

Syncro 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/601156

NS/1404/23/K/601157

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.



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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.

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Preface

The Syncro 24 is available in two versions:

Syncro 24 Standalone modem.

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

This manual provides full information for installing, configuring and using the Syncro 24 and Syncro 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 Syncro 24 and Syncro 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

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|-----------|-----------------|
| Chapter 1 | Introduction |
| Chapter 2 | Installation |
| Chapter 3 | Getting Started |

1.1 The Syncro 24 Modem

The Syncro 24 Modem operates synchronously or asynchronously at 2400 bps over 2-wire leased lines or PSTN, or over 4-wire leased lines.

The modem complies with the following communications standards:

- ITU-T V.26 full-duplex: 2400 bps, synchronous and asynchronous operation over 4-wire leased lines.
- ITU-T V.26*bis* half-duplex: 2400 bps, synchronous and asynchronous operation over PSTN or 2-wire leased lines.
- Bell 201.

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.
- Comprehensive modem configuration using AT commands.
- A port conforming to ITU-T V.24/V.28 (EIA RS-232-C) standards for connecting the DTE.
- A separate command port for connecting a terminal or PC, so that commands may be entered or calls monitored while the modem is in use.
- 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

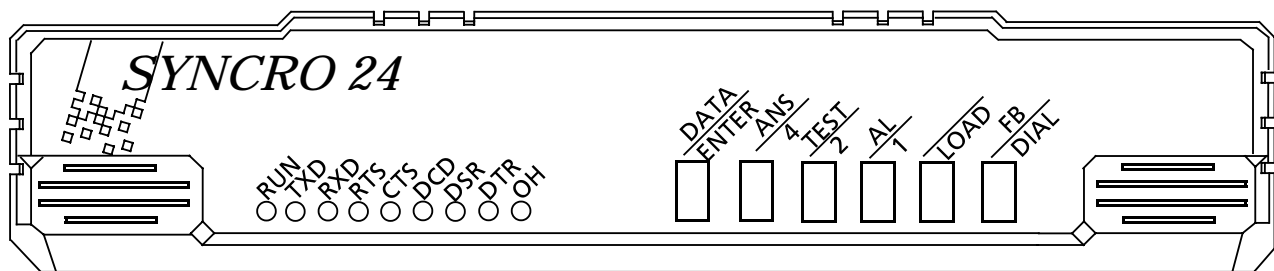


Figure 1-1 The Standalone Modem Front Panel

1.2.1 The Indicators

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

- | | |
|------------|--|
| RUN | 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. |
| TXD | Transmit Data. A flashing light indicates that data is being transferred from the local DTE. |
| RXD | Receive Data. A flashing light indicates that the modem is sending data to the local DTE. |
| RTS | 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. |
| CTS | 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 RTS indicator. |
| DCD | 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. |
| DSR | 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. |

| | |
|------------|---|
| DTR | Data Terminal Ready. Lit to indicate that the local DTE is ready to begin communications. |
| OH | 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 *left-hand* names are for on-line operation of the modem. The *right-hand* names 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>DATA</u> ENTER | Use as DATA to go into data mode when manually connecting a call, and press again to revert to command mode. Use as ENTER in conjunction with the 4 , 2 , 1 and LOAD buttons to load a configuration or dial a telephone number. |
| <u>ANS</u> 4 | Use as ANS : out enables autoanswer, in disables autoanswer. Use as 4 in conjunction with the LOAD , 2 , 1 and FB buttons to select a configuration or telephone number. |
| <u>TEST</u> 2 | Use as TEST to activate a test sequence for local or remote tests with your modem (see Chapter 7). Use as 2 in conjunction with the LOAD , 4 , 1 and FB buttons to select a configuration or telephone number. |
| <u>AL</u> 1 | Use as AL to select an analogue loopback (see Chapter 7). Use as 1 in conjunction with the LOAD , 4 , 2 and FB buttons to select a configuration or telephone number. |
| <u>LOAD</u> | Use as LOAD to select a load configuration option. Also used to select a Data Link test. |
| <u>FB</u> DIAL | Use as DIAL to select a stored telephone number to dial. It is also used in conjunction with the LOAD , 4 , 2 and 1 buttons to load a factory or user configuration. |

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.

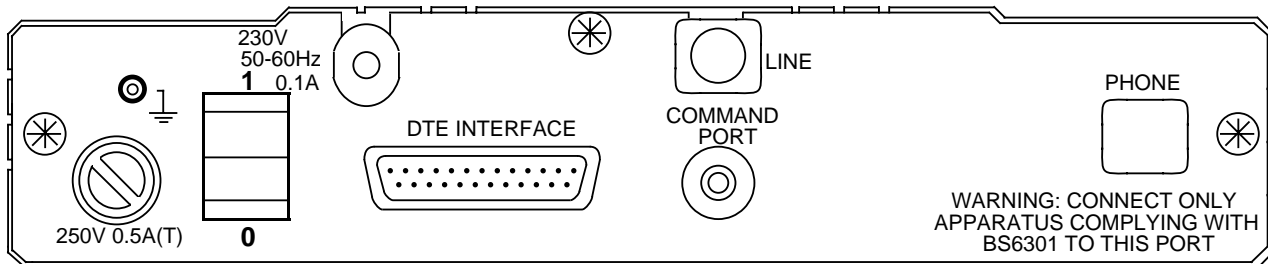



Figure 1-2 The Standalone Modem Rear Panel

| | |
|---|---|
| DTE INTERFACE | Female 25-way D-type connector (ISO 2110) to connect the modem to your local DTE. |
| COMMAND PORT | 3.5 mm stereo jack socket to accept the command port adapter. |
| EARTH  | 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 <i>before</i> the line cord is connected. |
| POWER | 2-metre mains cable fitted with a moulded plug for connection to a standard power outlet. To isolate the modem from the power source, <i>first</i> remove the line cord, <i>then</i> remove the mains plug from the power outlet. |
| FUSE | 500 mA (T) anti-surge 250 V mains fuse. You must <i>first</i> disconnect the modem from the line and <i>then</i> from the power supply before replacing this fuse. Always replace the fuse with one of the same rating. |
| SWITCH | Modem power ON (1) or OFF (0). |
| LINE | 3-metre line cord fitted with a standard British Telecom plug to connect to your telephone line socket. |

PHONE

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

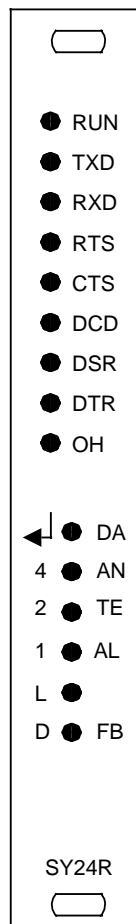


Figure 1-3 The Rackmount Modem Front Panel

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 your data DTE (computer or terminal). See Appendix B for details of the pin connections.
- A telephone line (PSTN or leased), terminated with a standard BT type 431A 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 data 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.
- A telephone to plug into the standalone modem for manual dialling.

Please refer to the Appendix entitled '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 to provide easy access for disconnection, and 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) to be connected directly to the modem.
- A PC to be connected directly to the modem.
- A terminal connected to a computer which is to be connected directly to the modem.

It will transmit and receive data in one of three ways:

- Asynchronous mode only.
- Synchronous mode only.
- Synchronous/asynchronous switchable mode.

Consult the DTE's manual for the relevant information.

2.2.1 AT Command Entry

To control your modem, you will need to send AT commands to it.

You must decide whether you are going to enter commands via your data DTE, or via a separate command terminal.

You can use your data DTE if:

- it is a dumb terminal, a PC running a software package which facilitates communication with the remote modem or which puts the PC in 'terminal emulation' mode, or a terminal connected via a computer which is able to communicate with the modem, and
- it works in asynchronous mode, or synchronous/asynchronous switchable mode.

You will need a separate command terminal if:

- your data DTE works in synchronous mode only, or
- your data DTE is a PC or terminal/computer which does not contain suitable software as listed above, or
- you want the convenience of a separate terminal (to avoid switching between synchronous/asynchronous mode, or having to escape to off-line mode, for example).

2.2.2 Data DTE

Your DTE must match the communications requirements of the remote modem and DTE.

However, if it is also to be used for entering commands, it must communicate in the following character format:

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

and at the following baud rate:

2400 bps.

Other DTE formats can be accommodated, but the modem must be set to match the DTE by using the U command (see Chapter 8).

2.2.3 Command Terminal

Your separate command terminal must be asynchronous with the following character format:

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

If it is to be connected to the standalone modem's command port, its data rate must be 2400 bps.

If it is to be connected via a Network 16 Controller Card, its data rate must be 9600 bps.

If it is to be connected to Network 16 via a Y cable (see Appendix B), its data rate must be 1200 bps.

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 suitable connector for your local mains supply. If this is not the case, refer to the Appendix entitled 'Country-Specific Information' for details of how to change it.

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 insert the mains plug into the mains supply. Do not switch on until all other connections have been made.

2.3.2 DTE Port Connection

See Figure 2-1, A, B or C as appropriate.

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, although some synchronous terminals require a crossover cable. 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.

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).

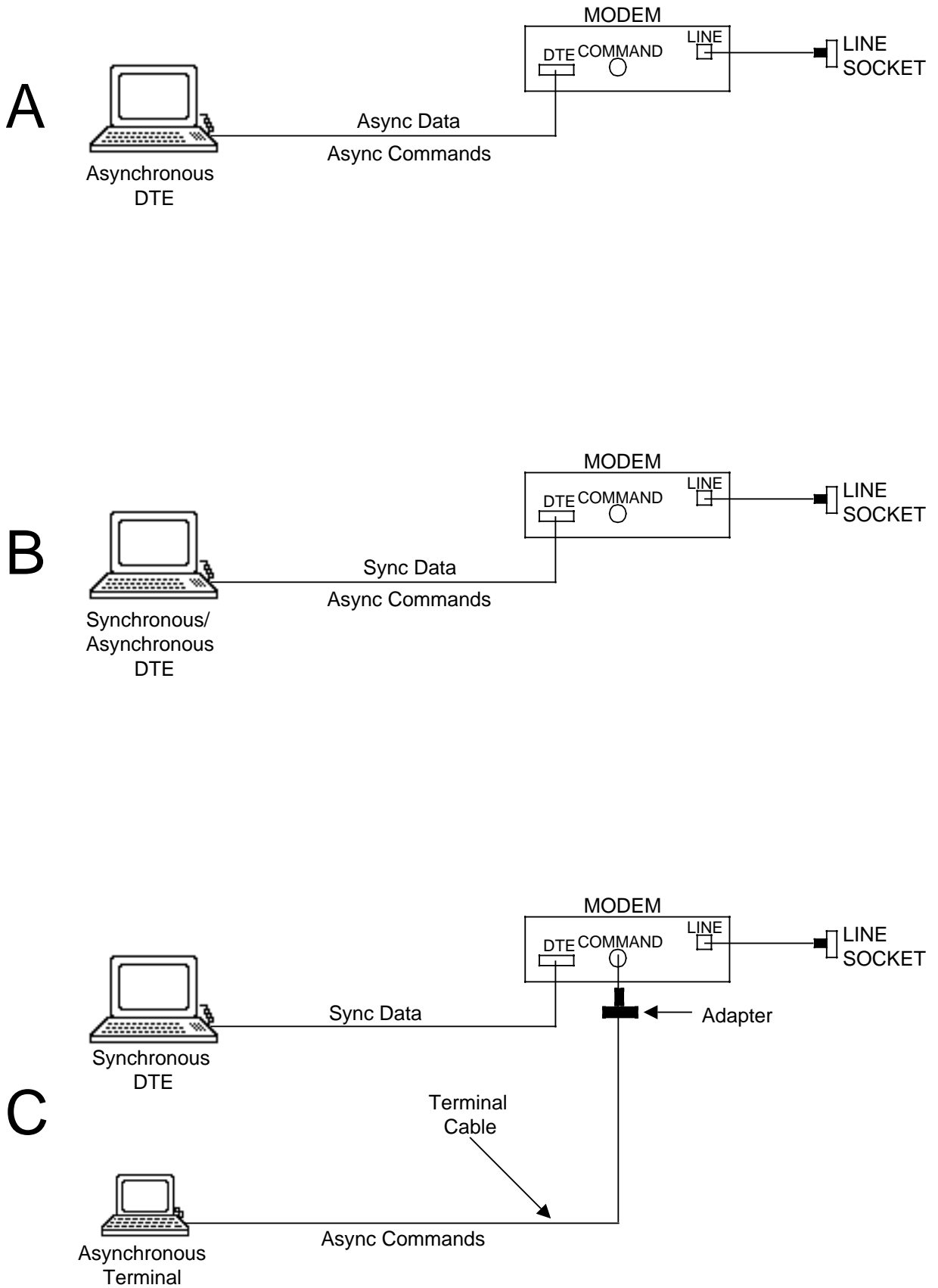


Figure 2-1 Standalone Modem Connections

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. The PSTN line must be disconnected before the mains plug.

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).

2.3.5 Telephone Connection

If you wish to connect a telephone to the modem to allow you to manually dial calls, see the Appendix entitled 'Technical Guide'.

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.

Note that in order to meet the EMC requirements for CE marking the ferrite core supplied with the card (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.

See the rack system manual for further details.

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.
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.
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 an RTS-CTS delay of 200 msec), 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.
- Receiving status information from the modem.
- 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 &F, &L, Z 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. ATF6). 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.

During a call, you can check its duration by the K command (i.e. type **ATK<CR>**).

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),
- 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:

| Configuration | Description |
|----------------------|---|
| 0 | PSTN; synchronous half-duplex operation; 2400 bps; DCD/DSR, RTS and DTR normal; commands via command port. |
| 1 | PSTN; asynchronous half-duplex operation; 2400 bps; DCD/DSR and RTS normal; DTR ignored; commands via DTE port. |
| 2 | 4-wire leased line; synchronous full-duplex operation; 2400 bps; DTR ignored; commands via command port. |
| 3 | 4-wire leased line; synchronous full-duplex operation; 2400 bps; commands via command port. |
| 4 | 4-wire leased line; asynchronous full-duplex operation; 2400 bps; 10-bit data; commands via DTE port. |
| 5 | PSTN; asynchronous half-duplex operation; 2400 bps; 10-bit data; DTR autoanswer; commands via DTE port. |
| 6 | PSTN; asynchronous half-duplex operation; 2400 bps; 11-bit data; DTR autoanswer; commands via DTE port. |
| 7 | PSTN; synchronous half-duplex operation; 2400 bps; CDSTL operation; commands via command port. |
| 8 | PSTN; synchronous half-duplex operation; 2400 bps; delayed DTR; commands via command port. |
| 9 | PSTN; synchronous half-duplex operation; 2400 bps; RTS-CTS 70 msec; commands via command port. |
| 10 | PSTN; synchronous half-duplex operation; 2400 bps; RTS-CTS 200 msec; commands via command port. |
| 11 | PSTN; synchronous half-duplex operation; 2400 bps; RTS clamped; commands via command port. |

All configurations are suitable for PSTN operation except 2, 3 and 4, which are only suitable for leased line (private wire) operation.

In asynchronous applications the DTE port will be used for both commands and data, but in synchronous applications the command port (requiring a separate command terminal) will be used.

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:

Normal The signal is sent in the normal manner. In this mode, DTE signals must be controlled properly by the originating DTE.

Forced On 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.

Ignored 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, synchronous, half-duplex.
Rates : Primary 2400.
V.24 : DCD/DSR, RTS and DTR normal.
RTS-CTS Delay : 30 ms.
Commands : Via command port.
Typical Use : To communicate half-duplex synchronous data over a standard dialup telephone line such as: mini to mainframe; point of sale file transfer; BACS and EFTPOS file transfer; PC to PC file transfer
Your modem will autoanswer calls if DTR is high, and will disconnect incoming or outgoing calls when DTR is dropped.

| | | | | | |
|-----|----------------------|--------------|-----|-----------------|-------------|
| E1 | Command Echo | ON | &X0 | Timing Source | INTERNAL |
| F8 | Communication Format | 2400 B | &Y1 | Control Port | ON |
| M3 | Speaker Control | ON UNTIL DCD | *G0 | Calling Tone | OFF |
| Q0 | Quiet Mode | OFF | *M0 | Data Monitor | OFF |
| V1 | Results | LONG FORM | *R0 | RTS Clamp | OFF |
| X4 | Result Codes | ALL | *T1 | DCD Timeout | LOSS |
| &B0 | Make Busy | OFF | *W0 | DSR | NORMAL |
| &C1 | DCD/DSR to DTE | NORMAL | /A0 | RTS Timeout | OFF |
| &L0 | Line Mode | 2W PSTN | /B0 | Carrier | CONTROLLED |
| &O0 | S Reg Output Format | DECIMAL | /D0 | DCD Threshold | -43dB |
| &P1 | Make/Break Ratio | UK | /F0 | Fallback | DISABLED |
| &Q3 | Operation Mode SYNC | MANUAL DIAL | /H1 | Amp Equaliser | ON |
| &R0 | RTS/CTS Delay | 30 mS | /I1 | Delay Equaliser | ON |
| &S1 | Switches | ENABLED | /O1 | DSR in Test | OFF |
| &V0 | Dumb Mode | OFF | /T8 | Test Pattern | 511/ERR INJ |

Factory Configuration 1

Operation : PSTN, asynchronous, half-duplex.
Rates : Primary 2400.
V.24 : DCD/DSR and RTS normal; DTR ignored.
RTS-CTS Delay : 30 ms.
Commands : Via DTE port.
Typical Use : To communicate half-duplex asynchronous data over a standard dialup telephone line such as: point of sale file transfer; remote data capture; PC to PC file transfer.
Your modem will autoanswer calls regardless of the state of DTR.

| | | | | | |
|-----|----------------------|--------------|-----|-----------------|-------------|
| E1 | Command Echo | ON | &X0 | Timing Source | INTERNAL |
| F8 | Communication Format | 2400 B | &Y0 | Control Port | OFF |
| M3 | Speaker Control | ON UNTIL DCD | *G0 | Calling Tone | OFF |
| Q0 | Quiet Mode | OFF | *M0 | Data Monitor | OFF |
| V1 | Results | LONG FORM | *R0 | RTS Clamp | OFF |
| X4 | Result Codes | ALL | *T1 | DCD Timeout | LOSS |
| &B0 | Make Busy | OFF | *W0 | DSR | NORMAL |
| &C1 | DCD/DSR to DTE | NORMAL | /A0 | RTS Timeout | OFF |
| &L0 | Line Mode | 2W PSTN | /B0 | Carrier | CONTROLLED |
| &O0 | S Reg Output Format | DECIMAL | /D0 | DCD Threshold | -43dB |
| &P1 | Make/Break Ratio | UK | /F0 | Fallback | DISABLED |
| &Q0 | Operation Mode ASYNC | DTR IGNORED | /H1 | Amp Equaliser | ON |
| &R0 | RTS/CTS Delay | 30 mS | /I1 | Delay Equaliser | ON |
| &S1 | Switches | ENABLED | /O1 | DSR in Test | OFF |
| &V0 | Dumb Mode | OFF | /T8 | Test Pattern | 511/ERR INJ |

Factory Configuration 2

Operation : 4-wire leased line, synchronous, full-duplex.
Rates : Primary 2400.
V.24 : DTR ignored.
RTS-CTS Delay : 15 ms.
Commands : Via command port.
Typical Use : This is the normal configuration for a modem in synchronous leased line mode. It is used to link two full-duplex applications over a single four-wire leased line, or at the 'master' end of multidrop applications.

| | | | | | |
|-----|----------------------|--------------|-----|-----------------|-------------|
| E1 | Command Echo | ON | &X0 | Timing Source | INTERNAL |
| F8 | Communication Format | 2400 B | &Y1 | Control Port | ON |
| M3 | Speaker Control | ON UNTIL DCD | *G0 | Calling Tone | OFF |
| Q0 | Quiet Mode | OFF | *M0 | Data Monitor | OFF |
| V1 | Results | LONG FORM | *R0 | RTS Clamp | OFF |
| X4 | Result Codes | ALL | *T1 | DCD Timeout | LOSS |
| &B0 | Make Busy | OFF | *W0 | DSR | NORMAL |
| &C1 | DCD/DSR to DTE | NORMAL | /A0 | RTS Timeout | OFF |
| &L0 | Line Mode | 2W PSTN | /B0 | Carrier | CONTROLLED |
| &O0 | S Reg Output Format | DECIMAL | /D0 | DCD Threshold | -43dB |
| &P1 | Make/Break Ratio | UK | /F0 | Fallback | DISABLED |
| &Q3 | Operation Mode SYNC | MANUAL DIAL | /H1 | Amp Equaliser | ON |
| &R0 | RTS/CTS Delay | 30 mS | /I1 | Delay Equaliser | ON |
| &S1 | Switches | ENABLED | /O1 | DSR in Test | OFF |
| &V0 | Dumb Mode | OFF | /T8 | Test Pattern | 511/ERR INJ |

Factory Configuration 3

Operation : 4-wire leased line, synchronous, full-duplex.
Rates : Primary 2400.
V.24 : DTR ignored.
RTS-CTS Delay : 150 ms.
Commands : Via command port.
Typical Use : This is used at the 'slave' end when you wish to link two or more full-duplex synchronous applications over a multidrop four-wire leased line.

| | | | | | |
|-----|----------------------|---------------|-----|-----------------|-------------|
| E1 | Command Echo | ON | &X2 | Timing Source | SLAVE |
| F8 | Communication Format | 2400 B | &Y1 | Control Port | ON |
| M3 | Speaker Control | ON UNTIL DCD | *G0 | Calling Tone | OFF |
| Q0 | Quiet Mode | OFF | *M0 | Data Monitor | OFF |
| V1 | Results | LONG FORM | *R0 | RTS Clamp | OFF |
| X4 | Result Codes | ALL | *T0 | DCD Timeout | OFF |
| &B0 | Make Busy | OFF | *W1 | DSR | FOLLOWS DTR |
| &C1 | DCD/DSR to DTE | NORMAL | /A2 | RTS Timeout | CONSTANT |
| &L3 | Line Mode | 4W LEASE LINE | /B0 | Carrier | CONTROLLED |
| &O0 | S Reg Output Format | DECIMAL | /D1 | DCD Threshold | -33dB |
| &P1 | Make/Break Ratio | UK | /F0 | Fallback | DISABLED |
| &Q1 | Operation Mode SYNC | ASYNC DIAL | /H0 | Amp Equaliser | OFF |
| &R0 | RTS/CTS Delay | 150 mS | /I0 | Delay Equaliser | OFF |
| &S1 | Switches | ENABLED | /O0 | DSR in Test | NORMAL |
| &V0 | Dumb Mode | OFF | /T8 | Test Pattern | 511/ERR INJ |

Factory Configuration 4

Operation : 4-wire leased line, asynchronous, full-duplex.
Rates : Primary 2400.
V.24 : 10-bit data.
RTS-CTS Delay : 30 ms.
Commands : Via DTE port.
Typical Use : This is the normal configuration for a modem in asynchronous leased line mode. It is used to link two asynchronous devices set to 7 data bits with parity, or 8 data bits with no parity.

| | | | | | |
|-----|----------------------|---------------|-----|-----------------|-------------|
| E1 | Command Echo | ON | &X0 | Timing Source | INTERNAL |
| F8 | Communication Format | 2400 B | &Y0 | Control Port | OFF |
| M3 | Speaker Control | ON UNTIL DCD | *G0 | Calling Tone | OFF |
| Q0 | Quiet Mode | OFF | *M0 | Data Monitor | OFF |
| V1 | Results | LONG FORM | *R0 | RTS Clamp | OFF |
| X4 | Result Codes | ALL | *T0 | DCD Timeout | OFF |
| &B0 | Make Busy | OFF | *W0 | DSR | NORMAL |
| &C1 | DCD/DSR to DTE | NORMAL | /A0 | RTS Timeout | OFF |
| &L3 | Line Mode | 4W LEASE LINE | /B1 | Carrier | CONSTANT |
| &O0 | S Reg Output Format | DECIMAL | /D1 | DCD Threshold | -33dB |
| &P1 | Make/Break Ratio | UK | /F0 | Fallback | DISABLED |
| &Q4 | Operation Mode ASYNC | ASYNC DIAL | /H0 | Amp Equaliser | OFF |
| &R0 | RTS/CTS Delay | 30 mS | /I0 | Delay Equaliser | OFF |
| &S1 | Switches | ENABLED | /O0 | DSR in Test | NORMAL |
| &V0 | Dumb Mode | OFF | /T8 | Test Pattern | 511/ERR INJ |

Factory Configuration 5

Operation : PSTN, asynchronous, half-duplex.
Rates : Primary 2400.
V.24 : DTR autoanswer. 10-bit data.
RTS-CTS Delay : 30 ms.
Commands : Via DTE port.
Typical Use : To communicate half-duplex asynchronous data over a standard dialup telephone line such as: point of sale transfer; remote data capture; PC to PC file transfer.

| | | | | | |
|-----|----------------------|--------------|-----|-----------------|-------------|
| E1 | Command Echo | ON | &X0 | Timing Source | INTERNAL |
| F8 | Communication Format | 2400 B | &Y1 | Control Port | OFF |
| M3 | Speaker Control | ON UNTIL DCD | *G0 | Calling Tone | OFF |
| Q0 | Quiet Mode | OFF | *M0 | Data Monitor | OFF |
| V1 | Results | LONG FORM | *R0 | RTS Clamp | OFF |
| X4 | Result Codes | ALL | *T1 | DCD Timeout | LOSS |
| &B0 | Make Busy | OFF | *W0 | DSR | NORMAL |
| &C1 | DCD/DSR to DTE | NORMAL | /A0 | RTS Timeout | OFF |
| &L0 | Line Mode | 2W PSTN | /B0 | Carrier | CONTROLLED |
| &O0 | S Reg Output Format | DECIMAL | /D0 | DCD Threshold | -43dB |
| &P1 | Make/Break Ratio | UK | /F0 | Fallback | DISABLED |
| &Q4 | Operation Mode SYNC | ASYNC DIAL | /H1 | Amp Equaliser | ON |
| &R0 | RTS/CTS Delay | 30 mS | /I1 | Delay Equaliser | ON |
| &S1 | Switches | ENABLED | /O1 | DSR in Test | OFF |
| &V0 | Dumb Mode | OFF | /T8 | Test Pattern | 511/ERR INJ |

Factory Configuration 6

Operation : PSTN, asynchronous, half-duplex.
Rates : Primary 2400.
V.24 : 11-bit data (8 data bits, odd parity).
RTS-CTS Delay : 30 ms.
Commands : Via DTE port.
Typical Use : To communicate half-duplex asynchronous data over a standard dialup telephone line such as: point of sale file transfer; remote data capture; PC to PC file transfer.
Your modem will autoanswer calls if DTR is high, and will disconnect incoming or outgoing calls when DTR is dropped.

| | | | | | |
|-----|----------------------|--------------|-----|-----------------|-------------|
| E1 | Command Echo | ON | &X0 | Timing Source | INTERNAL |
| F8 | Communication Format | 2400 B | &Y1 | Control Port | OFF |
| M3 | Speaker Control | ON UNTIL DCD | *G0 | Calling Tone | OFF |
| Q0 | Quiet Mode | OFF | *M0 | Data Monitor | OFF |
| V1 | Results | LONG FORM | *R0 | RTS Clamp | OFF |
| X4 | Result Codes | ALL | *T1 | DCD Timeout | LOSS |
| &B0 | Make Busy | OFF | *W0 | DSR | NORMAL |
| &C1 | DCD/DSR to DTE | NORMAL | /A0 | RTS Timeout | OFF |
| &L0 | Line Mode | 2W PSTN | /B0 | Carrier | CONTROLLED |
| &O0 | S Reg Output Format | DECIMAL | /D0 | DCD Threshold | -43dB |
| &P1 | Make/Break Ratio | UK | /F0 | Fallback | DISABLED |
| &Q4 | Operation Mode SYNC | ASYNCR DIAL | /H1 | Amp Equaliser | ON |
| &R0 | RTS/CTS Delay | 30 mS | /I1 | Delay Equaliser | ON |
| &S1 | Switches | ENABLED | /O1 | DSR in Test | OFF |
| &V0 | Dumb Mode | OFF | /T8 | Test Pattern | 511/ERR INJ |

Factory Configuration 7

Operation : PSTN, synchronous, half-duplex.
Rates : Primary 2400.
V.24 : CDSTL operation.
RTS-CTS Delay : 30 ms.
Commands : Via DTE port.
Typical Use : To communicate half-duplex synchronous data over a standard dialup telephone line where your computer or terminal uses DTR to instruct the modem to go on-line.

| | | | | | |
|------|----------------------|--------------|-----|-----------------|-------------|
| E1 | Command Echo | ON | &X0 | Timing Source | INTERNAL |
| F8 | Communication Format | 2400 B | &Y1 | Control Port | ON |
| M3 | Speaker Control | ON UNTIL DCD | *G0 | Calling Tone | OFF |
| Q0 | Quiet Mode | OFF | *M0 | Data Monitor | OFF |
| V1 | Results | LONG FORM | *R0 | RTS Clamp | OFF |
| X4 | Result Codes | ALL | *T1 | DCD Timeout | LOSS |
| &B0 | Make Busy | OFF | *W0 | DSR | NORMAL |
| &C1 | DCD/DSR to DTE | NORMAL | /A0 | RTS Timeout | OFF |
| &L0 | Line Mode | 2W PSTN | /B0 | Carrier | CONTROLLED |
| &O0 | S Reg Output Format | DECIMAL | /D0 | DCD Threshold | -43dB |
| &P1 | Make/Break Ratio | UK | /F0 | Fallback | DISABLED |
| &Q11 | Operation Mode SYNC | CDSTL | /H1 | Amp Equaliser | ON |
| &R0 | RTS/CTS Delay | 30 mS | /I1 | Delay Equaliser | ON |
| &S1 | Switches | ENABLED | /O1 | DSR in Test | OFF |
| &V0 | Dumb Mode | OFF | /T8 | Test Pattern | 511/ERR INJ |

Factory Configuration 8

Operation : PSTN, synchronous, half-duplex.
Rates : Primary 2400.
V.24 : Delayed DTR.
RTS-CTS Delay : 30 ms.
Commands : Via command port.
Typical Use : Used for applications where you need to initiate calls using an asynchronous device, before changing to the synchronous port to transmit data.
Your modem will autoanswer calls if DTR is low but disconnect after the period in S-register S25 if it does not go high. If DTR is dropped your modem will also wait for a period before disconnecting the line.

| | | | | | |
|-----|----------------------|--------------|-----|-----------------|-------------|
| E1 | Command Echo | ON | &X0 | Timing Source | INTERNAL |
| F8 | Communication Format | 2400 B | &Y1 | Control Port | ON |
| M3 | Speaker Control | ON UNTIL DCD | *G0 | Calling Tone | OFF |
| Q0 | Quiet Mode | OFF | *M0 | Data Monitor | OFF |
| V1 | Results | LONG FORM | *R0 | RTS Clamp | OFF |
| X4 | Result Codes | ALL | *T1 | DCD Timeout | LOSS |
| &B0 | Make Busy | OFF | *W0 | DSR | NORMAL |
| &C1 | DCD/DSR to DTE | NORMAL | /A0 | RTS Timeout | OFF |
| &L0 | Line Mode | 2W PSTN | /B0 | Carrier | CONTROLLED |
| &O0 | S Reg Output Format | DECIMAL | /D0 | DCD Threshold | -43dB |
| &P1 | Make/Break Ratio | UK | /F0 | Fallback | DISABLED |
| &Q1 | Operation Mode SYNC | ASYNCR DIAL | /H1 | Amp Equaliser | ON |
| &R0 | RTS/CTS Delay | 30 mS | /I1 | Delay Equaliser | ON |
| &S1 | Switches | ENABLED | /O1 | DSR in Test | OFF |
| &V0 | Dumb Mode | OFF | /T8 | Test Pattern | 511/ERR INJ |

Factory Configuration 9

Operation : PSTN, synchronous, half-duplex.
Rates : Primary 2400.
V.24 : Normal.
RTS-CTS Delay : 70 ms.
Commands : Via command port.
Typical Use : To communicate half-duplex synchronous data over a standard dialup telephone line such as: mini to mainframe; point of sale file transfer; BACS and EPROS file transfer; PC to PC file transfer.
Your modem will autoanswer calls if DTR is high, and will disconnect incoming or outgoing calls when DTR is dropped.

| | | | | | |
|-----|----------------------|--------------|-----|-----------------|-------------|
| E1 | Command Echo | ON | &X0 | Timing Source | INTERNAL |
| F8 | Communication Format | 2400 B | &Y1 | Control Port | ON |
| M3 | Speaker Control | ON UNTIL DCD | *G0 | Calling Tone | OFF |
| Q0 | Quiet Mode | OFF | *M0 | Data Monitor | OFF |
| V1 | Results | LONG FORM | *R0 | RTS Clamp | OFF |
| X4 | Result Codes | ALL | *T1 | DCD Timeout | LOSS |
| &B0 | Make Busy | OFF | *W0 | DSR | NORMAL |
| &C1 | DCD/DSR to DTE | NORMAL | /A0 | RTS Timeout | OFF |
| &L0 | Line Mode | 2W PSTN | /B0 | Carrier | CONTROLLED |
| &O0 | S Reg Output Format | DECIMAL | /D0 | DCD Threshold | -43dB |
| &P1 | Make/Break Ratio | UK | /F0 | Fallback | DISABLED |
| &Q3 | Operation Mode SYNC | MANUAL DIAL | /H1 | Amp Equaliser | ON |
| &R0 | RTS/CTS Delay | 70 mS | /I1 | Delay Equaliser | ON |
| &S1 | Switches | ENABLED | /O1 | DSR in Test | OFF |
| &V0 | Dumb Mode | OFF | /T8 | Test Pattern | 511/ERR INJ |

Factory Configuration 10

Operation : PSTN, synchronous, half-duplex.
Rates : Primary 2400.
V.24 : Normal.
RTS-CTS Delay : 200 ms.
Commands : Via command port.
Typical Use : To communicate half-duplex synchronous data over a standard dialup telephone line such as: mini to mainframe; point of sale file transfer; BACS and EPROS file transfer; PC to PC file transfer.

| | | | | | |
|-----|----------------------|--------------|-----|-----------------|-------------|
| E1 | Command Echo | ON | &X0 | Timing Source | INTERNAL |
| F8 | Communication Format | 2400 B | &Y1 | Control Port | ON |
| M3 | Speaker Control | ON UNTIL DCD | *G0 | Calling Tone | OFF |
| Q0 | Quiet Mode | OFF | *M0 | Data Monitor | OFF |
| V1 | Results | LONG FORM | *R0 | RTS Clamp | OFF |
| X4 | Result Codes | ALL | *T1 | DCD Timeout | LOSS |
| &B0 | Make Busy | OFF | *W0 | DSR | NORMAL |
| &C1 | DCD/DSR to DTE | NORMAL | /A0 | RTS Timeout | OFF |
| &L0 | Line Mode | 2W PSTN | /B0 | Carrier | CONTROLLED |
| &O0 | S Reg Output Format | DECIMAL | /D0 | DCD Threshold | -43dB |
| &P1 | Make/Break Ratio | UK | /F0 | Fallback | DISABLED |
| &Q3 | Operation Mode SYNC | MANUAL DIAL | /H1 | Amp Equaliser | ON |
| &R0 | RTS/CTS Delay | 200 mS | /I1 | Delay Equaliser | ON |
| &S1 | Switches | ENABLED | /O1 | DSR in Test | OFF |
| &V0 | Dumb Mode | OFF | /T8 | Test Pattern | 511/ERR INJ |

Factory Configuration 11

Operation : PSTN, synchronous, half-duplex.
Rates : Primary 2400.
V.24 : RTS clamped.
RTS-CTS Delay : 30 ms.
Commands : Via command port.
Typical Use : To communicate in half-duplex synchronous applications, where the protocol being used does not safeguard the passage of data.
Your modem will autoanswer calls if DTR is high, and will disconnect incoming or outgoing calls when DTR is dropped.

| | | | | | |
|-----|----------------------|--------------|-----|-----------------|-------------|
| E1 | Command Echo | ON | &X0 | Timing Source | INTERNAL |
| F8 | Communication Format | 2400 B | &Y1 | Control Port | ON |
| M3 | Speaker Control | ON UNTIL DCD | *G0 | Calling Tone | OFF |
| Q0 | Quiet Mode | OFF | *M0 | Data Monitor | OFF |
| V1 | Results | LONG FORM | *R1 | RTS Clamp | ON |
| X4 | Result Codes | ALL | *T1 | DCD Timeout | LOSS |
| &B0 | Make Busy | OFF | *W0 | DSR | NORMAL |
| &C1 | DCD/DSR to DTE | NORMAL | /A0 | RTS Timeout | OFF |
| &L0 | Line Mode | 2W PSTN | /B0 | Carrier | CONTROLLED |
| &O0 | S Reg Output Format | DECIMAL | /D0 | DCD Threshold | -43dB |
| &P1 | Make/Break Ratio | UK | /F0 | Fallback | DISABLED |
| &Q3 | Operation Mode SYNC | MANUAL DIAL | /H1 | Amp Equaliser | ON |
| &R0 | RTS/CTS Delay | 30 mS | /I1 | Delay Equaliser | ON |
| &S1 | Switches | ENABLED | /O1 | DSR in Test | OFF |
| &V0 | Dumb Mode | OFF | /T8 | Test Pattern | 511/ERR INJ |

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. Ensure your modem is switched on and is off-line (OH light off).
2. Press the **LOAD (L)** button.
3. Select your configuration by pressing the appropriate buttons shown in Table 4-1.

| CONFIGURATION | BUTTON SELECTION | | | |
|---------------|------------------|-----|-----|----------|
| | 4 | 2 | 1 | DIAL (D) |
| 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 for 2 seconds and release the **ENTER (I)** 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.

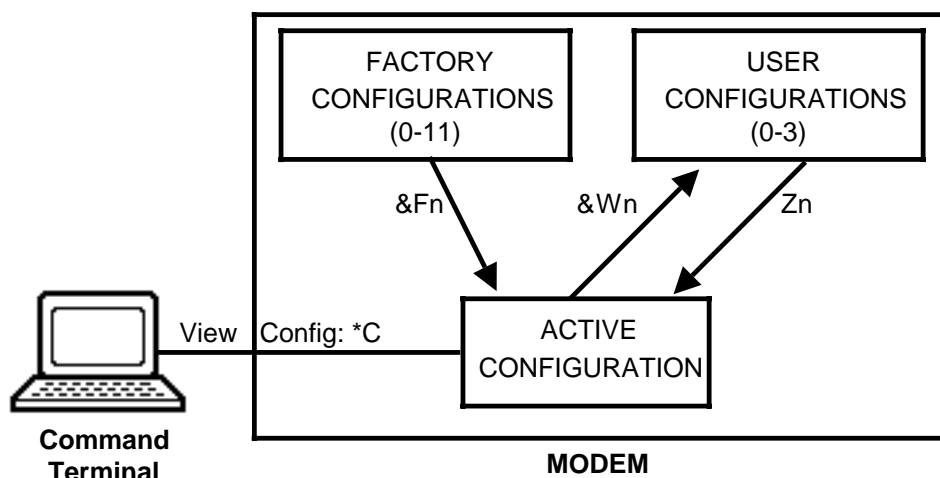


Figure 4-1 Modem Software Configurations

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.

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 |
| 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 |
| &Y | Command port selection |

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 |
| &Q | DTR dialling control |
| &R | RTS-CTS delay |
| *R | RTS clamp |
| /U | User asynchronous commands |
| /B | Constant carrier |
| /D | Carrier threshold |
| /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 |
| /R | RTS-CTS delay timer |

5.3 Commands Affecting the Communications Line

Modulation Format

The following commands enable you to select suitable primary modulation formats for your modem.

| | |
|----|----------------------------|
| F | Communications format |
| &X | Modem timing (synchronous) |

Line Commands

The following commands enable you to select suitable modem/line characteristics.

| | |
|----|----------------------|
| /H | Amplitude equalisers |
| /I | Delay equalisers |

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.

In addition, the following commands are relevant.

| | |
|----|-------------------|
| &L | Line type |
| /D | Carrier threshold |

5.4 V.25*bis* Mode

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

*V Select V.25*bis* command mode

You return to AT command mode by the BAK command.

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 21 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 (0-20) |
| &N | Display/delete telephone directory |
| Nn? | Display a single directory entry |
| *N | Read directory for free space |

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 |

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:

| Location | 4 | 2 | 1 |
|-----------------|----------|----------|----------|
| 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's **PHONE** socket (see Section 1.2.2).

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 Sync/Async DTR command (&Q) must be set to &Q2 for synchronous, or &Q5 for asynchronous, DTR operation.
2. The DTE must control the DTR line (pin 20), 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.

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

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

BUSY

If the count-down time (forty seconds) 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 the Appendix entitled 'Country-Specific Information'. 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 Answering Calls

The following command is relevant:

A Answer (Go off-hook).

6.3.1 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.

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.

6.3.2 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 a Local Analogue Loopback diagnostic test (see Section 7.2.1) to help locate the source of operational problems.

The test can be activated by:

- The front panel buttons (Section 7.3).

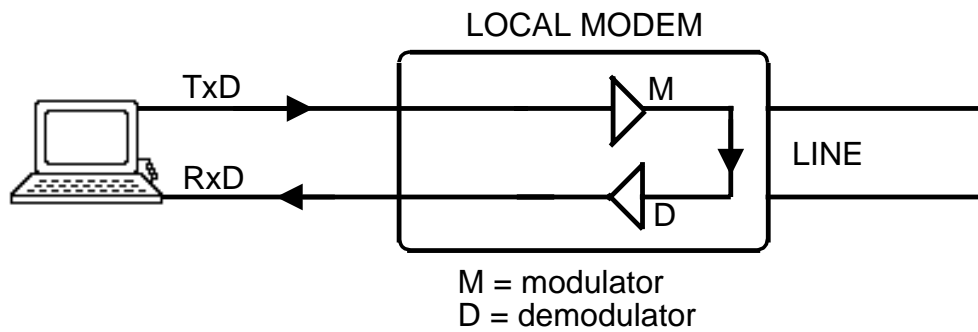
- AT commands (Section 7.4).

The Local Analogue Loopback test checks the connection between the local DTE and the local modem's modulator/demodulator.

7.2 Local Analogue Loopback Test Details

This test checks the connections between the local DTE and the local modem.

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



7.3 Testing via the Front Panel

To carry out a Local Analogue Loopback test via the front panel:

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 synchronous terminal or test set, running at 2400 bps, 7 data bits and even parity, 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.

7.4 Testing by Command

The following commands are available for Local Analogue Loopback testing:

| | |
|----|------------------------------|
| &T | Select modem test operation |
| &B | Delay busying |
| I | Display modem identity codes |

To carry out a Local Analogue Loopback test by command:

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** (external test pattern) and press **RETURN**.
4. If you selected &T1, you must key in a test message. This should be echoed back to the screen via the modem's analogue loopback connection.
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**.

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.

The default values quoted in the command descriptions are those for factory default configuration 0.

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

In leased line multidrop applications, 'slave' modems seize the line by raising RTS. Other terminals are then disabled until this condition is cleared. This command will allow you to set the maximum time a 'slave' can seize the line by raising RTS.

- /A0** Timeouts disabled. S10 and S56 ignored. Default.
- /A1** Loss-of-RTS timeout. Period determined by S10 and S56.
- /A2** Anti-streaming timeout. S10=0 disables loss-of-RTS timeout.
- /A3** Loss-of-RTS and anti-streaming timeouts. S56=0 disables anti-streaming timeout.

S-register S10 determines the length of the loss-of-RTS timeout, S-register S56 determines the length of the constant-RTS timeout.

Both S10 and S56 are measured in increments of 1 second or 0.1 of a second, depending on the setting of *B.

&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 Constant Carrier when On-line

On point-to-point leased lines you may require that carrier is output regardless of the state of RTS.

/B0 Carrier output controller by RTS. Default.

/B1 Carrier always on. Should only be active in 4-wire leased line applications.

&C DSR & DCD Control

&C0 DSR and DCD are maintained in the on condition. State of data carrier is disregarded.

&C1 DSR and DCD follow the state of the received carrier. Default.

The normal operating mode is &C1. &C0 should only be set if you are entering commands through the DTE interface and your DTE needs to see DSR and DCD to operate.

*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.

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 (see Chapter 9), 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 0-20 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.

Note that the &L command (leased line or PSTN) sets /D automatically at /D1 for leased line or /D0 for PSTN.

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.

F Communications Format

This command is used to determine which modulation scheme and primary data rate are used by the modem.

- F8** 2400 bps, V.26 modulation B.

&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).

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 Amplitude Equalisers

Used to enable or disable the modem's amplitude equalisers.

/H0 Amplitude equalisers disabled.

/H1 Amplitude equalisers enabled. Default.

Note that command &L (leased line or PSTN selection) sets /H automatically at /H0 for leased line and /H1 for PSTN operation.

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 02 for standalone, or 04 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 000 for standalone, or 004 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 Delay Equalisers

Used to enable or disable delay equalisers.

/I0 Delay equalisers disabled.

/I1 Delay equalisers enabled. Default.

Note that command &L (leased line or PSTN selection) sets /I automatically at /I0 for leased line and /I1 for PSTN operation.

K Call Timer

This command accesses the call timer within your modem.

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

&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.

&L3 Enable 4-wire leased line operation.

If you select &L0, the following commands will automatically be set:

/D0 -43 dB to -48 dB threshold.

/H1 Amplitude equaliser enabled.

/I1 Delay equaliser enabled.

***T1** DCD timeouts enabled.

/A0 RTS anti-streaming disabled.

If you select &L1 or &L3, the following commands will automatically be set:

/D1 -33 dB to -38 dB threshold.

/H0 Amplitude equaliser disabled.

/I0 Delay equaliser disabled.

***T0** DCD timeouts disabled.

/A0 RTS anti-streaming disabled.

For PSTN or leased line operation, connection is made through the fitted line cord. For leased line operation you may need to alter how the cord is wired to the modem's terminal block and the transmit level settings. For details see the Appendix entitled 'Technical Guide'.

M Speaker Control

This command controls your standalone modem's internal speaker.

- M0** Speaker off.
- M1** Speaker on during call set-up and dialling, 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.

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 (0-20) 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 (0-20) 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 a secure phone number, i.e. a phone number 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.

&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 N20. 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.

***N Read Directory for Free Space**

This command checks the telephone directory for free locations.

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 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.

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.

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. (DTR low means that the DTE is not ready, high means that the DTE is ready.)

- &Q0** Asynchronous mode. DTR is ignored.
- &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. DTR conforms to V.24 108/2. The modem will not dial or answer when DTR is low. When on-line, if DTR goes low, the modem disconnects.
Default.
- &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. DTR conforms to V.24 108/2. The modem will not dial or answer when DTR is low. When on-line, if DTR goes low, the modem disconnects.
- &Q7** Command mode switch. An on-to-off transition of DTR causes the modem to switch from command mode to on-line mode. Only applicable if the modem is on the main channel.
- &Q8** 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.

&R RTS to CTS Delay

Used in half-duplex operation, to set the RTS-CTS delay.

&R0 RTS to CTS delay is defined in S-register S26. Default.

&R1 CTS is forced on when the modem is off-line.

S-register S26 can be set to values between 0 and 255, and can be timed in either 1 msec or 10 msec intervals as set by the /R command. A minimum value of 8 msec is assumed.

***R RTS Clamp**

In half-duplex operation, RTS is used to signal the modem to open the line for transmitting data. However, if the remote modem is transmitting at the same time, then data in both directions will be lost. Most synchronous protocols will not allow this to happen, but as a safeguard this command will trap these occurrences.

***R0** RTS overrides condition of DCD (RTS clamp disabled). Default.

***R1** RTS is ignored until DCD is off (RTS clamp enabled).

/R S26 Increments

Used to select whether the value of S-register S26 is in increments of 1 ms or 10 ms. (S26 is used for the RTS-CTS timer.)

/R0 S26 in 10 ms increments.

/R1 S26 in 1 ms increments.

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** Initiates Local Analogue Loopback.

***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 and constant-carrier timeouts 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.

/U Asynchronous Format

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

- /U1** 7 data, no parity, 1 stop.
- /U2** 7 data, no parity, 2 stop.
- /U3** 7 data, odd parity, 1 stop.
- /U4** 7 data, odd parity, 2 stop.
- /U5** 7 data, even parity, 1 stop.
- /U6** 7 data, even parity, 2 stop.
- /U7** 8 data, no parity, 1 stop.
- /U8** 8 data, no parity, 2 stop.
- /U9** 8 data, odd parity, 1 stop.

- /U10** 8 data, odd parity, 2 stop.
- /U11** 8 data, even parity, 1 stop.
- /U12** 8 data, even parity, 2 stop.

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.

- V0** Selects numeric (terse) codes.
- V1** 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 +++).

- &V0** Commands are accepted from the DTE when the modem is off-line, or when on-line by using the escape sequence. Default.
- &V1** Commands may only be entered when the modem is off-line. The escape sequence is ignored.
- &V2** 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).

X Response Codes

This command is used to select the response codes that you wish in response to a command from your DTE.

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.

Default is X4.

| COMMAND | | | | | | RESPONSE CODE | | COMMENTS |
|---------|----|----|----|----|----|---------------|----------------------|---------------------------|
| X0 | X1 | X2 | X3 | X4 | X5 | X6 | TERSE/VERBOSE | |
| * | * | * | * | * | * | * | 0 OK | Command actioned |
| * | * | * | * | | | | 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 |
| | * | * | * | * | * | * | 10 CONNECT 2400 | Connected at 2400 bps |
| * | * | * | * | * | * | * | 15 ABORTED | Connection aborted |
| * | * | * | * | * | * | * | 16 TIMEOUT | Connection timed-out |
| * | * | * | * | * | * | * | 26 BLACKLIST | |
| | | | | | * | * | 31 VOICE | Voice call detected |
| | | | | | * | * | 32 RINGING | Telephone ringing |
| | | * | | * | | * | 33 DIAL TONE | Dial tone, call cleared |
| * | * | * | * | * | * | * | 34 PRIVATE LINE | Leased line mode |
| * | * | * | * | * | * | * | 41 BUSY TONE | |
| | | | | | | | 80 /LOSS OF RTS | Extended timeout response |
| | | | | | | | 81 /CONSTANT RTS | Extended timeout response |
| | | | | | | | 82 /CONSTANT CARRIER | Extended timeout response |
| | | | | | | | 83 /DTE | Extended timeout response |
| | | | | | | | 84 /LINE | Extended timeout response |
| | | | | | | | 110 /AL | Extended timeout response |
| | | | | | * | * | 119 TEST TERMINATED | Timeout response |

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

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

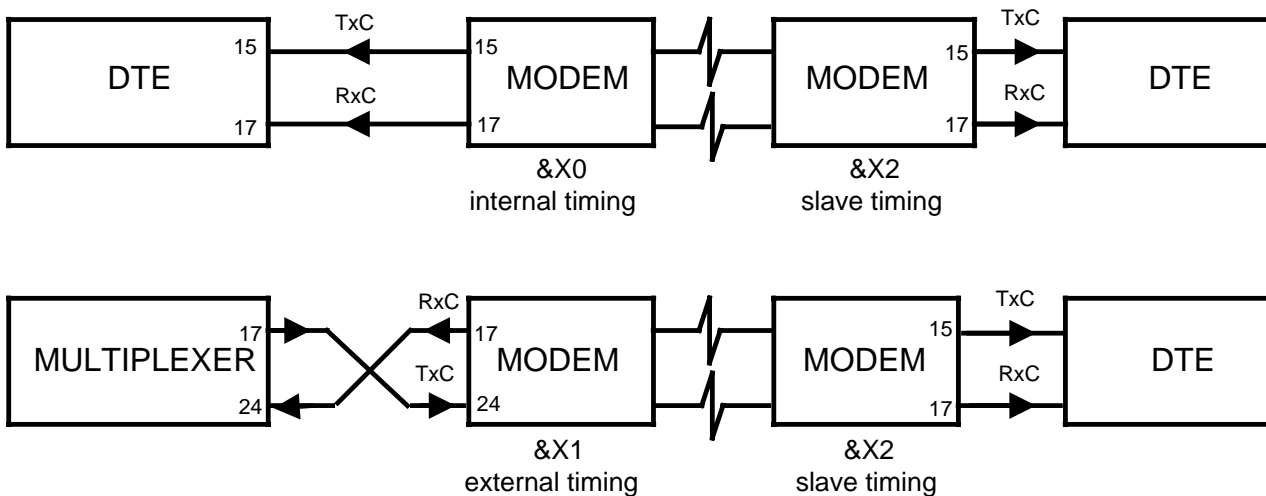
With X0, X1 or X2 set, the modem does not look for busy tone.

&X Modem Timing

This command determines the timing source for the modem transmitter.

- &X0** Internal timing (supplied by the modem). Use in simple point-to-point applications, whether 2-wire or 4-wire 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 and 4-wire full-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. Only valid in 4-wire point-to-point systems.

The following diagrams illustrate the use of &X command:



&Y Command Port Selection

This command is used to determine whether you can enter AT commands through the DTE interface, or through the separate command port.

- &Y0** Commands accepted via the DTE interface.
- &Y1** Commands accepted via the command port.

Note that when you are using the DTE interface, commands can only be entered when your modem is off-line unless you use the +++ escape sequence.

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).

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.

WARNING 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.

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: 0-255 (seconds) Default: 4 (seconds)

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

S7 Wait for Answer Tone

Timer Range: 0-255 (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: 0-255 (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: 0-255 (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 0.5 seconds) Default: 50 (2.5 seconds)

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

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 (or after 10 blocks).

S25 Delay to DTR Timer

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

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

S26 RTS to CTS Delay

Timer Range: 0-255 (0.01 seconds) Default: 3

Note that /R1 selects 0.1 second units.

S36 Maximum Number of Redial Attempts

Counter Range: 0-15 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: 0-255 (minutes) Default: 0

This register sets the period of inactivity in transmitted data which will cause the modem to disconnect the current call. When set to 0, the facility is disabled.

S38 Modem Product Code

Counter Range: 0-255 Default: 02 (Standalone)
04 (Rackmount)

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

S56 Constant Carrier Timeout

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

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

- **Asynchronous V.25bis commands** must be entered in the format:

Command <CR> <LF>

Note: When switching between synchronous device and asynchronous command, enter <CR><LF> first to clear buffer. Data format is set by the /U command.

- **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 (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.

PRIiii

where iii 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 |

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.

Transmitter/Receiver

| | |
|-----------------|--|
| Modulation | 4-phase DPSK V.26 and V.26 <i>bis</i> compliant (2400 bps). Modulation 'B'. Carrier frequency 1800 Hz. Receive levels 0 to -43 dBm. |
| Operation | 4-wire 2400 bps full-duplex asynchronous or synchronous operation. 2-wire 2400 bps half-duplex asynchronous or synchronous operation. |
| Output level | Selectable 0 dBm to -15 dBm. 600 ohms impedance (UK versions set to -13 dBm for leased line). |
| 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 selectable from 9 msec to 250 msec. 8 msec minimum for leased line operation. 25 msec minimum for PSTN operation. |
| Equaliser | Optional delay and amplitude equaliser. |

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 100 msec. ID time 100 msec. 2 of 8 MF tone transmission. |
| Line Interface | 600 ohm impedance. 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. |
| Disconnect | Call clear selectable on loss of DTR, and/or no carrier for n seconds, and/or constant carrier for n seconds. |
| Test Function | Local analogue loop. Test function selectable via front panel switches or AT commands. |

Facilities

| | |
|--------------|---|
| Command Sets | Extended AT command set. Commands can be entered asynchronously via the DTE interface or separate command port. Extended V.25 <i>bis</i> command set: asynchronous, synchronous or HDLC. Asynchronous commands can be entered via the DTE or the command port. Synchronous or HDLC commands can be entered via the DTE port. |
| Memory | Non-volatile memory. 12 preset factory, and 4 user-defined configurations. 21 stored telephone numbers. |

Physical Description

| | |
|-----------------------------|---|
| Power | Standalone: 230 ± 10% VAC, 50-60Hz, 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 30°C storage: -25°C to 55°C Relative humidity 5% to 95% non-condensing. Altitude to 3000 metres. |
| Dimensions | Standalone : 39 mm high × 190 mm wide × 253 mm deep. Rackmount : Takes up one rack slot (19" × 4U). |
| Call progress | Audio call progress monitor. |
| Connections (Standalone) | 2 metre power cable. RS-232/V.24 DTE interface. 3 mm stereo jack for command port. 2 metre new plan line cord for PSTN or leased line. Telephone socket for handset. |

The modem has two serial ports. The DTE port is used to pass user data, and may also be used to enter commands. The command port is used to enter commands only.

The rackmount DTE port is described in the Rackmount manual.

B.1 DTE Port, Standalone Modem

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 ¹ | | |
| 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 25 | | 142 | +12 volt test -12 volt test Make busy Test Indicator | From From To From | Control Control Control Control |
| 14 16 | | | Command Terminal TxD ² Command Terminal RxD ² | To From | |

- Notes: 1. Pin 7 is signal common for the main DTE and the command terminal.
2. See Technical Guide (link 10).

B.1.2 Cables

If the modem is to be connected directly to the DTE, the connecting cable should have straight-through pin-to-pin connections.

If the modem is to be connected to a multiplexer channel, the cable should be a synchronous crossover connections.

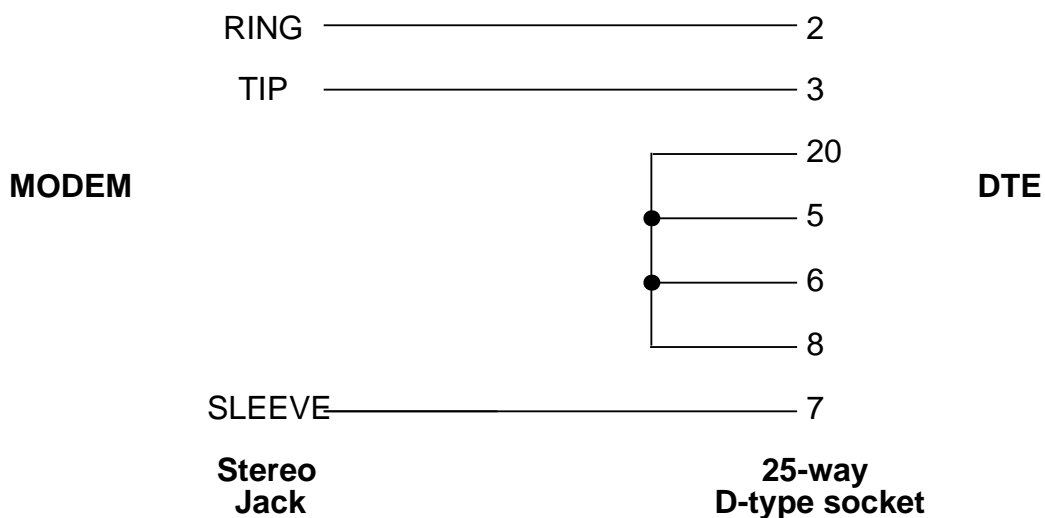
B.2 Command Port

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:

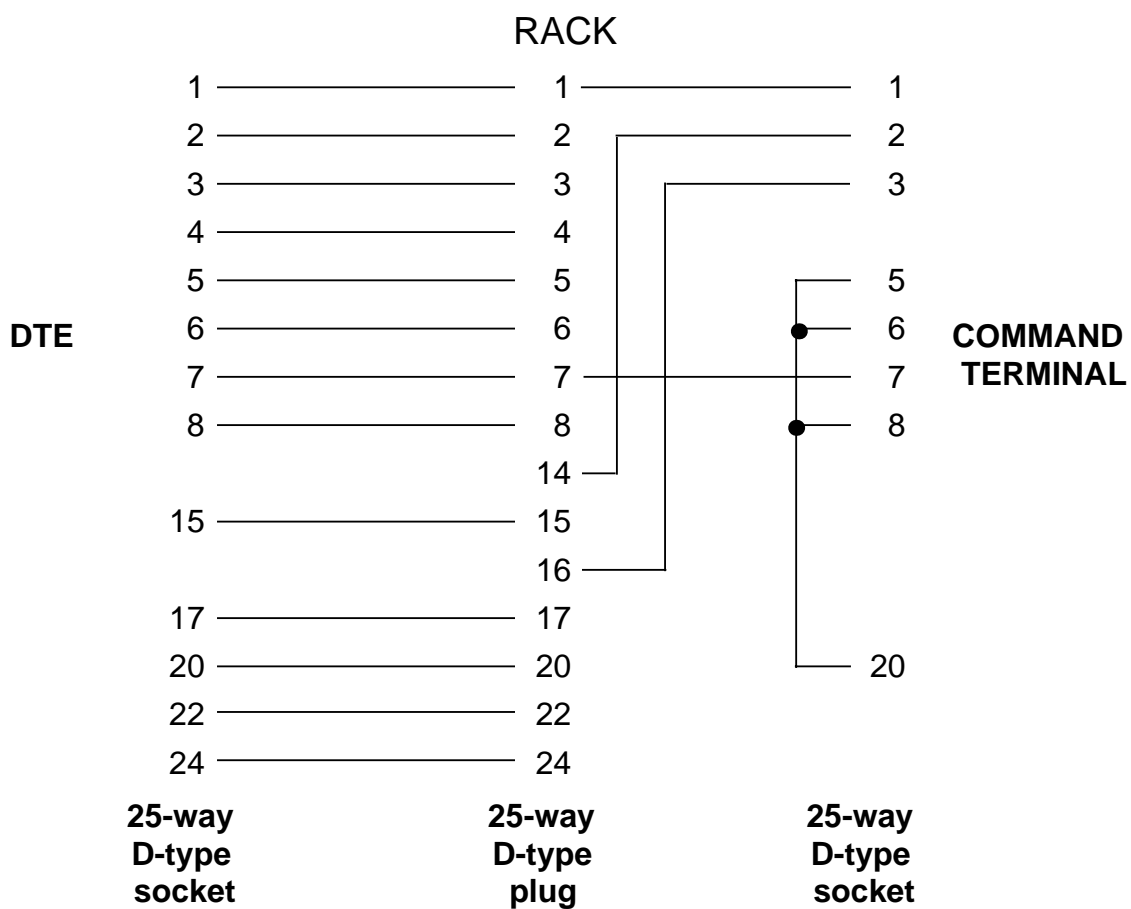


B.2.2 Rackmount Modem

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.

Note that links on the board must be set to the appropriate position (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 either two-wire or four-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.

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) 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 moulded 13 amp plug, fitted with a 3 amp fuse. If this is unsuitable for your mains socket, you must change it. Do not use an adapter.

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 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 |
|-------------------------|---------------|---------------|
| S7 Wait for carrier | 0 seconds | 59 seconds |
| S8 Pause time for comma | 4 seconds | 8 seconds |

The use of multiple commas in a dialling string does not override the 8-second statutory maximum.

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.

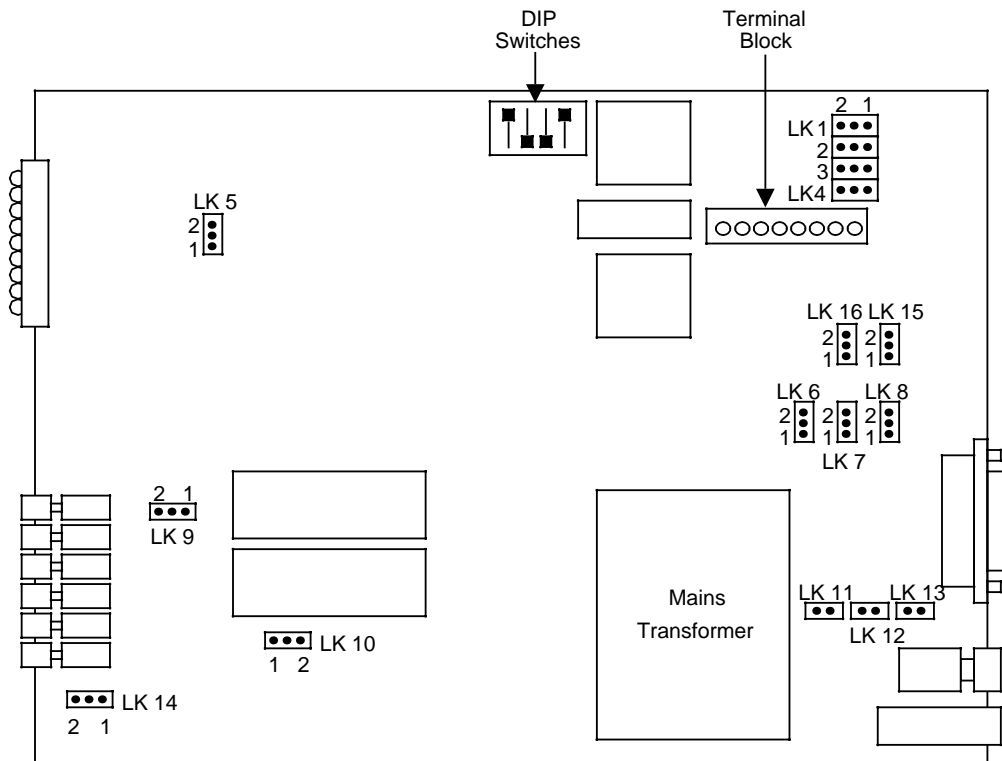


Figure D-1 Standalone Card Layout

D.2.2 Terminal Block Wiring

PSTN Operation

| Terminal Description | Cable Colour | Comments |
|-----------------------------|---------------------|-----------------------|
| 1 Ext Phone | Not fitted | See below |
| 2 Ext Phone | Not fitted | See below |
| 3 Line | Red | Incoming line |
| 4 Line | White | Incoming line |
| 5 Anti-tinkle | Blue | |
| 6 Earth | Green | Used for earth recall |
| 7 Not used | Black | |
| 8 Not used | Orange | |

Connections 1 and 2 may be used to connect a handset to the modem. They are in parallel with the line socket already provided on the rear of the modem and are switched out when the modem goes on-line.

Leased Line Operation, 2-wire and 4-wire

| Terminal Description | Cable Colour | Comments |
|-----------------------------|---------------------|--------------------------|
| 1 Not used | Not fitted | |
| 2 Not used | Not fitted | |
| 3 Line 2W/Tx 4W | Black | Line pair 2W, Tx pair 4W |
| 4 Line 2W/Tx 4W | Orange | Line pair 2W, Tx pair 4W |
| 5 Not used | Blue | |
| 6 Not used | Green | |
| 7 Rx 4W | White | Rx pair 4W |
| 8 Rx 4W | Red | Rx pair 4W |

D.2.3 Transmit Level Settings


These levels are selected using the DIP switches.

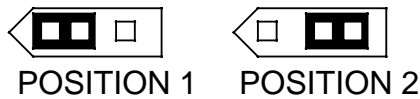
| | SW4 (-8 dBm) | SW3 (-4 dBm) | SW2 (-2 dBm) | SW1 (-1 dBm) |
|----------------|------------------------|------------------------|------------------------|------------------------|
| UK PSTN | ON | OFF | OFF | ON |
| UK leased line | ON | ON | OFF | ON |

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, 3, 5, 8, 9, 10 and 14 are for factory use only and must not be changed.

Links 2, 4: Telephone Socket Option

- Position 1 – Telephone socket in series with the line.
- Position 2 – Telephone socket in parallel with the line.

Link 6: Busy-Out

- Position 1 – Busy-out via pin 25.

Link 7: Analogue Loop

- Position 1 – Analogue loop allowed via pin 18.
- Position 2 – Analogue loop disabled via pin 18.

Links 11, 12, 13: Voltage Option

- 240 volts: Link 12 fitted (factory default).
- 110 volts: Links 11 and 13 fitted.

Links 15, 16: Command Acceptance

- Position 1 – Commands accepted at pins 14 & 16 of the DTE interface and the command port.
- Position 2 – Commands accepted only at the command port.

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/-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.

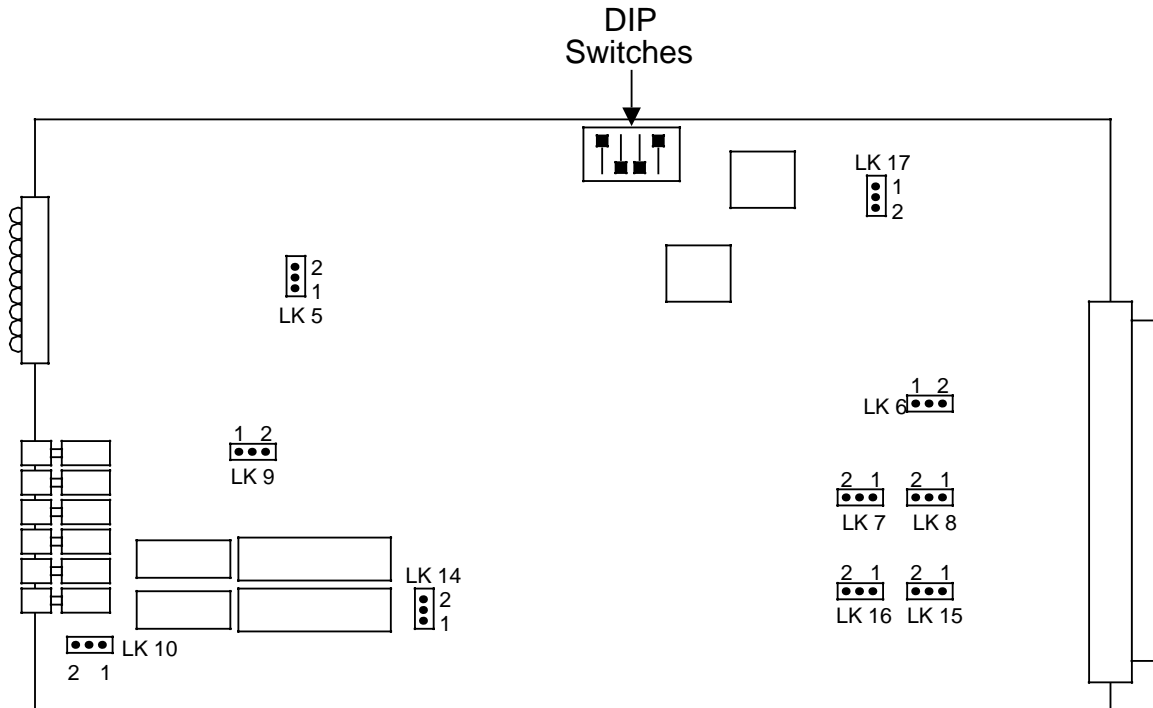


Figure D-2 Rackmount Card Layout

D.3.2 Transmit Level Settings


These levels are selected using the DIP switches.

| | SW4 (-8 dBm) | SW3 (-4 dBm) | SW2 (-2 dBm) | SW1 (-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.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 5, 8, 9, 10, 14 and 17 are for factory use only and must not be changed.

Link 6: **Busy-Out**

Position 1 – **Busy-out on pin 25.**

Link 7: **Analogue Loop**

Position 1 – **Analogue loop allowed via pin 18.**

Position 2 – **Analogue loop disabled via pin 18.**

Links 15, 16: **Command Port**

Position 1 – **The command port is connected to pins 14 and 16 of the DTE connector on the rack.**

Position 2 – **The command port is connected to the Network 16 Controller (default).**

D.3.4 Line Connection

The modem is connected to the PSTN or leased line using the appropriate terminal block on the rear panel of the Network 16 rack.

Refer to your Network 16 Reference Manual for full details.

