrl-N>	Store a dialback security telephone no

For example:

**ATN1&ZT9,0123456789** will store tone dialling, prefix, pause and number in directory location 1.

The <Ctrl-F> modifier is a very powerful feature of your modem. With it you can specify a modem configuration to be linked to a particular telephone number stored in memory. When that number is recalled to make a call, the modem configuration will be changed just for the duration of that call, and then will automatically revert to its usual configuration.

### **6.1.2 Retrieval**

There are three ways of recalling and dialling numbers stored in the directory:

- By selecting one of the locations 0-7 from the front panel buttons (see Section 6.2.1).
- By raising DTR on the V.24 interface, when your modem will dial the number stored in location 0 (see Section 6.2.3).
- By command from the terminal or computer program (see Section 6.2.4).

## 6.2 Dialling a Telephone Number

There are several ways in which you can dial a telephone number:

- By using the front panel buttons to autodial a number from location 0-7 of your modem's directory (Section 6.2.1).
- By manually dialling using a telephone (Section 6.2.2).
- By using the V.24 DTR signal to autodial a number from your modem's directory (Section 6.2.3).
- By using the D command to dial a number (see Section 6.2.4).
- By using the DN command to autodial a number from your modem's directory (and change the modem's configuration if required).

The commands concerned with dialling are:

D	Dial a number (modifiers apply: see Section 6.2.4)
DN	Dial a stored number (with changed configuration if required)
H	Go on-hook
O	Go on-line
&Q	Autodial by DTR
K	Check call time

### 6.2.1 Autodialling via the Front Panel

You can cause the modem to dial any one of the first eight previously-stored directory numbers by using the front panel buttons:

1. Push in the **DIAL** button.
2. Select the directory location containing the telephone number you wish to dial by using the buttons labelled 4, 2 and 1 (binary) as follows:

<b>Location</b>	<b>4</b>	<b>2</b>	<b>1</b>
0	Out	Out	Out
1	Out	Out	In
2	Out	In	Out
3	Out	In	In
4	In	Out	Out
5	In	Out	In
6	In	In	Out
7	In	In	In

3. Press and release the **ENTER** button. The stored number will now be dialled.
4. Release all the other buttons.

### **6.2.2 Manual Dialling by Attached Telephone**

This procedure requires a telephone to be connected to your modem (see the Appendix entitled 'Technical Guide').

1. Dial the required number as normal.
2. When you hear answer tone from the remote modem, press the **DATA** button on your modem's front panel.
3. Replace the handset on-hook.
4. The call will clear down when you press the **DATA** button.

### **6.2.3 Autodialling by DTR**

The autodial by DTR facility works as follows:

1. The DTR command (&Q) must be set to &Q2 for synchronous or &Q5 for asynchronous operation.
2. The DTE must control the DTR line, raising it to request a connection.
3. When the modem detects that the DTR line has been raised, it connects to the telephone line and dials the number stored in memory location N0.
4. To terminate the call, the DTE must drop DTR. This causes the modem to disconnect.

Note that the modem will also disconnect if the remote modem disconnects. You can terminate the call by issuing an H command.

### **6.2.4 Dialling by Command**

When using the D command to dial a number, you can incorporate any of the following modifiers:

- |   |                                     |
|---|-------------------------------------|
| P | Pulse dial the following number(s). |
| T | Tone dial the following number(s).  |
| , | Pause before continuing to dial.    |
| W | Wait for a dial tone.               |
| ! | Flash break.                        |



- U Redial until answered.
- /nnn Dial alternative number nnn.
- ; Return to command mode after dialling.

### **6.2.5 Connection Sequence**

When the dial command is received by the modem, all characters that are extra to the number you are dialling are considered to be modifiers. Invalid characters are ignored.

The modem connects to the telephone line. The setting of the X command determines whether or not it attempts to detect a dialling tone. If it is set to monitor the dialling tone (default), but detects nothing within the timeout period, the call is cleared and the following message displayed:

NO DIALTONE

However, if the dial tone is detected successfully, or if the X command setting does not require dial tone, the modem begins to dial the number.

If you press any key after a dial command is terminated by <CR>, the modem abandons the call and displays the message:

ABORTED

(Note, however, that this feature can be disabled with the "H command.)

When dialling is complete, the modem allows forty seconds to make a connection, and monitors the telephone line for network tones.

When a call is successful, i.e. the remote modem's answer tone is detected, the modem proceeds to exchange signals with the remote modem; a process known as handshaking.

The modem verifies the call with the following response:

CONNECT

The connect response may also display the associated line speed, or interface speed, according to the setting of the constant speed interface command &l.

If LAPM or MNP is enabled, the modem attempts to connect with error correction enabled. If the handshake is successful, the modem displays an appropriate message (see the V command). If the MNP handshake is not successful, the modem normally transmits data without error correction. (Refer also to the command -E.)

If the busy (engaged) tone is detected, the modem clears the call and responds with the message:

BUSY

If the forty-second count-down time expires without a successful handshake, the modem clears the call and responds with the message:

NO ANSWER

If the modem detects a dial tone after dialling is completed, then the call clears and the modem responds with the message:

DIALTONE

### **6.2.6 The Blacklist**

National regulations specify a maximum number of times that a number may be automatically redialled within a specified time interval, if it is busy, engaged or unobtainable when first dialled.

The telephone number blacklist is used to prevent the modem from exceeding this limit when in autodial mode (that is, when the U modifier has been included in the dial string).

The following conditions apply to this feature:

- The blacklist operates on PSTN calls only.
- Twenty blacklisted numbers can be accommodated at a time.
- Each number dialled with the U modifier is entered onto the blacklist, and cleared only if the call is successful. A successful call is defined as one which results in the response CONNECT XXXX.
- If the modem has blacklisted the maximum of 20 numbers, it will not allow another number with the U modifier to be dialled until one of the previously blacklisted numbers has timed out.

UK regulations are given in Appendix C. Note that when the modem is being controlled by external communications software, the user must ensure that this is set up so that repeat dialling obeys the regulations.

## 6.3 Security Control

If dialback security has been set up (see Section 5.9), then you will need to use the following procedure when dialling from a local modem to the central site modem.

1. From your (calling) modem, dial the central site modem.

After the CONNECT message, you will see the prompt:

Enter Dial Back Password

2. Type your password, e.g. **ABCDE**. *Do not insert a carriage return, just wait.*

The modem responds with:

Secure Dial Modem Dialling Back -

Replace Telephone Handset

\*Re-dial if dialback is not received within 2 minutes\*

Carry out these instructions.

3. The central site modem will now dial back using the stored number (e.g. 0123 456789).

After the incoming call is established, you will see the prompt:

Enter Dial Back Password

4. Type: **ABCDE** *Do not insert a carriage return, just wait.*

After 5-10 seconds you will receive the following message:

Secure Dial Modem - Software Issue NN/NN/X

where NN/NN/X is the command I3 identification of the modem.

The link is now transparent and you can access the equipment attached to the central site modem.

## 6.4 Answering Calls

The following command is relevant:

A            Answer (Go off-hook).

### 6.4.1 Auto-Answer

The modem is factory-configured to answer incoming calls automatically after two rings.

When an incoming call is detected, the modem goes off-hook and sends answer tone according to the mode set by the communications format command F.

If the command is set for a fixed line format (F1 to F5), the modem only attempts to connect to the line in that format.

If the command is set for auto-detect format (F0), the modem sends V.25 answer tone followed by V.22*bis* carrier. If the proper response is not received, the modem tries other formats in turn.

It is possible to alter the number of rings the modem has to detect before automatically answering the call, by adjusting the contents of the S-register S0. Setting the S-register to zero disables the auto-answer facility.

### 6.4.2 Answering by Command

If auto-answer is disabled (S-register S0 = 0), your modem can only answer an incoming call if it is manually instructed to do so by the A command.

## 7.1 Introduction

Operational problems may be caused by any of the following:

- Faulty local, or remote, DTE.
- Faulty local, or remote, modem.
- Faulty telephone line.
- Communications software set up incorrectly.

The modem can run the following diagnostic tests to help locate the source of operational problems, when in *V.22bis* or *V.22* modes:

- Local Analogue Loopback, with or without self-test (Section 7.2.1).
- Remote Digital Loopback, with or without self-test (Section 7.2.2).

The self-test feature allows a pattern generator to send test sequences through the modem. These are error-checked and, when the test is terminated, the modem responds with the number of errors encountered.

Tests can be activated by:

- The front panel buttons (Section 7.3).
- AT commands (Section 7.4).
- Signals in the DTE interface (Section 7.5).

### Sequence of Testing

The Local Analogue Loopback test should always be activated first, as this test checks the connection between the local DTE and the local modem's modulator/demodulator.

The Remote Digital Loopback test should be activated next. This test checks the connection from the local DTE, over the telephone line, to the remote modem's modulator/demodulator.

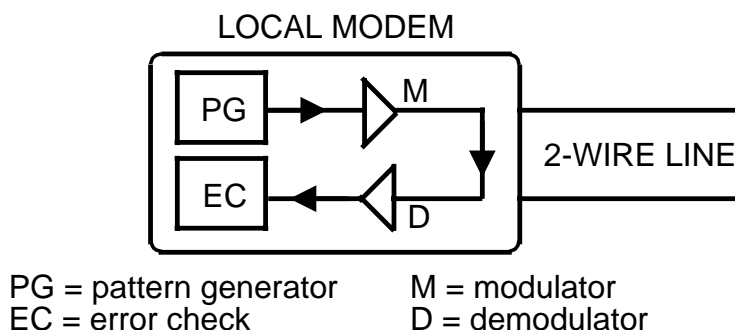
Analysis of each test result should indicate the source of possible faults.

## 7.2 Test Details

### 7.2.1 Local Analogue Loopback

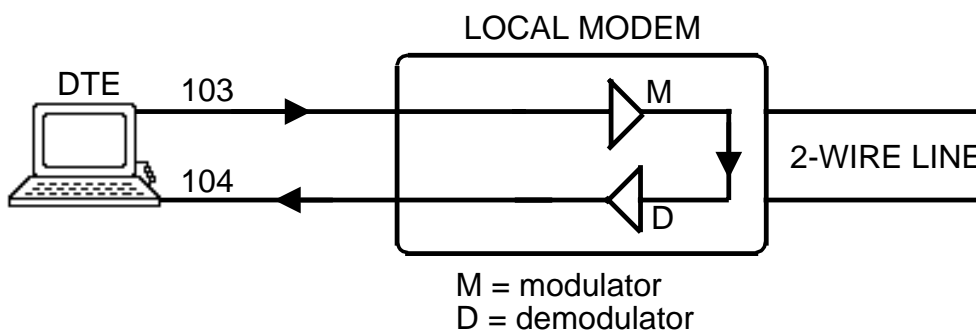
#### Using the Modem's Test Pattern Generator (Self-Test)

The modem's test pattern generator transmits a known message internally through the modem and compares the message received with the message sent. It then reports any errors, and displays an error count at the end of the test.



#### Using an External Test Source

An external source (terminal or test set) is used to generate a test pattern, which must be checked when it returns to the external source.



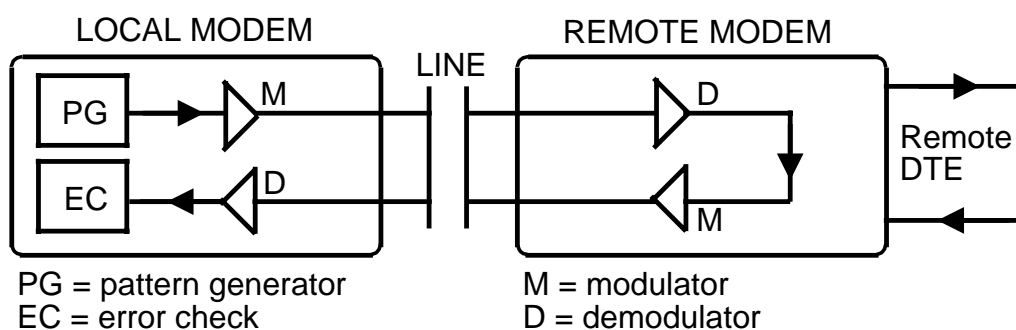
## 7.2.2 Remote Digital Loopback

**Remote digital loopbacks are only available with error correction switched off.**

The remote modem must be V.54 compatible for the test to function.

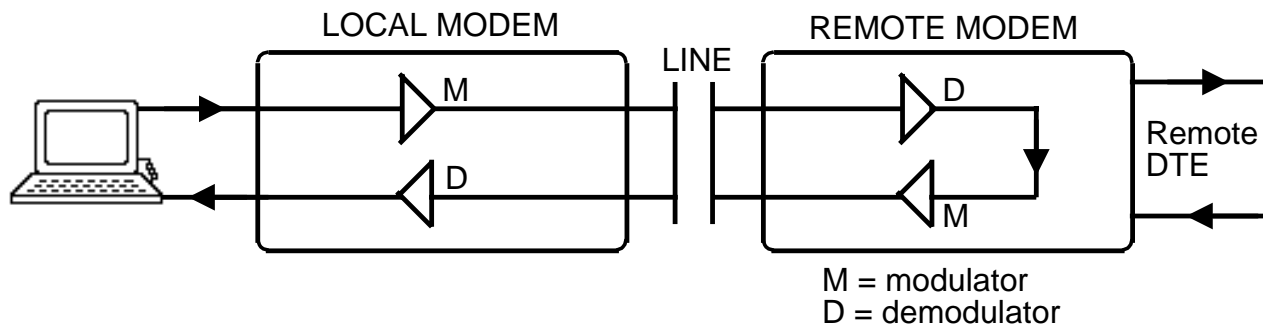
### Using the Modem's Test Pattern Generator (Self-Test)

The modem's test pattern generator transmits a known message through the modem to the remote modem and back to the local modem, which compares the message received with the message sent. It then reports any errors, and displays an error count at the end of the test.



### Using an External Test Source

An external source (terminal or test set) is used to generate a test pattern, which must be checked when it returns to the external source.



## 7.3 Testing via the Front Panel

You can use the buttons on the front panel of the modem to perform loopback tests, using either the self-test feature, or an external terminal or test set.

### 7.3.1 Local Analogue Loopback

#### Using the Modem's Test Pattern Generator (Self-Test)

1. Press the **TEST** button, then the **AL** button. The **RUN** indicator should flash to show that a test is in progress.
2. The **DSR** indicator will flash each time a test pattern mismatch occurs.
3. To terminate the test, release the **TEST** and **AL** buttons in any order. The total number of errors will be displayed on your terminal. If your modem is operating correctly you will get the response 000 ERRORS.
4. You may inject errors (to check that the test pattern is working correctly) if an appropriate /T option is set, by using the **ENTER** button.

#### Using an External Test Source

1. Press the **AL** button.
2. The **DCD** indicator should light and the **RUN** indicator flash. If the **DSR** indicator lights, there is a fault on the modem.
3. Attach a terminal or test set (synchronous or asynchronous depending on the operating mode of your modem), running from the modem's clock, to the DTE port of your modem.
4. Transmit a test pattern. If the pattern is echoed back to the terminal, analogue loop is working correctly. If the pattern is not echoed, or is corrupted, check the LEDs:
  - If only the **TXD** light flashes when the pattern is sent from the terminal, check the terminal settings and DTE cable. If these are correct, the modem is faulty.
  - If both the **TXD** and **RXD** lights flash when a pattern is sent from the terminal, and no pattern or only a corrupted pattern is echoed back, check the terminal settings and the DTE cable. If these are correct, the modem is faulty or strapped incorrectly.



## 7.3.2 Remote Digital Loopback

### Using the Modem's Test Pattern Generator (Self-Test)

1. Establish a connection with the remote modem (which must be ITU-T V.54 compatible).
2. On the local modem, depress the **TEST** button, then the **RDL** button, and leave both buttons depressed. The **RUN** indicator should flash to show that the test is in progress.
3. The **DSR** indicator will flash each time a test mismatch occurs.
4. To terminate the test, release the **TEST** and **RDL** buttons (in any order). The total number of errors will be displayed on your terminal. If your modem is operating correctly you will get the response 000 ERRORS.
5. You may inject errors (to check that the test pattern is working correctly) if an appropriate /T option is set, by using the **ENTER** button.

### Using an External Test Source

1. Establish a connection with the remote modem (which must be ITU-T V.54 compatible).
2. On the local modem, depress the **TEST** button followed by the **RDL** button, then release the **TEST** button.
3. Attach a terminal or test set (asynchronous or synchronous depending on the operating mode of your modem), running from the modem's clock, to the DTE port of your modem.
4. Transmit a test pattern. If the pattern is echoed back to the terminal, the remote digital loop is working correctly. If the pattern is not echoed, or is corrupted, check the LEDs:
  - If only the **TXD** light flashes when the pattern is sent from the terminal, check terminal settings and DTE cable. If these are correct, the modem or line is faulty.
  - If both the **TXD** and **RXD** lights flash when a pattern is sent from the terminal, and no pattern or only a corrupted pattern is echoed back, check terminal settings and the DTE cable. If these are correct, the modem or line is faulty.

## 7.4 Testing by Command

The following commands are available for testing:

&T	Select modem test operation
/T	Test pattern
&B	Delay busying
I	Display modem identity codes

### 7.4.1 Local Analogue Loopback

This procedure tests connections between the local DTE and local modem. It can be used with, or without, the modem's self-test feature.

1. Ensure that the modem can accept AT commands and is on-hook.
2. If required set the test timer with the command **ATS18=n** (n = 1 to 255 seconds).
3. Enter the command **AT&T1** (without self-test) or **AT&T8** (with self-test), and press **RETURN**.
4. If you selected &T1 (without self-test), you must key in a test message. This should be echoed back to the screen via the modem's analogue loopback connection.

If you selected &T8 (with self-test), the test sequence is automatic and the circuit is checked for errors.

5. To terminate the test manually, first enter the escape sequence (default **+++**) if you are using the main DTE for commands. The modem responds with the message **OK**.

Now enter the command **AT&T0**, and press **RETURN**. The modem again responds with the message **OK**.

If you had selected the self-test procedure, the error count is also displayed.

## 7.4.2 Remote Digital Loopback

This test checks the local DTE, the local modem, the remote modem, and the telephone line. It can be used with, or without, the modem's self-test feature.

The test is only valid if the modem has established a V.22 or V.22*bis* connection, without error correction. If one or more of these conditions does not comply, the modem responds with the message ERROR.

1. Ensure that your modem has established a connection with a remote modem in V.22 or V.22*bis* mode.
2. Enter the escape sequence command (default +++ ) so that the modem can accept AT commands. The modem should acknowledge with the message OK.
3. If required, set the test timer with the command **ATS18=n** (n = 1 to 255 seconds).
4. Ensure that the remote modem is conditioned to accept an RDL test (&T4).
5. Enter the command **AT&T6** (without self-test) or **AT&T7** (with self-test) and press ENTER.
6. If you selected &T6 (without self-test), you must key in a test message. This should be echoed back to the screen via the remote modem's digital loopback connection.

If you selected &T7 (with self-test), the test sequence is automatic and the circuit is checked for errors.

7. To terminate the test manually, first enter the escape sequence (default +++ ) if you are using the main DTE for commands. The modem responds with the message OK.

Now enter the command **AT&T0** and press RETURN. The modem again responds with the message OK.

If you had selected the self-test feature, the error count is also displayed.

If the call is disconnected during the test, the test procedure is terminated.

To transmit data, enter the command **ATO**, and press RETURN. The modem responds with the message CONNECT XXXX. Data can now be transferred.

## **7.5 Testing via DTE Interface Signals**

The DTE interface (Appendix B) allows some tests to be controlled by signals from the DTE.

In the factory default configuration, the facility is disabled. To allow DTE-initiated tests, the command &T12 must be set.

The modem's self-test facility cannot be used with the tests; the DTE must be used to generate a test pattern and provide error-checking facilities.

### **7.5.1 Local Analogue Loopback**

1. The modem's internal links must first have been set as described in the Appendix entitled 'Technical Guide'.
2. Initiate the test by a signal (> +6 volts) on pin 18 of the DTE port.
3. Transmit a test pattern from the DTE. It will be passed round the loop and returned to the DTE.
4. Check that the test pattern has not been corrupted.
5. Terminate the test by returning pin 18 to the low (< -6 volts) state.

### **7.5.2 Remote Digital Loopback**

1. The modem's internal links must first have been set as described in the Appendix entitled 'Technical Guide'.
2. Initiate the test by a signal (> +6 volts) on pin 21 of the DTE port.
3. Transmit a test pattern from the DTE. It will be passed round the loop and returned to the DTE.
4. Check that the test pattern has not been corrupted.
5. Terminate the test by returning pin 21 to the low (< -6 volts) state.

### **7.5.3 Test State Indication**

The test state can be indicated to the DTE by a signal from the modem on pin 25. In the default state, pin 25 will go high whenever the modem is performing a test, regardless of the method used to start the test. This can be used to indicate to the DTE that the modem has entered test mode and is not available for normal data transmission. (This output can be disabled by a link change as described in the Appendix entitled 'Technical Guide'.)

This chapter contains a description of all the AT commands that are incorporated in your modem. The commands are listed alphabetically, with symbols in the following sequence:

& \* / % " -

Full instructions for entering AT commands are given in Section 3.3.

In addition to the commands that must have the AT prefix, there are two which do not require the prefix or the terminator:

### **+++ Escape Sequence**

You must enter this sequence when your modem is on-line and you intend to use the main DTE to enter commands.

d+++d where d is a period of silence defined in S-register S12. Its factory default is 0.5 seconds.

This sequence will produce the response OK, put the modem into command mode, and keep the current call live.

To return to the on-line mode, use the O command, or to clear the call use H.

Note that the + character can be changed by altering the contents of S-register S2.

### **A/ Repeat Last Command(s)**

This sequence will cause the modem to repeat the previous command or command string.

## **A Answer (Go Off-Hook)**

This command will cause the modem to go off-hook and send an answer signal to the remote modem.

If the carrier signal is not received by the end of the answering sequence, the modem disconnects and responds with:

NO CARRIER

If the answer sequence is aborted by dropping DTR, the modem disconnects and responds with:

ABORTED

If the modem detects dial tone instead of a calling modem, it will disconnect and respond with:

DIALTONE

## **/A RTS Timeout Control**

This command allows you to set a timeout facility to automatically disconnect the modem.

- /A0**     Timeouts disabled. Default.
- /A1**     Loss-of-RTS timeout.
- /A2**     Anti-streaming timeout.
- /A3**     Loss-of-RTS and anti-streaming timeouts.

/A1 is normally only used with PSTN modems. It causes the modem to disconnect when RTS goes low for a period held in register S10.

/A2 is normally used on a leased line where you have a master and number of slave modems and it is necessary to restrict the time that any one modem is on-line. After RTS is raised, the modem will disconnect after the period set in register S56. RTS must be dropped and re-asserted to cause the modem to go on-line again.

S-register S10 determines the duration of the RTS timeout (S10 is measured in increments of 1 second or 0.1 of a second, depending on the setting of the \*B command). S-register S56 determines the anti-streaming timeout. Setting a register to zero disables the associated timeouts.

## **"A Originate/Answer Mode**

In a 2-wire full-duplex leased line system, one modem must be in 'originate mode', with the associated modem in 'answer mode'.

- "A0** Answer mode.
- "A1** Originate mode. Default.

## **&B Delayed Busying**

This command is used for maintenance purposes to prevent incoming calls.

- &B0** Normal connections. Default.
- &B1** Busy-out the line.
- &B2** Busy-out the line and initiate local analogue loopback.

&B1 or &B2 will busy-out the telephone line 5 seconds after the current call has ended, or immediately if no call is active. (Busy-out puts the modem off-hook without causing the PSTN exchange to expect a call.) &B0 is used to clear the busied line and restore normal connections.

## **\*B Timeout Increments for \*T and /A**

This command is used to select whether the value in S-register S10 is measured in increments of 1 second or 0.1 of a second (S10 is used by the \*T and /A commands).

- \*B0** S10 is in 0.1 of a second increments (range 0-25.5 seconds). Default.
- \*B1** S10 is in 1 second increments (range 0-255 seconds).

## **%B Pin 23 Fallback Request**

This command selects how your modem will react to the state of pin 23. To use this, the DTE must control pin 23 equivalently to operating the **FB** button. This command is only active if Link 9 is in position 1 (see the Appendix entitled 'Technical Guide'.)

- %B0** State of pin 23 ignored. Default.
- %B1** State of pin 23 actioned:
  - High = Primary rate.
  - Low = Fallback rate.

## **&C DSR & DCD Control**

- \*C0** DSR and DCD are maintained in the on condition. State of data carrier is disregarded. Default.
- \*C1** DCD follows the state of the received carrier. DSR is on only when the modem is on-line and ready to transmit data.
- \*C2** DSR and DCD are on in command mode. During the connect sequence and when on-line, DSR and DCD represent their normal state.
- \*C3** DSR is always on except that it goes off for a period of two seconds immediately after a call is dropped. DCD is maintained in the on condition while the modem is off-line, and follows the received carrier while the modem is on-line.

## **\*C Display Active Configuration**

This command displays your modem's active configuration on your terminal.

Examples of configuration screens are given in Section 4.1.3.

## **/C Cable Equaliser**

Any cable between the modem and the telephone exchange has the effect of altering the higher frequencies; the longer the cable, the more the higher frequencies will be suppressed. The cable equaliser compensates for this loss.

- /C0** Cable equaliser disabled.
- /C1** Cable equaliser enabled. Default.

When using V.22bis or V.22 modes, the equaliser should normally be disabled; it can be enabled to improve performance on very poor circuits.

## **%C Data Compression**

- |            | <b>V.42bis</b>                     | <b>MNP5</b>                        |
|------------|------------------------------------|------------------------------------|
| <b>%C0</b> | Data compression disabled.         | Data compression disabled.         |
| <b>%C1</b> | Data compression enabled. Default. | Data compression enabled. Default. |



<b>%C2</b>	Data compression enabled for transmitted data only.	Data compression disabled.
<b>%C3</b>	Data compression enabled for received data only.	Data compression enabled.

The data compression technique used depends on the setting of the -E command.

## **D Dial a Number**

This command is used to dial a specified telephone number with, if required, special instructions (known as modifiers).

**Dnn** where nn is the telephone number

To dial a number with no modifiers, enter the number you want to dial immediately after the command, e.g. **ATD0123456789**.

To dial a number with modifiers, select the required modifiers from the list below, and incorporate them in the dialling sequence as instructed.

An example of a number with modifiers would be to dial through a PABX where the prefix to an outside line is 9, and a pause is needed before the number, e.g. **ATD9,0123456789**.

In the default setup, you can abort a dialling command by pressing any key on the keyboard (see "H command).

### **Dialling Modifiers**

- P** Pulse Dial
- T** Tone Dial

These modifiers select pulse or tone dialling. They can be inserted at any required point in the dialling string, which is useful where switchboards use a different prefix dialling mode.

**ATDP nn** where nn is the telephone number.  
**ATDT nn** where nn is the telephone number.  
**ATDP p T nn** where p is the prefix and nn is the telephone number.

The modem will stay in the set P or T mode for future dialling until the alternative modifier is selected.

, **Pause Before Dialling**

A comma will cause the modem to pause for the period of time set in S-register S8, for example after a prefix, before continuing to dial. Multiple pauses may be used. (The factory default for S8 is 4 seconds.)

**ATDp, nn** where p selects an outside line through a PABX, then the modem pauses before dialling the number nn.

W **Wait for Dial Tone**

This modifier is used where a second dialling tone is required following a prefix, e.g. after 9 to obtain an outside line from a PABX.

**ATDp W nn** where p is the prefix and nn the number

The maximum wait for dial tone is set in S-register S6 (see Chapter 9).

! **Flash or Time Break**

This modifier releases the telephone line for 0.08 seconds. It can be used for transferring calls, or time break recall.

**ATDp ! nn** where p is the prefix and nn the telephone number.

U **Redial Until Answered**

This modifier causes the modem to keep dialling the number until it gets an answer within the limit set in S-register S36 (see Chapter 9).

**ATDU nn** where nn is the telephone number.

Most countries have rules governing the number of rediallings allowed and the interval between them: see details in Section

6.2.6 and Appendix C. Attempts to continue dialling after the limit is reached produce the message:

### BLACKLIST

The blacklist is cleared by pressing the **DATA** button when the modem is on-line. This also causes the modem to go off-line.

### / Dial Alternative Number

This modifier causes the modem to dial the specified alternative number after a pause of 5 seconds if the first is unobtainable.

**ATDnn / nnn** where nn is the first and nnn the alternative number.

### ; Return to Command Mode after Dialling

The semicolon modifier is used at the end of a telephone number so that you can issue more commands after dialling: for example to enter a security code, or touch-tone commands to a service. For example:

```
Terminal:  ATDT9, 0123456789; Dial telephone no
Modem:    OK
Terminal:  ATDT1234;      Transmit touch tones 1234
Modem:    OK
Terminal:  ATH           Disconnect the phone call
```

In this example, the modem tone-dialled 9 to access an outside line, paused, and then dialled 0123 456789. On completing dialling, the modem responded with OK. At this point the modem was instructed to send a message 1234, which it sent and returned OK.

It is important to remember to terminate all message strings with a semicolon. When your transaction has finished, you must use the H command to clear the call.

### DN **Dial a Stored Number**

This command is used to dial a number from the modem's telephone directory.

**DNn** where n selects location 0-50 in the directory.

The modem's configuration will be changed while dialling if the location contained instructions to do so.

Section 6.1 describes how to store numbers in the directory.

## **/D Carrier Threshold**

This command is used to select a minimum carrier threshold level, below which any signal received will be ignored.

- /D0** Carrier threshold –43 dB to –48 dB. Default.
- /D1** Carrier threshold –33 dB to –38 dB.
- /D2** Carrier threshold –26 dB to –31 dB.
- /D3** Carrier threshold –16 dB to –21 dB.

For PSTN applications the normal carrier signal level is –43 dBm. For leased line applications the level varies according to the quality of the line; selection of a carrier signal threshold should be made accordingly. If reverting to PSTN, reset to –43 dBm.

## **%D Remote Down-Load**

This command is used to send back the altered remote modem's configuration to become its new active configuration. Issuing this command in PSTN mode will cause any call to be dropped.

## **E Echo Commands**

This command determines whether command characters entered at the port to which you are connected will be echoed back.

- E0** Disable echo.
- E1** Enable echo. Default.

Echo should normally be enabled if the port is operating in full-duplex, and disabled in half-duplex mode.

## **%E Remote Configuration Control**

This command allows you to select which remote configuration control facilities you require at the local modem (i.e. the one you are currently configuring). An appropriate selection is also required at the remote modem(s).

- a) Will the local modem accept remote configuration commands from the attached DTE?
- b) Will the local modem accept as its active configuration, a configuration sent from the remote modem?

- c) Will the local modem accept commands from the remote modem to send the local modem's current active configuration to the remote modem?

<b>Command</b>	<b>(a)</b>	<b>(b)</b>	<b>(c)</b>	<b>Remarks</b>
<b>%E0</b>	no	no	no	Disabled
<b>%E1</b>	no	no	yes	
<b>%E2</b>	no	yes	no	
<b>%E3</b>	no	yes	yes	
<b>%E4</b>	yes	no	no	
<b>%E5</b>	yes	no	yes	
<b>%E6</b>	yes	yes	no	
<b>%E7</b>	yes	yes	yes	Default

Care must be taken when changing the configuration of a remote modem. For example, if the remote modem's active configuration is %E7 and it is subsequently changed to %E4 you will have no further configuration control over the remote modem.

A working example of this and the other remote configuration commands is given in Section 5.8.

## **"E Security Control**

This command is used to enable or disable the security features of your modem.

- "E0** Security disabled. Default.
- "E1** Security level 1 enabled.
- "E2** Security level 2 enabled (for rack card only).

If security is enabled, you need to use commands "W and "Z. See also Section 5.9.

## **-E Error Correction Format**

This command is used to select the format of error correction that your modem will accept or work to when in *V.22bis* or *V.22* modes. It is used in conjunction with the %C command for selecting the MNP class.

- E0** Error correction disabled. Default.
- E1** Error correction is enabled according to V.42. The modem will auto-detect the format of error correction used by the remote modem. If the error correction handshake times out without detecting error correcting ability in the remote modem then the modem reverts to standard data mode (no error correction).
- E2** MNP error correction is enabled in Reliable mode. The modem will only accept a call from a modem using MNP error correction (classes 2-5). If the modem fails to establish MNP error correction, the call is disconnected.
- E3** MNP error correction is enabled in Auto-Reliable mode. The modem accepts calls from the remote modem regardless of whether MNP error correction (classes 2-5) is used or not. If the modem fails to establish MNP error correction, it reverts to its normal operation.
- E4** LAPM error correction is enabled in Reliable mode. The modem will only accept a call from a remote modem using LAPM error correction. If the modem fails to establish LAPM error correction, the call is disconnected.
- E5** LAPM error correction is enabled in Auto-Reliable mode. The modem accepts calls from the remote modem regardless of whether LAPM error correction is used or not. If the modem fails to establish LAPM error correction, it reverts to its normal operation.

Note that if using error correction on a leased line, MNP requires -E2 at both ends, but LAPM requires -E4 at both ends.

## **F Communications Format**

This command is used to determine which modulation scheme and primary data rate are used by the modem. A fallback rate may also be specified.

- F0** Autosense; the modem automatically configures itself to the speed of the remote modem with which it is trying to connect.
- F1** V.21, 300 bps.
- F2** V.22, 600 bps.
- F3** V.23, 75/1200 bps.
- F4** V.22, 1200 bps.
- F5** V.22*bis*, 2400 bps. Default.

When the modem makes or answers a call in autosense mode (F0), and a connection is made, a search sequence is initiated. This ensures that a transmission mode is used which is compatible with that of the remote modem contacted. When the handshake is successful, a connection is established. If the modem is unable to connect at the specified modulation format, or is unable to autosense, the modem disconnects from the line.

V.23 operation is used chiefly to access databases. The dialling modem (originator) usually has little data to send and uses the 75 bps channel. The answering modem at the database has more to send and uses the 1200 bps channel.

## **&F Recall Factory Configuration**

This command recalls one of the factory configurations to become the modem's active configuration.

- &Fn** where n is the factory configuration number (0-11).

## **/F Fallback Format**

This command is used to set up a fallback communications format.

- /F0** Fallback facility disabled.
- /F1** V.21, 300 bps.
- /F2** V.22, 600 bps.
- /F3** V.23, 75/1200 bps.
- /F4** V.22, 1200 bps. Default.
- /F5** V.22*bis*, 2400 bps.

## **%F Fallback Request**

This command selects either primary rate (determined by F) or fallback rate (determined by /F).

- %F0** Fallback disabled. Primary rate used. Default.
- %F1** Fallback selected. Fallback rate used.

## **&G Guard Tones**

Normally only used in V.22*bis* mode, this command enables you to select the guard tone frequency required by approval authorities.

- &G0** No guard tone. Default.
- &G1** Guard tone 550 Hz (Scandinavian countries).
- &G2** Guard tone 1800 Hz (UK and most of the world).

## **/G T/2 Equaliser**

This command is used to enable or disable the T/2 equaliser. V.22*bis* or V.22 operating modes only.

- /G0** T/2 equaliser disabled.
- /G1** T/2 equaliser enabled. Default.

Normally enabled for V.22*bis* or V.22 modes.



## **H Go On-Hook**

If you are using the data DTE for commands, you must first enter the (default +++ ) escape sequence. (This is not necessary if you are using a separate command terminal.)

The H command will immediately disconnect the current call and return the modem to command mode.

## **"H Keyboard Abort Disable**

This command controls the feature which allows you to abort a dialling command by pressing any key on the keyboard.

- "H0** Keyboard abort disabled.
- "H1** Keyboard abort enabled. Default.

## **I Modem Identity Codes**

This command is used to check hardware and software identity.

- I0** Displays your modem's product code in decimal. Default is 226 for standalone, or 228 for rackmount. This code may be changed by using S-register S38 (to allow compatibility with certain software packages).
- I1** Requests that a checksum is performed on your modem's firmware ROM. The response shows the value as four hex digits.
- I2** Validates that the checksum is correct by comparing it with a stored value. Returns the response OK or ERROR.
- I3** Displays the firmware release number.
- I4** Displays your modem's three-digit identity code in decimal. The code for your modem is 226 for standalone, or 228 for rackmount.

I3 and I4 are useful for programmers writing software to control the modem. They allow a check for connection to the correct modem type with correct firmware release number.

## **&I Constant Speed Interface**

Constant speed interface is used to fix the speed of data transmission between the DTE and modem to that of the autobaud

speed, regardless of the rate determined by the communications format.

- &I0** Constant speed interface disabled. The initial message will be sent at the DTE rate. The speed will then transfer to the line setting. The CONNECT response shows the line rate.
- &I1** Constant speed interface enabled. The CONNECT response shows line speed. Default.
- &I2** Constant speed interface enabled. The CONNECT response shows interface speed.
- &I3** Constant speed interface disabled. This is used with a host computer which cannot support split speed operation, but can support autobaud. The CONNECT response shows the line speed, except in V.23 when it shows 1200 bps.

This facility is useful for applications involving DTEs that can only operate at one speed\*, or where the modem is used with a communications software package.

\* If this speed is different from that set by the F command, you must enable flow control by using the %K and %U commands.

## **K Call Timer**

This command will access the call timer within your modem.

The response will show the current, or previous, call time in minutes and seconds.

## **%K Modem Flow Control**

Modem flow control allows the modem to control the flow of data to it from the DTE. The DTE must react to the method chosen.

- %K0** Modem flow control disabled.
- %K1** XON/XOFF flow control enabled.
- %K2** CTS flow control enabled. Default.
- %K3** XON/XOFF and CTS flow control enabled.
- %K5** Dual XON/XOFF flow control enabled.
- %K7** Dual XON/XOFF and CTS flow control enabled.

Dual flow control allows the use of one of two sets of flow control characters; data flow can be stopped with either set. The secondary

flow control characters are stored in registers S41 (secondary XON) and S42 (secondary XOFF). See Section 5.6.

## **&L Line Type**

This command is used to set your modem from default PSTN to leased line operation (for leased line operation see the Appendix entitled 'Technical Guide').

- &L0** Enable 2-wire PSTN operation. Default.
- &L1** Enable 2-wire leased line operation.

When you select leased line operation, the modem goes on-line in the mode determined by the "A command. See Section 5.5.

## **M Speaker Control**

This command controls your standalone modem's internal speaker.

- M0** Speaker off.
- M1** Speaker on during call set-up and off when carrier is detected.
- M2** Speaker on.
- M3** Speaker on during call set-up. It is off when carrier is detected and when dialling. Default.

## **\*M Inactivity Data Monitor**

This command controls a disconnect timer that will clear the call if the modem has not seen any data for a period of time.

- \*M0** Data monitor disabled. Default.
- \*M1** Transmitted data (from DTE) is monitored.
- \*M2** Received data (from line) is monitored.
- \*M3** Both transmitted data and received data are monitored.

The length of monitoring time is stored in S-register S37, which can be set between 0 and 255 minutes.

## **Nn? Display a Single Directory Entry**

This command is used to display a single entry from the modem's directory where n represents the entry (0-50) that you want to display.

## **Nn&Z Store a Telephone Number**

This command is used to store a telephone number in the modem's directory. You can also use modifiers, for example to include ASCII text identifying the service, and to store an associated modem configuration.

**Nn&Znn** where n is the directory location (0-50) and nn the number and modifiers. A blank n is equivalent to 0.

### **Modifiers**

:: Store a Remark with a Telephone No

Telephone numbers may have remarks stored with them, which are displayed when the number is dialled.

Each remark entered must be within colon delimiters.

Remarks must come immediately **after** the command, but **before** the phone number and any instructions connected with the phone number.

Thus, with the phone number alone, remarks are situated as follows:

**AT N1&Z : Head Office : 0123456789**

If other instructions are included:

**AT N1&Z : Head Office : T9, 0123456789**

Spacing is not necessary, we've used it just for clarity.

< > Secure Telephone No

Angled brackets may be used to designate secure phone numbers, i.e. phone numbers that you do not wish to appear on the screen.

To do this the phone number must be typed between angled brackets:

**AT N1&Z <0123456789>**

As a number enclosed within < > will not be displayed during dialling or in the directory display, it is advisable to include Remark text with such numbers (see :: above).

For example, if the number is stored as:

**AT N1&Z : Mainframe :<T9,0123456789>**

it will be displayed (when dialled, or in the directory) as:

Mainframe

<Ctrl-F> Store a Modem Configuration with a Telephone No

To use this feature you need to key <Ctrl-F> **after** the telephone number and dialling parameters, and **before** pressing <CR> to save the entry.

After you have keyed <Ctrl-F>, the modem asks for the configuration number. The cursor stays positioned just after this prompt, allowing you to key Fn (n=0-11) for a factory configuration, or Zn (n=0-3) for a user configuration.

For example if your modem is configured to factory configuration 1 (F1) and you want it to change to user configuration 3 (Z3) each time the modem dials 0123456789, the procedure is as follows.

Enter the command:

**AT N1&Z 0123456789 <Ctrl-F>**

A Configuration No: prompt now appears on the terminal screen (except with rackmounted modems).

Enter the configuration number you want, in this case Z3.

Press RETURN and the OK message appears.

Configuration Z3 is now associated with phone number 0123456789 in the modem's memory. Each time this number is dialled (using ATDN1), the modem will change to configuration Z3.

<Ctrl-G> Store a Password

For dialling into a modem where level 1 security is enabled, it is necessary to program the password. To do this, use this modifier as follows:

**ATDnnnnnnnnnnnn<Ctrl-G>pppppppp<CR>**

where nnnnnnnnnnn is the telephone number to be dialled, and ppppppppp is the security password.

See Section 5.9.

#### **<Ctrl-l> Store a Password and a User ID**

For dialling into a level 2 modem (rackmounted), it is necessary to program the access security password and user ID in a stored telephone number string.

The format for this is:

```
ATDnnnnnnnnnnnn<CTRL-l>uuuppppppppp<CR>
```

where:

nnnnnnnnnnnn is the telephone number to be dialled,

uuu is the user ID, and

ppppppppp is the security password.

See Section 5.9.

### **&N Display/Delete Telephone Directory**

This command will display your complete telephone directory.

**&N** Your telephone directory is displayed like this:

```
N0 - T9, 0123 456789
N1 - : Head Office : T9, 0123 987654
N3 - : Northern Office : T9, 0987 654321
N11 - : USA :
N20 - P0987 123456 - Z2
```

The locations are designated N0 to N50. Empty locations are not listed. In this example only five directory locations have numbers stored in them, and directory entry N11 is a secure number.

**&N99** will clear all entries in the telephone directory.

### **O Return to On-Line**

This command is only needed if you are using the data DTE for commands, and have previously entered the escape sequence (default+++ ) to interrupt a communications session.

This command will cause the modem to go on-line and look for carrier from a remote modem.

### **&O S-Register Output Format**

This command selects the S-register display format when you request it by the command Sn?. See Chapter 9.

- &O0** Output in decimal. Default.
- &O1** Output in hexadecimal.
- &O3** Output in binary.

The binary output is useful for examining bit-mapped S-registers.

### **\*O Overspeed**

This command only applies to V.22*bis* asynchronous operation. It should be set to mirror the overspeed mode of your attached DTE.

- \*O0** Overspeed mode is ITU-T +1% to -2.5%. Default.
- \*O1** Overspeed mode is ITU-T +2.3% to -2.5%.

### **/O DSR Control while Tests Active**

This command is used to select the state of DSR (Data Set Ready) while tests are active.

- /O0** DSR active in test modes.
- /O1** DSR inactive in test modes. Default.

The factory default (off) complies with the ITU-T recommendation. /O0 allows DSR to be turned on where your DTE needs it to transmit or receive characters.

### **%O Byte Synchronous Character Format for V.25*bis***

This command allows ASCII or EBCDIC character format to be used if \*V2 is selected.

- %O0** V.25*bis* byte synchronous will work in ASCII. Default.
- %O1** V.25*bis* byte synchronous will work in EBCDIC.

Note that when using EBCDIC, all characters are 8 bits with no parity.

## **%P Pass-Through Flow Controls**

This command is only effective when flow control %U and/or %K is selected.

- %P0** Pass through disabled. Default.
- %P1** The modem will pass XONs down the line to the remote modem.
- %P2** The modem will pass XOFFs down the line to the remote modem.
- %P3** The modem pass XONs and XOFFs down the line to the remote modem.

The various settings allow you to choose which flow control characters received from the DTE (XONs stored in S39, S41 and S49, and XOFFs stored in S40, S42 and S50), will be sent to the remote modem. The character will be sent transparently in sequence with the data for the %P1, 2, 3 settings. (The modem will also respond to flow control characters according to the setting of the %U command regardless of the setting of this command).

## **Q Quiet Mode**

This command determines whether response codes are sent to the DTE when commands are executed. The full response code table is given with the X command.

- Q0** Response codes are sent. Default.
- Q1** Response codes are **not** sent.
- Q2** Response codes are **not** sent in answer mode and **are** sent in originating mode.
- Q3** Response codes are **not** sent while the modem is on-line.

Q2 is useful when a DTE would get confused seeing response codes in answer mode, but still requires results for dialling or configuration.

## **&Q Sync/Async Mode and DTR Control**

This command has two purposes: the first is to switch the modem between synchronous and asynchronous mode, the second is to determine how the modem interacts with the DTR (Data Terminal Ready) signal from your DTE. Synchronous modes are only valid



when using V.22*bis* or V.22 communications format. (DTR low means that the DTE is not ready, high means that the DTE is ready.)

- &Q0** Asynchronous mode. DTR is ignored. Default.
- &Q1** Synchronous mode. The modem will answer and dial with DTR low, but will disconnect if DTR does not go high after the time defined in S-register S25. When on-line, if DTR goes low, the modem will wait for S25 time before the call is disconnected.
- &Q2** Synchronous mode. When DTR goes high, the modem dials the stored telephone number held in location N0. When on-line, if DTR goes low, the modem disconnects.
- &Q3** Synchronous mode. The modem will not dial or answer when DTR is low. When on-line, if DTR goes low, the modem disconnects. DTR conforms with ITU-T circuit 108/2.
- &Q4** Asynchronous mode. The modem will answer or dial with DTR low, but will disconnect if DTR does not go high after the time defined in S-register S25. When on-line, if DTR goes low, the modem will wait for S25 time before the call is disconnected.
- &Q5** Asynchronous mode. When DTR goes high, the modem dials the stored telephone number held in N0. When on-line, if DTR goes low, the modem disconnects.
- &Q6** Asynchronous mode. The modem will not dial or answer when DTR is low. When on-line, if DTR goes low, the modem disconnects. DTR conforms with ITU-T 108/2.
- &Q7** Command mode switch. An on-to-off transition on the DTR line causes the modem to switch from command mode to on-line mode.
- &Q9** An on-to-off transition on the DTR line causes the modem to default to user configuration 0.
- &Q10** Synchronous mode. This conforms to V.24 108/1 (CDSTL, Connect DataSet To Line). When DTR goes high the modem goes on-line, and when it goes low it disconnects.
- &Q11** Asynchronous mode. This conforms to V.24 108/1 (CDSTL, Connect DataSet To Line). When DTR goes high the modem goes on-line, and when it goes low it disconnects.

- &Q13** Asynchronous mode. When DTR goes low the modem disconnects and puts the busy-out condition on the line.
- &Q14** Synchronous mode. When DTR goes low the modem disconnects and puts the busy-out condition on the line.

## **%R RTS/CTS Control**

This command allows you to control the state of CTS from your modem.

- %R0** CTS follows RTS when on-line.
- %R1** CTS is always on when the modem is off-line, and follows RTS when on-line. This enables you to configure your modem and dial out. Default.
- %R2** CTS is on in command mode.
- %R3** CTS is always on. This is used in full-duplex operation, where the state of CTS must be high to allow the terminal to communicate with the modem.

## **"R Manual Retrain**

This command will cause the modem to initiate a retrain to synchronise with the remote modem. For *V.22bis* and *V.22* modes only. This is usually used only for test purposes.

## **Sn? Display Single S-Register Setting**

This command will display the setting of a single S-register where *n* is the S-register location to be examined.

The **&O** command selects the format for this display.

## **Sn= Set an S-Register to a Value**

This command will set an S-register content to a new value.

- Sn=xxx** where *n* is the S-register location and *xxx* is the new value in decimal (prefix it with **>** for hexadecimal).

## **&S Front Panel Switch Control**

This command allows you to disable the front panel switches and re-program the **AL** button to perform different functions.

- &S0** Front panel switches disabled.

- &S1** Front panel switches enabled with **AL** selecting an analogue loop. Default.
- &S2** Front panel switches enabled with **AL** busying the telephone line.
- &S3** Front panel switches enabled with **AL** selecting an analogue loop and busying the telephone line.

Busying means that the modem seizes the telephone line but does not go on-line. This disables the modem from answering a call.

Information on analogue loop is given in Chapter 7.

## **\*S Display S-Register Summary**

This command will display the values of all S-registers in the format selected by the **&O** command. The display may include some registers not used by this modem. See Chapter 9.

## **/S Extra Response Codes**

This command is used to select whether response codes preceded by / will be issued or not. (A table of these codes is given with the **X** command.)

- /S0** Extra responses off.
- /S1** Extra responses on. Default.

## **&T Select Modem Test Operation**

This command is used to select a test operation. See Chapter 7. It is used in conjunction with S-register timer **S18**, which determines the length of time that a test is performed.

- &T0** Stops test currently in progress.
- &T1** Selects Local Analogue Loopback without self-test.
- &T4** Enables the local modem to run a Remote Digital Loopback when requested by the remote modem. Default.
- &T5** Prohibits the local modem from running a Remote Digital Loopback when requested by the remote modem.
- &T6** Initiates Remote Digital Loopback without self-test (ITU-T V.54 Loop 2).
- &T7** Initiates Remote Digital Loopback with self-test.
- &T8** Initiates Local Analogue Loopback with self-test.

- &T11** Disables selection of V.54 tests on pin 21 of the DTE interface.
- &T12** Enables selection of V.54 tests on pin 21 of the DTE interface.
- &T13** Disables selection of V.54 tests on pin 18 of the DTE interface.
- &T14** Enables selection of V.54 tests on pin 18 of the DTE interface.

## **\*T Carrier Timeouts**

While in PSTN operation, your modem will immediately disconnect if the remote modem disconnects, and your modem detects dial tone from your local exchange. However, should the remote modem not disconnect, then \*T allows you to set timeouts which will cause a disconnection on loss of, or constant presence of, carrier.

- \*T0** Loss-of-carrier timeout disabled.
- \*T1** Loss-of-carrier timeout enabled. Default.
- \*T2** Constant-carrier timeout enabled.
- \*T3** Loss-of-carrier and constant-carrier timeouts enabled.

Register S10 determines the length of the loss-of-carrier timeout. Register S56 determines the length of the constant-carrier timeout. Setting a register to zero disables the associated timeout.

S10 is measured in increments of 1 second or 0.1 of a second, depending on the setting of the \*B command. S56 is measured in increments of 1 second.

## **/T Test Pattern**

This command enables you to select a type of test pattern. Your modem will convert this to a pseudo-random sequence.

- /T0** MARKS pattern.
- /T1** FOX pattern (not for synchronous).
- /T2** Reversals.
- /T3** 511 pattern (not for asynchronous).
- /T4** MARKS pattern with error injection.
- /T5** FOX pattern with error injection (not for synchronous).
- /T6** Reversals with error injection.
- /T7** 511 pattern with error injection (not for asynchronous).

## **/U Asynchronous Format**

This command enables you to determine the data format your modem expects to output or receive when in asynchronous mode. See "U for data rate.

<b>/U0</b>	Autobaud for async data format. Default.
<b>/U1</b>	7 data, no parity, 1 stop.
<b>/U2</b>	7 data, no parity, 2 stop.
<b>/U3</b>	7 data, odd parity, 1 stop.
<b>/U4</b>	7 data, odd parity, 2 stop.
<b>/U5</b>	7 data, even parity, 1 stop.
<b>/U6</b>	7 data, even parity, 2 stop.
<b>/U7</b>	8 data, no parity, 1 stop.
<b>/U8</b>	8 data, no parity, 2 stop.
<b>/U9</b>	8 data, odd parity, 1 stop.
<b>/U10</b>	8 data, odd parity, 2 stop.
<b>/U11</b>	8 data, even parity, 1 stop.
<b>/U12</b>	8 data, even parity, 2 stop.

## **%U User Flow Control**

User flow control may be used when the rate at which data is received from the line is greater than the rate at which the DTE can process it.

<b>%U0</b>	User flow control disabled. Default.
<b>%U1</b>	XON/XOFF flow control enabled.
<b>%U2</b>	RTS flow control enabled.
<b>%U3</b>	XON/XOFF and RTS flow control enabled.

See Section 5.6.

## **"U DTE Rate**

This command is used to specify the rate at which the modem expects data to be transmitted from the DTE when in asynchronous mode. It applies to the main DTE port (the speed of the command port is fixed). See /U for data format.

<b>"U0</b>	Autobaud. Default.	<b>"U9</b>	1200 bps.
<b>"U1</b>	50 bps.	<b>"U10</b>	2400 bps.
<b>"U2</b>	75 bps.	<b>"U11</b>	4800 bps.
<b>"U3</b>	110 bps.	<b>"U12</b>	7200 bps.
<b>"U4</b>	134.5 bps.	<b>"U13</b>	9600 bps.
<b>"U5</b>	150 bps.	<b>"U15</b>	14,400 bps.
<b>"U6</b>	200 bps.	<b>"U16</b>	16,800 bps.
<b>"U7</b>	300 bps.	<b>"U17</b>	19,200 bps.
<b>"U8</b>	600 bps.		

## **V Verbose Response Codes**

This command determines how the modem communicates with the user, i.e. whether response codes are expressed as words or numeric code. Referred to as verbose/terse, or long/short form. Response codes are listed with the X command.

<b>V0</b>	Selects numeric (terse) codes.
<b>V1</b>	Selects word (verbose) codes. Default.

Numeric codes are followed by a single <CR>. Word codes are followed by <CR><LF>.

## **&V Dumb Mode**

This command is applicable to the DTE port only and determines whether the modem will accept AT commands and/or the escape sequence (default +++).

<b>&amp;V0</b>	Commands are accepted from the DTE when the modem is off-line, or when on-line by using the escape sequence. Default.
<b>&amp;V1</b>	Commands may only be entered when the modem is off-line. The escape sequence is ignored.
<b>&amp;V2</b>	Commands and escape sequence are ignored.

## **\*V V.25bis Command Mode**

This command allows your modem to accept *V.25bis* commands. (*V.25bis* commands are listed in Chapter 10.)

- \*V1** Modem accepts asynchronous *V.25bis* control.
- \*V2** Modem accepts byte synchronous *V.25bis* control.
- \*V3** Modem accepts HDLC synchronous *V.25bis* control.

The **\*V1** command can be entered through either the main DTE port or the command port. It enables the port at which it is entered.

The **\*V2** and **\*V3** commands are only valid when commands are entered at the main DTE port.

## **&W Save User Configuration**

This command allows you to store a newly customised configuration from the active area.

**&Wn** where n is the user configuration number (0-3).

## **\*W DSR Control**

- \*W0** Normal DSR control (see &C).
- \*W1** DSR follows DTR. This is used for hosts which on raising DTR expect DSR to be returned by the modem. (Overridden by /O when in test mode.)

## **%W Stop Modifying the Remote Configuration**

This command terminates the operation on the remote configuration copy started by the %Z command. Subsequent commands will affect the local modem's active configuration.

## **"W Key Store**

This command is used to store three alphanumeric characters as a key (for use in conjunction with the Network 16 Controller Card for authentication of level 2 security).

**"Waaa** where aaa is the key

See Section 5.9.

## **X Response Codes**

This command is used:

- to turn off modem response codes which cannot be interpreted by the DTE's operating software.
- to allow a telephone number to be dialled without waiting for dial tone or absence of busy tone (see Section 6.2.5).

- |           |  |
|-----------|--|
| <b>X0</b> | The modem ignores network tones: when a connection is established, the speed of connection is not indicated. |
| <b>X1</b> | The modem ignores network tones, but displays the connection speed.  |
| <b>X2</b> | The modem detects dial tone, and displays the connection speed.  |
| <b>X3</b> | The modem detects busy tone, and displays the connection speed.  |
| <b>X4</b> | The modem detects busy and dial tones, and displays the connection speed.                                    |
| <b>X5</b> | The modem detects busy and ringback tones, and displays the connection speed.                                |
| <b>X6</b> | The modem detects busy, dial and ringback tones, and displays the connection speed. Default.                 |

The connection speed displayed is determined by the Constant Speed Interface command &l.

With X0, X1, X3 or X5 set, the modem does not look for dial tone.  
With X0, X1 or X2 set, the modem does not look for busy tone.

In the following table, asterisks under each X command indicate the response codes that will be sent. Whether these are in terse or verbose form is determined by the V command. The modem can send not only standard responses, but also extra responses when the /S1 command is set.



COMMAND							RESPONSE CODE		COMMENTS
X0	X1	X2	X3	X4	X5	X6	TERSE	VERBOSE	
*	*	*	*	*	*	*	0	OK	Command actioned
				*	*	*	1	CONNECT 300	Connected at 300 bps
*	*	*	*				1	CONNECT	Connected
*	*	*	*	*	*	*	2	RING	Incoming ring detected
*	*	*	*	*	*	*	3	NO CARRIER	Modem carrier lost
*	*	*	*	*	*	*	4	ERROR	Command syntax error
				*	*	*	5	CONNECT 1200	Connected at 1200 bps
		*		*		*	6	NO DIAL TONE	No dial tone detected
			*	*	*	*	7	BUSY	Number engaged
*	*	*	*	*	*	*	8	NO ANSWER	Number does not answer
	*	*	*	*	*	*	9	CONNECT 600	Connected at 600 bps
	*	*	*	*	*	*	10	CONNECT 2400	Connected at 2400 bps
	*	*	*	*	*	*	11	CONNECT 1275	Connected at 1275 bps
	*	*	*	*	*	*	12	RDL GRANTED	Test modes only
	*	*	*	*	*	*	13	RDL DENIED	Test modes only
*	*	*	*	*	*	*	15	ABORTED	Connection aborted
*	*	*	*	*	*	*	16	TIMEOUT	Connection timed-out
*	*	*	*	*	*	*	21	LINK FAILURE	Connection aborted, no error correction at remote site
	*	*	*	*	*	*	26	BLACKLIST	
	*	*	*	*	*	*	28	CONNECT 4800	Connected at 4800 bps
	*	*	*	*	*	*	30	CONNECT 9600	Connected at 9600 bps
					*	*	31	VOICE	Voice call detected
					*	*	32	RINGING	Telephone ringing
		*		*		*	33	DIAL TONE	Dial tone, call cleared
*	*	*	*	*	*	*	34	PRIVATE LINE	Leased line mode
							36	RETRAIN	
							37	BAD SQ	
*	*	*	*	*	*	*	40	NOT STORED	User Config not stored
			*	*	*	*	41	BUSY TONE	
	*	*	*	*	*	*	45	CONNECT 19200	Connected at 19200 bps
	*	*	*	*	*	*	46	CONNECT 7512	Connected at 75/1200 bps
*	*	*	*	*	*	*	70	ACCESS GRANTED	Secure access successful
*	*	*	*	*	*	*	71	ACCESS DENIED	Secure access failed
							80	/LOSS OF RTS	Extended timeout response
							81	/CONSTANT RTS	Extended timeout response
							83	/DTE	Extended timeout response
							84	/LINE	Extended timeout response
							92	/LAPM	LAPM error correction
							96	/REL	MNP error correction
							110	/AL	Extended timeout response
*	*	*	*	*	*	*	119	TEST TERMINATED	Timeout response

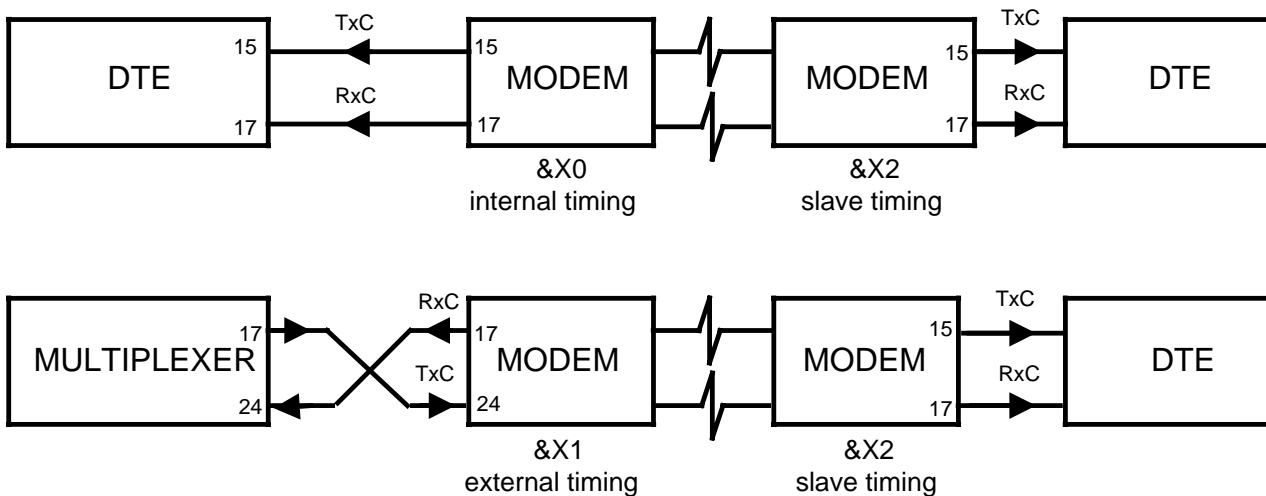
Responses marked / will appear only when /S1 is set.

## &X Modem Timing

This command is only valid for 2-wire V.22bis and V.22 full-duplex operation. It determines the timing source for the modem transmitter.

- &X0** Internal timing (supplied by the modem). Use in simple 2-wire point-to-point applications, whether PSTN or leased line. Default.
- &X1** External timing (supplied to modem on pin 24). Use where the modem link is an extension of a network which requires timing synchronisation throughout. Applicable in 2-wire half-duplex systems.
- &X2** Slave timing (derived from receive timing). Use where a link requires one timing source for both transmission directions, and the timing is determined by the remote device.

The following diagrams illustrate the use of &X command:



## %X Remote Up-Load

This command is used to request a copy of the remote modem's active configuration. This will momentarily interrupt data transmission.

## **\*Y Break Mode Control**

This command is used to determine the manner in which a break received from the DTE port or the remote modem, is handled.

- \*Y0** Break immediately passed through the modem. Default.
- \*Y1** Break immediately passed through the modem, and the buffers emptied.
- \*Y2** Break sent in sequence with the buffered data.

## **Z Recall User Configuration**

This command will recall a previously-configured user configuration to become the active configuration.

- Zn** where n is the user configuration number (0-3).

## **%Z Modify the Remote Configuration**

This command allows you to alter the locally-held copy of the remote modem's active configuration. Subsequent commands will affect only this copy, until the %W command is issued.

## **"Z Password Store**

This command is used to store an eight-character alphanumeric password. The modem will return ERROR if other than eight characters are entered.

- AT"Znnnnnnnn** where nnnnnnnn is the password.

**Note that passwords are case-sensitive.**

See Section 5.9.



## 9.1 Introduction

S-registers are special 8-bit stores which are used to access features that are not available through AT commands, and to store features set by standard commands.

**Indiscriminate changing of S-registers can result in conflicting settings which may cause the modem to malfunction.**

Refer to Appendix C for UK restrictions of S-registers.

S-registers are used in two main ways: those that contain whole characters ('non-bit-mapped' registers), and those whose bits are used for different purposes ('bit-mapped' registers).

### Non-Bit-Mapped Registers

These may be sub-divided into three types:

**Counters** and other whole numbers. Counters are absolute values. A zero setting will usually disable the counter.

**Timers**, often expressed as values from 0 to 255. Timers are stated in increments relative to their use. Setting at zero usually disables the timer so that the function will run until commanded to stop.

**ASCII** character registers, used to define a single ASCII character that will cause the modem to perform a certain function when it receives that character.

### Bit-Mapped Registers

These registers are used to store modem features normally set with AT commands. The 8 bits are grouped as necessary for the various options.

It is not necessary to access these registers in normal modem use, and they are not discussed further in this manual.

## 9.2 Manipulating S-Registers

The following commands may be used to inspect and change the contents of S-registers:

*S	Display S-register summary
Sn?	Display single S-register setting
Sn=	Set an S-register to a value
&O	S-register output format

## 9.3 Non-Bit-Mapped S-Registers

### **S0 Answer After Specified Number of Rings, or Disable Auto-answer**

Counter    Range: 0-255    Default: 2

The number entered in the S0 register determines the number of times an incoming call signal is received, before the call is answered. If S0 is set at 0, the autoanswer facility is disabled.

### **S1 Ring Counter**

Counter    Range: 0-255    Default: 0

This register records the number of incoming ring signals detected. It cannot be over-written by the user.

### **S2 Escape Character**

ASCII      Range: 0-127    Default: 43H (ASCII +)

This register contains the code interpreted as the AT escape character.

### **S3 Carriage Return Character**

ASCII      Range: 0-127    Default: 13H (ASCII CR)

This register contains the code interpreted, and output, as the carriage return character, when the modem is in command mode.

### **S4 Line Feed Character**

ASCII      Range: 0-127    Default: 10H (ASCII LF)

This register contains the code which is output as the line feed character when the modem is in command mode.

### **S5 Backspace Character**

ASCII      Range: 0-127    Default: 8 (ASCII BS)

This register contains the code that is interpreted as the backspace character when the modem is in command mode.

## **S6 Dial Tone Wait Time**

Timer      Range: 4-8 (seconds)      Default: 4 (seconds)

This register contains the time that the modem waits for a dial tone.

## **S7 Wait for Answer Tone**

Timer      Range: 5-40 (seconds)      Default: 40 (seconds)

This register contains the time that the modem waits for a valid carrier tone to be sent from the remote modem. The timeout commences after the last digit is dialled. Not applicable in leased line mode.

## **S8 Pause Time for Comma**

Timer      Range: 4-8 (seconds)      Default: 4 (seconds)

This register contains the time that the modem waits when it encounters a comma in an AT dialling sequence.

## **S9 DCD Detect Time**

Timer      Range: 0-255 (seconds)      Default: 10 (seconds)

This register contains the time allowed to validate a connection.

## **S10 Carrier Loss to Hang-up Delay**

Timer      Range: 1-150 (each unit is 0.1 seconds) Default: 25 (2.5 seconds)

This register contains the time that the modem waits, after the carrier has been lost, before disconnecting the line (see \*T). It is also used by the /A command. Each count represents one tenth of a second. The \*B command can be used to change the units to 1.0 seconds.

## **S12 Escape Sequence Guard Time**

Timer      Range: 0-255 (in 0.2 seconds) Default: 50 (1 second)

The escape sequence guard time is the time required to elapse immediately before and after sending the AT escape sequence (default +++).



### **S18 Test Timer**

Timer Range: 0-255 (seconds) Default: 0 (manual termination)

This register is used in conjunction with the command &T to cause tests to run for a set period. The value 0 causes the test to run until it is manually terminated by the user.

### **S25 Delay to DTR Timer**

Timer Range: 0-255 (seconds) Default: 10 (seconds)

This is used with the &Q1 and &Q4 commands.

### **S36 Maximum Number of Redial Attempts**

Counter Range: 0-7 Default: 7

The modem normally makes up to 7 attempts to dial a number. This number can be changed by entering a new number, within the range indicated above.

### **S37 Data Inactivity Timer**

Timer Range: 0-60 (minutes) Default: 0

The modem can automatically disconnect calls if no data is transmitted or received after a specified time, as set by the \*M command.

### **S38 Modem Product Code**

Counter Range: 0-255 Default: 226 (Standalone)  
228 (Rackmount)

This register determines the response to the I0 command. Different values may be required for compatibility with some communication software.

### **S39 Flow Control XON Character**

ASCII Range: 0-127 Default: 17H (ASCII DC1)

This register contains the XON character used in XON/XOFF flow control (DC1 = Ctrl-Q).

#### **S40 Flow Control XOFF Character**

ASCII Range: 0-127 Default: 19H (ASCII DC3)

This register contains the XOFF character used in XON/XOFF flow control (DC3 = Ctrl-S).

#### **S41 Secondary XON character**

ASCII Range: 0-255 Default: F9H

This register contains the secondary XON character used in dual flow control.

#### **S42 Secondary XOFF character**

ASCII Range: 0-255 Default: FBH

This register contains the secondary XOFF character used in dual flow control.

#### **S43 Dialback Security Enable**

ASCII Range: 0 or 255 Default: 0

When S43=0, dialback security is disabled. When S43=255, dialback security is enabled. No other values are valid.

#### **S49 User Flow Control XON Character**

ASCII Range: 0-255 Default: 17H (ASCII DC1)

This register contains the XON character used in user XON/XOFF flow control (DC1 = Ctrl-Q).

#### **S50 User Flow Control XOFF Character**

ASCII Range: 0-255 Default: 19H (ASCII DC3)

This register contains the XOFF character used in user XON/XOFF flow control (DC3 = Ctrl-S).

## **S56 Constant Carrier Timeout**

Timer      Range: 0-255 (seconds)      Default: 30 (seconds)

This register contains the period of time, after loss of constant carrier, before the incoming call is disconnected (\*T command). Timeout is disabled when the register is set at 0.

## **S93 V.42bis Dictionary Size**

Counter    Range: 9-12      Default: 11 (2048 bytes)

This register sets the V.42bis dictionary size as follows:

<b>Register</b>	<b>Dictionary Size (bytes)</b>
9	512
10	1024
11	2048
12	4096

A dictionary size of 4096 bytes is only available when one-way compression is used (%C2 or %C3).

## **S94 V.42bis Maximum String Length**

Counter    Range: 6-250 (bytes)      Default: 40 (bytes)

This register sets the maximum length of the string used in the V42bis compression algorithm.

As a general guide, for text files use a large dictionary size and large (e.g. 40) maximum string length. For binary files, use a small dictionary size and small maximum string length.



Before you can issue *V.25bis* commands, you must first put the modem into *V.25bis* mode by issuing the relevant \*V command. You exit by the BAK command.

The modem includes some commands that are additional to the standard *V.25bis* set.

## 10.1 Command Structure

- **Byte synchronous V.25bis commands** must be entered via the DTE port in the format:

**<SYN><SYN><STX> Command <ETX>**

where: <SYN> represents a synchronous-idle character (hex 16)  
 <STX> represents a start-of-text character (hex 02)  
 <ETX> represents an end-of-text character (hex 03)

The hex values given above apply when using ASCII.

Characters should be sent as consecutive 8-bit words of 7 data bits and odd parity when using ASCII.

- **HDLC synchronous character-oriented V.25bis commands** must be entered via the DTE port in the format:

**<F><A><C> Command <FCS><F>**

where: <F> represents the HDLC flag character  
 <A> represents 11111111  
 <C> represents 11001000  
 <FCS> represents a checksum automatically calculated

<A> and <C> are given as in the ITU-T Recommendation *with the LSB shown first*. Because the command field is a U1 frame transmitted with the P bit set to 1 and the global address, <A> and <C> have to be set as above.

Characters should be sent as consecutive 8-bit words of 7 data bits with the eighth bit as “don't care”.

## 10.2 Commands

### Summary

BAK	Additional command	Return to AT command language
CIC	V.25 <i>bis</i> command	Connect to incoming call
CLA	Additional command	Clear all or one directory entry
CRI	V.25 <i>bis</i> command	Call request with identity number
CRN	V.25 <i>bis</i> command	Dial a telephone number
CRS	V.25 <i>bis</i> command	Dial a stored telephone number
DIC	V.25 <i>bis</i> command	Disable autoanswer
DLN	Additional command	Dial last number
EON	Additional command	Echo V.25 <i>bis</i> commands
EOF	Additional command	No echo of V.25 <i>bis</i> commands
PRI	V.25 <i>bis</i> command	Program identity number
PRN	V.25 <i>bis</i> command	Store telephone number in directory
RLD	V.25 <i>bis</i> command	Display delayed numbers
RLF	V.25 <i>bis</i> command	Display blacklisted numbers
RLI	V.25 <i>bis</i> command	Request identity number
RLN	V.25 <i>bis</i> command	Display telephone directory

### Description

**CIC** Connect incoming call. If the modem has been instructed not to answer incoming calls, this command can be used to re-instruct the modem to answer the call.

**CLA** Clear telephone directory entries.

**CLAx** for a particular entry *xx*  
**CLA\*\*** for all entries.

**CRI** Dial a number with an identity number.

**CRInnn;iii**

where:    *nnn* = telephone number and its modifiers  
          ;    = required syntax separating the number  
          *iii* = identity number (up to 20 characters).

**CRN** Dial a telephone number. This implementation of V.25 *bis* allows the use of all the AT dial modifiers, except ; (see the D command).

**CRNnnn**

where *nnn* is the telephone number and dial modifiers.

**CRS** Dial a stored number. The *V.25bis* directory is the same as the AT directory except that it does not use location 0.

**CRSxx**

where xx is a two-digit number.

**DIC** Disregard incoming call. When an incoming call's response (INC) is displayed, this command can be used to instruct the modem not to answer that particular call. The command must be sent within five seconds of the incoming call's response being displayed, otherwise the call is connected.

**DLN** Redial last number.

**EON** Echo on. This command instructs the modem to echo the commands back to the DTE.

**EOF** Echo off. This command instructs the modem not to echo the commands back to the DTE.

**PRI** Program identity number.

**PRInnn**

where nnn is the identity number (up to 20 characters).

**PRN** Store a telephone number and its modifiers (a maximum of 20 characters).

**PRNxx;nnn**

where:    xx    =   directory number (1 to 20)  
          ;    =   required syntax separating the number  
          nnn =   the telephone number and its modifiers.

**RLD** Request delayed number list. (RLDxx for a particular entry.)

**RLF** Request blacklisted number list. (RLFxx for a particular entry.)  
Note that the modem's blacklist mechanism only affects numbers dialled with the 'U' modifier (automatic dialling by the modem). Only these numbers can be “delayed” or “blacklisted”.

**RLI** Request identity number.

**RLN** Request telephone number list. (RLNxx for a particular entry.)

## 10.3 Responses

### Summary

CFI	V.25 <i>bis</i> response	Call failure indicator
DLC	V.25 <i>bis</i> response	Delayed call message
EOL	Additional response	End-of-list message after LSD, LSF or LSN response
INC	V.25 <i>bis</i> response	Incoming call (ring detected)
INV	V.25 <i>bis</i> response	Invalid command entered
LSD	V.25 <i>bis</i> response	Response to the RLD command
LSF	V.25 <i>bis</i> response	Response to the RLF command
LSI	V.25 <i>bis</i> response	Response to the RLI command
LSN	V.25 <i>bis</i> response	Response to the RLN command
ONL	Additional response	Indicates a connection to a remote modem
OFL	Additional response	Indicates a disconnect from line
VAL	V.25 <i>bis</i> response	Valid command entered

### Description

CFI Call fail indication. Indicates that the modem has been unsuccessful in connecting a call. The response includes a two-letter code which specifies the reason for failure.

NS	Number not in memory
AB	Abort call due to timeout
FC	Blacklisted call
ET	Number busy
RT	Ring tone timeout
NT	Tone not detected on line
DT	No dial tone/disconnected

DLC Delayed call message.

DLCx

where x is the number of minutes delay for a blacklisted number.

EOL Indication of the end of an LSD, LSF or LSN listing.



- INC** Incoming call. Indicates that ringing is detected (signifying an incoming call). When there is a conflict, an incoming call has priority over a dial number request.
- INV** Invalid. Indicates that the modem cannot understand or execute a command.
- LSD** List of delayed numbers. This is the response to the RLD command; it is only relevant when the 'U' dial modifier has been used. The response is in the form:

```
LSD01;123456789;DPSTTT
LSD02;234567891;DPSTTT
LSD03;345678912;DPSTTT
LSD04;456789123;DPSTTT
LSD05;567891234;DPSTTT
EOL
```

See the note following LSN for an explanation of the format.

- LSF** List of blacklisted numbers. This is the response to the RLF command; it is only relevant when the 'U' dial modifier has been used. The response is in the form:

```
LSF01;123456789;FPSTTT
LSF02;234567891;FPSTTT
LSF03;345678912;FPSTTT
LSF04;456789123;FPSTTT
LSF05;567891234;FPSTTT
EOL
```

See the note following LSN for an explanation of the format.

- LSI** This is the response to the RLI command.
- LSIiii where iii is the identity number.

- LSN** Number status. This is the response to the RLN command. The response is in the form:

```
LSN01;123456789;ZPSTTT
LSN02;234567891;ZPSTTT
LSN03;345678912;ZPSTTT
LSN04;456789123;ZPSTTT
```

LSN05;567891234;ZPSTTT  
EOL

Note: In the response lists, LSDxx, LSFxx or LSNxx precedes each directory entry. The actual telephone number follows between two separators ( ; ). This is followed by the status of the telephone number in the form ZPSTTT where:

Z is U to represent an unrestricted call  
is D to represent a delayed call  
is F to represent a blacklisted call  
P is the delay time in minutes for a delayed call  
S is the number of dialled attempts that have failed  
TTT is the time that a blacklisted call has to wait before the restriction is lifted.

ONL Indicates that the modem has gone on-line and connected to a remote modem.

OFL Indicates that the modem has terminated the call and returned to the off-line state.

VAL Indicates that the modem has recognised and accepted the command.

## Transmitter/Receiver

Modulation	V.22bis QAM 1200, 2400 bps. V.22 DPSK 600, 1200 bps. V.23 FSK 1200/75, 75/1200, and 1200/1200 bps half-duplex. V.21 FSK 300 bps.
Carrier	V.22bis: Answer 2400 Hz, originate 1200 Hz. V.22: Answer 2400 Hz, originate 1200 Hz. V.23: Forward channel 1300 Hz (m), 2100 Hz (s); backward channel 390 Hz (m), 450 Hz (s). V.21: Answer 1650 Hz (m), 1850 Hz (s); originate 980 Hz (m), 1180 Hz (s).
Carrier Threshold	-6 dBm to -43 dBm.
Operation	2-wire synchronous or asynchronous.
Output level	Selectable -4 dBm to -15 dBm (UK versions set to -9 dBm for PSTN operation or -13 dBm for leased line operation).
Data Input	Serial binary. Complies with ITU-T V.28. Accepts levels + 3 volts to +25 volts (space), and -3 volts to -25 volts (mark). Single wire ground return. 3000 to 7000 ohms load.
Data Output	Serial binary. Complies with ITU-T V.28, + 12 and -12 volts nominal. Output impedance 300 ohms.
Synchronisation	RTS/CTS delay dependant on modulation format.
Equaliser	Automatic adaptive equaliser in V.22bis and V.22 modes.

Fixed compromise transmit equaliser in V.23 and V.21 modes.

## **Auto-dial/Auto-answer**

Method	Pulse dial. 10 pps rate. Make period 33 msec. Break period 67 msec (UK version). Interdigit period 800 msec. Tone dial. On time 101 msec. ID time 101msec. Duty cycle 50%.
Line Interface	600 ohm impedance. Bell tinkle suppression. Old and new dial tone detection. Secondary dial tone detection for PABX use. Progress tones and answer tone detection.
Auto-answer	ITU-T V.25 compliant.
Busy	Busy-out via AT command or loss of DTR.
Disconnect	Call clear selectable on loss of DTR, and/or no carrier for n seconds, and/or constant carrier for n seconds and/or by loss of data activity.
Test Functions	Local analogue loop. Remote digital loop. Test functions selectable via front panel switches, AT commands or on pins 18 and 21 of the DTE.

## **Facilities**

Command Sets	Extended AT and V.25 <i>bis</i> command sets. Commands can be entered asynchronously via the DTE interface or separate command port.
Memory	Non-volatile memory. 12 preset factory, and 4 user-defined configurations. 51 stored telephone numbers.

## Physical Description

Power	Standalone:	230 ± 10% VAC, 50-60 Hz, 0.1 A max. Optional 24 VDC to 48 VDC, 0.5A max. (DC source must be SELV)
	Rackmount:	power via the rack. Typical power consumption 11 watts.
Environment	Temperature: operating:	5°C to 40°C
	storage:	-25°C to 55°C
		Relative humidity 5% to 95% non-condensing. Altitude to 3000 metres.
Dimensions	Standalone :	45 mm high × 190 mm wide × 275 mm deep.
	Rackmount :	Takes up one rack slot (19" × 4U).





## B.1 DTE Port

### B.1.1 Interface

The connections are on a 25-way D-type female socket on the rear panel of the unit. The pin assignments are shown in the following table:

PIN	EIA REF	ITU-T REF	DESCRIPTION	FROM/TO MODEM	DATA/CONTROL/TIMING
1 7	AA AB	101 102	Protective Ground Signal Ground <sup>1</sup>		
2 3	BA BB	103 104	Transmitted Data (TxD) Received Data (RxD)	To From	Data Data
4 5 6 20 22 8	CA CB CC CD CE CF	105 106 107 108.2 125 109	Request To Send (RTS) Clear To Send (CTS) Data Set Ready (DSR) Data Terminal Ready (DTR) Ring Indicator (RI) Data Carrier Detect (DCD)	To From From To From From	Control Control Control Control Control Control
24 15 17	DA DB DD	113 114 115	External Tx Clock (XTxC) Internal Tx Clock (TxC) Internal Rx Clock (RxC)	To From From	Timing Timing Timing
9 10 18 21 23 25	CN	141 140 111 142	+12 volt test -12 volt test Local Analogue Loopback Remote Digital Loopback Data Rate Select/Indicate (DRS) <sup>2</sup> Test Indicator/Busy Out (TI/BO) <sup>3</sup>	From From To To From/To From	Control Control Control Control Control Control
14 16			Command Terminal TxD <sup>4</sup> Command Terminal RxD <sup>4</sup>	To From	

- Notes:
1. Pin 7 is signal common for the main DTE and the command terminal.
  2. See Technical Guide (link 9).
  3. See Technical Guide (link 6). Command &S2 or &S3 must be set.
  4. See Technical Guide (link 6).



## B.1.2 Cables

The modem-to-DTE connecting cable should be pin-to-pin connection such as part no X400-401511 (up to 2 metres in length) shown below.



If the modem is connected to a multiplexer channel, the cable should be a synchronous crossover type such as part no X400-400111 (up to 2 metres in length) shown below.



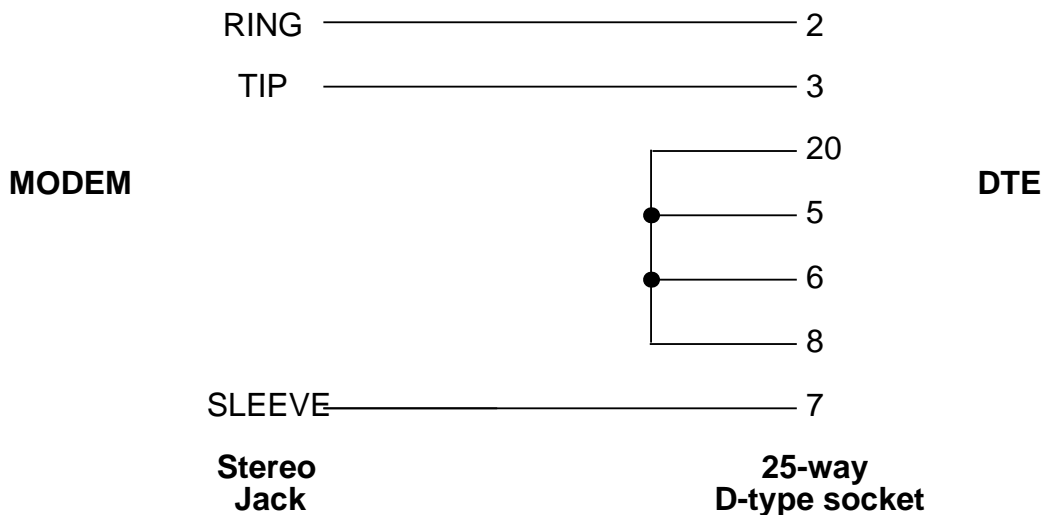
## B.2 Command Port

### B.2.1 Standalone Modem

The connections are on a 3.5 mm stereo socket, with the following pin assignments:

NAME	FUNCTION	V.24 COMMAND CABLE	DIRECTION
Ring	Transmit Data (TxD)	2 Transmit Data	To modem
Tip	Receive Data (RxD)	3 Receive Data	From modem
Sleeve	Signal Ground (GND)	7 Signal Reference	Common

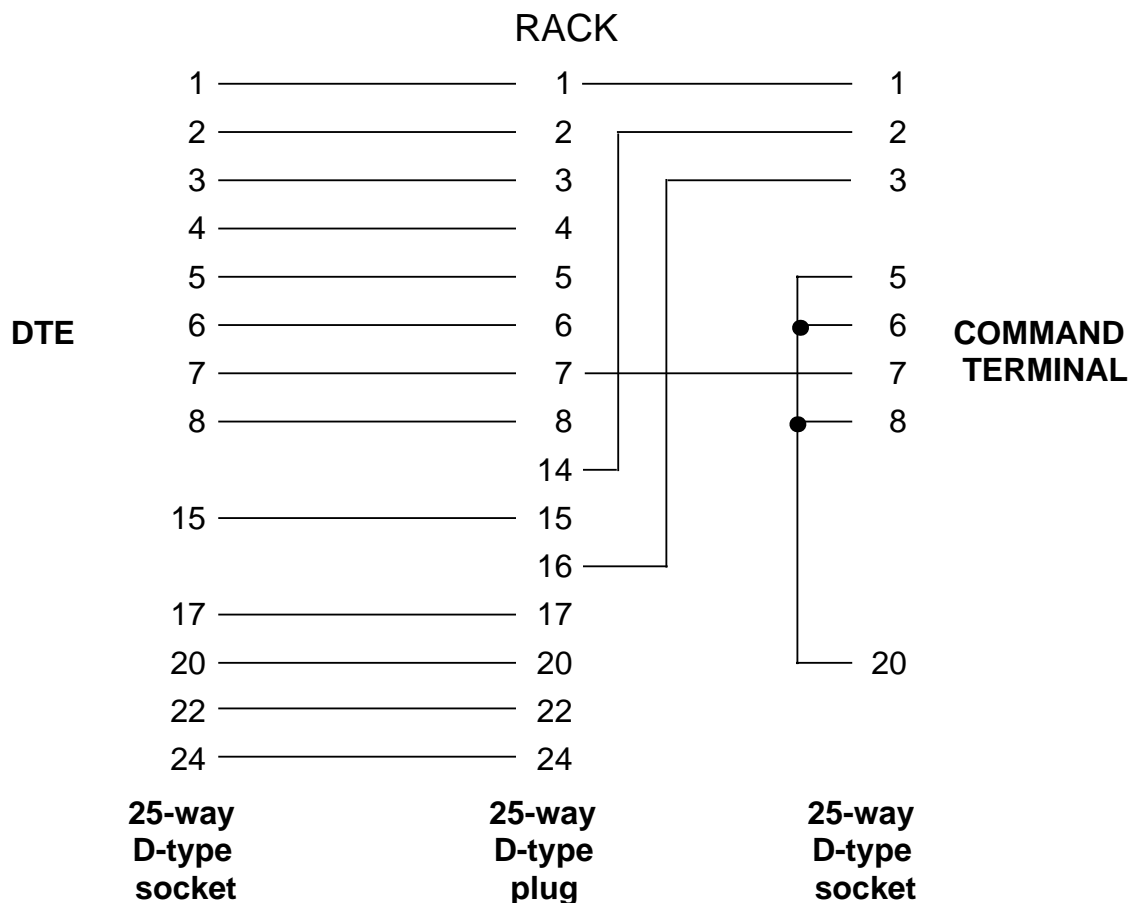
A command port adapter is provided with the modem, to enable a standard 25-way DTE plug to be connected to the command port:



## B.2.2 Rackmount Modem

Connection to the command port is normally made through the controller module in Network 16, or can be made directly through the DTE interface on the rearplane of Network 16 if you are not using the controller module.

For connection to the command port through the DTE interface, use a 'Y' cable as below. If you are using a 'Y' cable, links 9 and 4 should be in positions 2 and 1 respectively (see the Appendix entitled 'Technical Guide').





This appendix gives information which is specific to using the modem in the UK, so as to comply with the approvals regulations. For convenience, it is split into a number of sections, as shown below.

- C.1 Statutory Instructions for UK Users
- C.2 Installing the Standalone Modem
- C.3 UK Telephone Number Blacklist
- C.4 The Telephone Socket on the Modem
- C.5 Restrictions on use of S-Registers

## **C.1 Statutory Instructions for UK Users**

Users of this modem in the UK should pay particular attention to the information contained in this section.

The rackmount version is only approved for use in the Network 16 rack.

### **General**

- a) This modem is suitable for connection to the public switched telephone network (PSTN) provided by Approved Telecommunications Operators. (Direct exchange line, not shared service.)
- b) This modem is suitable for household, office and similar indoor use. It is not suitable for use as an extension to a 1+1 carrier system, or a payphone which was first available before the liberalisation of payphones in May 1988. This modem may be connected to a payphone approved under the arrangements for liberalisation, these payphones carry the green approved label.
- c) Interconnection directly, or by way of other apparatus, of ports marked with 'Warning. Connect only apparatus complying with BS6301 to these ports' with ports not so marked may produce hazardous conditions on the BT network. Advice should be sought from a competent engineer before such a connection is made.
- d) Only connect apparatus complying with BS6301 to the ports on the back panel of your modem marked with 'Warning. Connect only apparatus complying with BS6301 to these ports'.
- e) This modem is suitable for use on telephone lines provided with loop-disconnect or multi-frequency (MF) dialling facilities.
- f) This modem is suitable for use on point-to-point private circuits with two-wire termination.
- g) This modem may be used on circuits with British Telecom signalling at a nominal frequency of 2280 Hz.
- h) This modem does not require signalling or otherwise employ the frequency range DC to 200 Hz.
- i) This modem does not require DC from the British Telecom Private Speech Band Circuit for correct operation.

- j) The approval of this modem for connection to the British Telecom PSTN or Private Speech Band Circuits is INVALIDATED if the apparatus is subject to modification in any material way not authorised by BABT or if it is used with, or connected to:
  - i) Internal software that has not been formally accepted by BABT.
  - ii) External control software or external control apparatus which causes the operation of the modem or associated call set-up equipment to contravene the requirements of the standard set out in BABT/SITS/82/005S/D and BABT/SITS/82/01/C.
- k) All apparatus connected to this modem and thereby connected directly or indirectly to British Telecom PSTN or Private Speech Band Circuits must be approved apparatus as defined in Section 22 of the British Telecommunications Act 1984.
- l) This modem causes a voltage drop of 0.2 volts at a line current of 40mA.
- m) That for statutory purposes apparatus connected to the PSTN via a Relevant Branch System (RBS) is treated as if connected directly to the PSTN. Users should see BS6789 Section 6.1 para 2.4 for the definition of an RBS. Further information is contained in the proposed British Standard Guide for an RBS for PSTN lines.

### **Ringer Equivalence**

This modem has a ringer equivalence number (REN) of 3.0.

REN is a guide to the maximum number of pieces of apparatus (e.g. modems, telephones etc) that can be simultaneously connected to one telephone line. The REN value of each is added together and must not exceed 4.

Unless otherwise marked, a telephone supplied by BT can be assumed to have a REN of 1.

### **Automatic Dialling**

- a) This modem is a mode 1 device, and initiates repeat call attempts in accordance with call pattern B of BS6789; Part 3.1.
- b) Always ensure that numbers entered during the automatic dialling set-up phase are correct prior to dialling.

## **PBX and PABX Application**

- a) This modem has been approved for use of the following facilities:
  - i) Loop-disconnect and multi-frequency signalling.
  - ii) Storage of telephone numbers for retrieval by a pre-determined code.
  - iii) Detection of initial proceed indication.
  - iv) Detection of secondary indication.
  - v) Operation in the absence of proceed indication.
  - vi) Automatic dialling facilities.
  - vii) Tone detection i.e. ring tone, NU tone.
  - viii) Multiple repeat attempt facility.
  - ix) Automatic clearing from call originating end.
  - x) Call progress monitor (standalone version only).
  - xi) Series connection (standalone version only).
  - xii) Modem.

Any other usage will invalidate the approval of the apparatus, if as a result, it then ceases to conform to the standards against which approval was granted.

- b) This modem is only approved for compatible PBXs. The supplier of your modem should be consulted for an up-to-date list of PBXs with which this modem is compatible.
- c) There is no guarantee of correct working in all circumstances. Any difficulty should be referred to the supplier of the modem.
- d) This modem is suitable for connection to PBXs which return secondary proceed initiation.



## **Equipment Faults**

If any of your telephone apparatus is not operating properly, you should immediately remove it from the telephone line as this may harm the telephone network (PSTN). Contact your supplier.

## **Postcard for Requesting Socket Installation**

A postcard is supplied with this manual for requesting installation of British Telecom sockets for connection. It is not necessary to apply to British Telecom for installation of sockets where the wiring does not belong to British Telecom.

## **C.2 Installing the Standalone Modem**

This section supplements the information in Chapter 2. It includes details which are specific to the UK version of the product.

### **Line Connection**

The telephone socket on the rear panel is to BS6312, to enable any approved UK telephone to be connected.

The telephone cable from the modem is terminated with a BS6312 plug for connection to a BT socket.

When a private circuit is used, it must be terminated on pins 1 and 6 of a BS6312 socket.

### **Mains Power Connection**

The mains connector is a standard 13 amp plug, fitted with a 3 amp fuse.

The wires in the mains lead of this apparatus are coloured in accordance with the following code:

Green & Yellow: Earth    Blue: Neutral    Brown: Live

As these colours may not correspond with the coloured markings identifying the terminals in your plug, proceed as follows:

The wire which is coloured Green & Yellow must be connected to the terminal in the plug which is marked by the letter E or by the safety earth symbol  $\perp$ , or coloured green, or green & yellow.

The wire which is coloured Blue must be connected to the terminal in the plug which is marked with the letter N or coloured black.

The wire which is coloured Brown must be connected to the terminal in the plug which is marked with the letter L or coloured red.

If the moulded mains plug is removed from the lead of this equipment, the plug must be disposed of immediately.

### **Protective Earthing**

The protection of the user of this product relies on the connection of a protective earth. If this has not been hard-wired to the connection earth point of the modem, users should ensure:

- (i) That the connection to the line is unplugged before the mains plug is removed.
- (ii) That the connection to the line is not hard-wired.

## **C.3 UK Telephone Number Blacklist**

In most countries there are rules relating to how often and what time intervals should elapse between dialling attempts. This blacklist is only operational for dial-up (PSTN) applications. Below is the definition of the telephone number blacklist rules for your modem when supplied for use in the UK.

When the dial command includes the U modifier (automatic re-dial), the number is placed on the blacklist the moment it is dialled, and cleared only if the call is successful, i.e. the call results in a CONNECT message. Up to 20 numbers can be contained in this blacklist at one time. Should this limit be exceeded then the blacklist will need to be cleared before the PSTN autodialling operation can continue.

The following rules apply to numbers entered on the blacklist.

- i) After one unsuccessful connection attempt, ten seconds will elapse before a second dial command for the same number can be executed.
- ii) After a second unsuccessful connection attempt, 120 seconds will elapse before a third dial for the same number can be executed.
- iii) Another four attempts are allowed at 120 second intervals.
- iv) Should all seven attempts to dial a number be unsuccessful, the modem will be disabled from calling that number again until the four-hour timer has elapsed.
- v) Any attempt to redial the telephone number during a blacklisted period will result in a BLACKLIST response.

Note: These rules do not apply to manual redialling on the PSTN (using AT commands, or front panel buttons), nor to connections on leased lines.

When external Communication Software is used to control the modem, automatic redialling must conform to the above rules and the requirements of BAPT/SITS/82/005S/D and BAPT/SITS/82/01/C.

## **C.4 The Telephone Socket on the Modem**

For your safety a blanking plug has been fitted to the telephone socket of your modem to prevent access to internal connections, which may carry hazardous voltages generated by the telephone network.

Instructions for connecting a telephone to this socket are given in the Appendix entitled 'Technical Guide'. If the telephone connection is removed, you must re-fit the blanking plug.

If you find that you have lost the blanking plug, you can obtain a replacement from your supplier. Please quote part number A225-600094.

## C.5 Restrictions on Use of S-Registers

S-registers 6, 7, 8 and 36 must always comply with the statutory requirements listed below. Settings which do not conform are overridden and the minimum or maximum setting is reverted to.

S-REGISTER		MINIMUM VALUE	MAXIMUM VALUE
S6	Wait for dialtone	4 seconds	8 seconds
S7	Wait for carrier	0 seconds	59 seconds
S8	Pause time for comma	4 seconds	8 seconds
S36	Max. No. of dial attempts	1 attempt	7 attempts

The use of multiple commas in a dialling string does not override the 8-second statutory maximum in registers S6 and S8.



## D.1 Introduction

This appendix provides detailed information on the physical configuration of the modem.

### **WARNINGS**

**The information contained in this appendix is for use only by suitably qualified and competent engineers.**

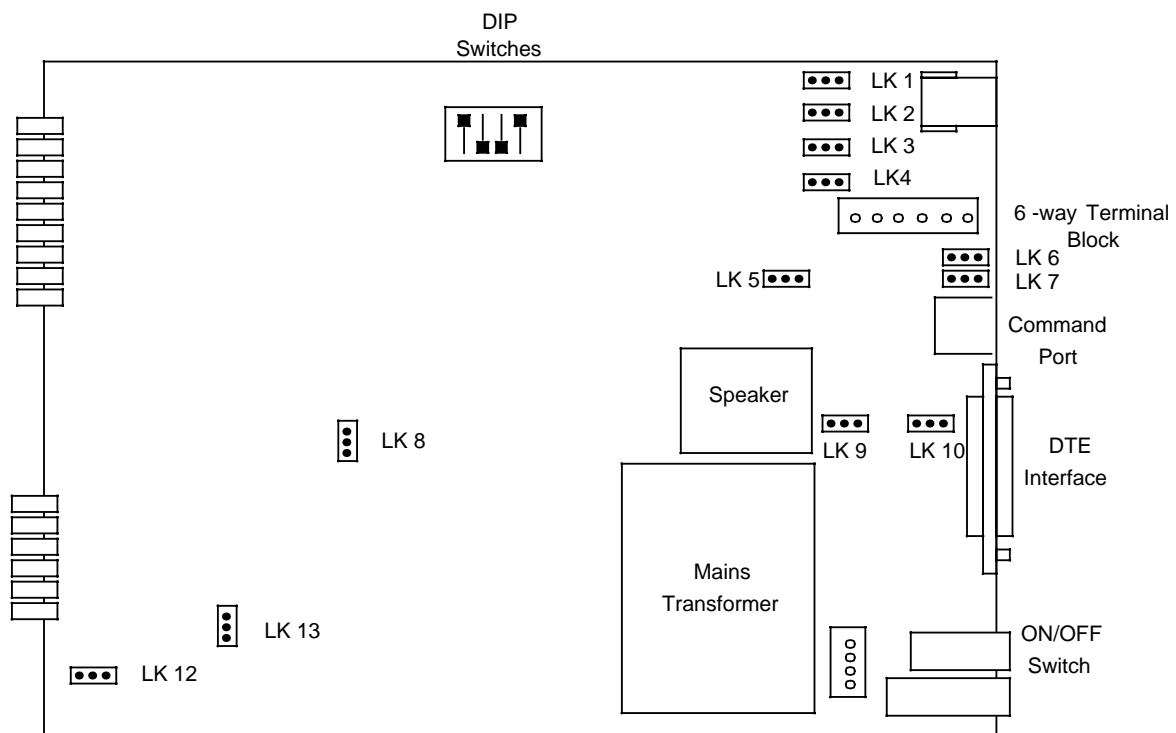
**In order to comply with national regulations it will be necessary to re-test the modem to ensure it meets the requirements of BAPT document 340 following any modifications. Failure to meet this condition will invalidate the approval.**

**This product contains static-sensitive devices. Normal anti-static precautions should be taken when handling the PCB.**

## D.2 Standalone Modem

### D.2.1 Accessing the Modem Card

1. Disconnect all telephone connections.
2. Disconnect the computer or terminal from the DTE and command port connectors, then remove the mains plug from its supply.
3. The modem is secured to the chassis by three back-panel-mounted screws. Remove these screws.
4. Carefully slide the modem and back panel out from the chassis. Place the modem in front of you with the front panel on the left as in the diagram below.

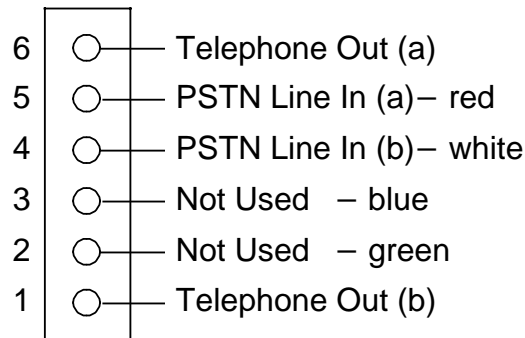


**Figure D-1 Standalone Card Layout**



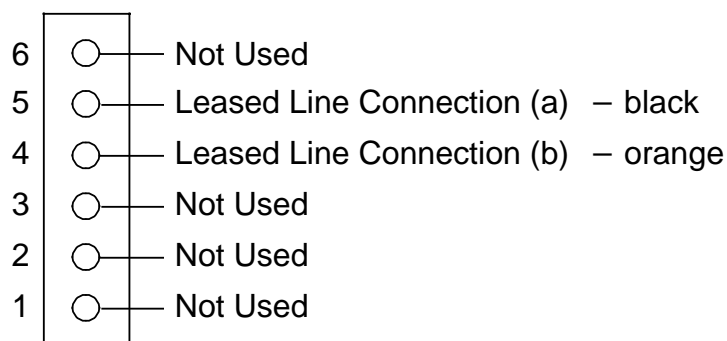
## D.2.2 Terminal Block Wiring

The terminal block and its wiring configuration for PSTN operation is shown in Figure D-2.



**Figure D-2 PSTN Terminal Block Connections**

To use the modem on a leased line, replace the line cord with a six-way cord (part no 710-1264) and connect it to the terminal block as shown in Figure D-3.



**Figure D-3 Leased Line Terminal Block Connections**

The red, white, green and blue wires must be cut back to the insulating sleeve.

## D.2.3 Transmit Level Settings


These levels are selected using the switch nearest the edge of the board.

	<b>SW4</b> (–8 dBm)	<b>SW3</b> (–4 dBm)	<b>SW2</b> (–2 dBm)	<b>SW1</b> (–1 dBm)
UK PSTN	ON	OFF	OFF	ON
UK leased line	ON	ON	OFF	ON

For UK use the switches must be set to the positions shown above that correspond to the type of circuit used. They are factory set for PSTN use.

## D.2.4 Link Options

PCB links enable you to make the appropriate connections for your operating mode.

Link boxes are drawn on the PCB as  but the positions are not marked. The link positions are:



Links 1, 2, 3, 4, 8, 12, and 13 are for factory use only and must not be changed.

Link 12 must be in position 1 to enable Battery Back-up.

Link 5 must be in position 1 to enable Watchdog Function.

Link 10:            Test indicate on pin 25. Not fitted (default).

Position 1 – AL on Pin 18. Pin 25 is 'Test Indicator' output.

Position 2 – Busy out on Pin 25. This link does not affect busy out using the front panel buttons.

Link 9:            Pin 23 disconnected. Not fitted (default).

Position 1 – AL on Pin 18. Pin 25 is 'Test Indicator' output.

Position 2 – Busy out on Pin 25.

Links 6 and 7:    Command acceptance.

Position 1 – Commands accepted at pins 14 and 16 of the DTE interface and the command port.

Position 2 – Commands accepted only at the command port.

Links 2 and 3:    Telephone Socket Option.

Position 1 – Telephone socket in parallel with the line.

Position 2 – Switched socket (default). The socket is normally connected to the line, but is disconnected when the modem is on-line. Position 2 is for normal operation. It is provided as copper track on the circuit side of the board.

## **D.2.5 Connecting a Telephone to the Modem**

1. Carry out steps 1-3 of Section D.2.1.
2. Carefully slide the modem part-way out of the chassis (it is not necessary to remove it completely).
3. Compress the tag on the blanking plug in the phone socket and withdraw it through the back panel, then put it somewhere safe for future use.
4. Plug your telephone cable into the modem, ensuring it clicks into place.
5. Slide the modem carefully back into the chassis and replace the securing screws and lockwashers.
6. Replace the mains plug in the socket, then the modem line cord.
7. Re-fit the connections to your DTE, and power the modem on to complete the process.

Should you decide at a later date to remove the telephone from the socket, dismantle the modem by the procedure described in 1 and 2 above. Ensure that you replace the blanking plug once you have removed the telephone cable, then reassemble and re-connect the modem as described in 5 to 7 above.

## **D.2.6 Connecting the 24 to 48 VDC Version**

The 24 to 48 volt DC powered version of the standalone modem is designed to operate on an exchange/PABX battery. The supply requirements are 24-48 VDC, 0.5A max. DC source must be SELV.

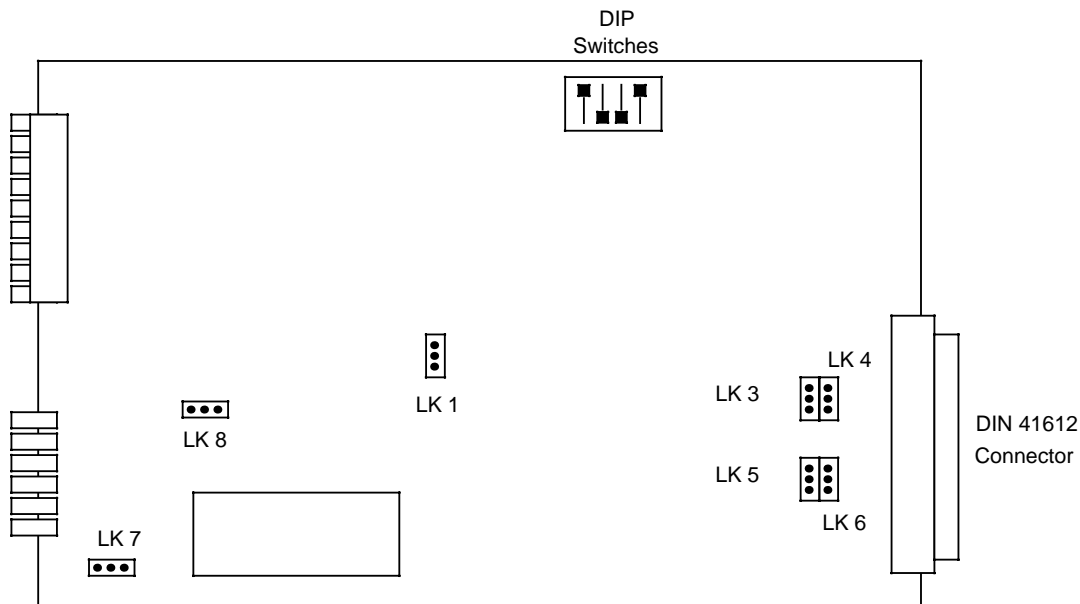
The modem power connection is via a 2 metre cable, stripped and tinned ready for connection to a terminal block.

Connect the red wire to the ground terminal and the black wire to the -24 to -48 volts DC supply. Double check the connections before turning the modem on. If the connections are reversed, or the supply voltage is too high, the fuse will blow. Use a 500mA(T) 250V fuse.

## D.3 Rackmount Modem

### D.3.1 The Modem Card

Before inserting the modem into the Network 16 rack, the switches and links should be in the correct positions for the application. The rackmount card layout is as shown below.



**Figure D-5 Rackmount Card Layout**

### D.3.2 Transmit Level Settings


These levels are selected using the DIP switch.

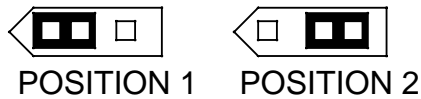
	<b>SW4</b> (-8 dBm)	<b>SW3</b> (-4 dBm)	<b>SW2</b> (-2 dBm)	<b>SW1</b> (-1 dBm)
UK PSTN	ON	OFF	OFF	ON
UK leased line	ON	ON	OFF	ON

For UK use the switches must be set to the positions shown above that correspond to the type of circuit used. The modem is factory set for PSTN use.

### D.3.3 Link Options

PCB links enable you to make the appropriate connections for your operating mode.

Link boxes are drawn on the PCB as  but the positions are not marked. The link positions are:



Links 4 and 6:

- Position 1 – The command port is connected to the Network 16 Controller (default).
- Position 2 – The command port is connected to Pins 14 and 16 of the DTE connector on the rack.

Link 3:            Not Fitted (default). Test indicate on Pin 25.

- Position 1 – Busy out on Pin 25.
- Position 2 – Test Indicate on Pin 25, AL on Pin 18.

Link 5:            Not fitted (default). Pin 23 not connected.

- Position 1 – Speed select on Pin 23.
- Position 2 – Speed indicate on Pin 23.

Links 1 and 8 are for factory use only and must not be changed.

Link 7 must be in Position 1 to enable Battery Back Up.

Link 2 must be in Position 1 to enable the Watchdog function.

### **D.3.4 Line Connection**

In addition to the modem you need a four-way (BT 4/502) or six-way (BT 6/502) linecord.

The modem is connected to the PSTN or leased line using the terminals on the rear panel of the rack and a linecord. Connect the cord to the terminals before plugging the other end into the BT socket.

