

Syncro 1496/1496R (V.32*bis*) Reference Manual

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Preface

The Syncro 1496 is approved for use in the following countries:

| | |
|---------|----------------|
| Belgium | Luxembourg |
| Denmark | Norway |
| Finland | Portugal |
| France | Spain |
| Germany | Sweden |
| Holland | Switzerland |
| Ireland | United Kingdom |
| Italy | |

It is essential that users make themselves familiar with the Appendix entitled Country-Specific Information, as the appropriate modem for each country has its own unique setup and connection requirements.

The Syncro 1496 is available in two versions:

Syncro 1496 Standalone modem.

Syncro 1496R Rackmount modem for use in the Network 16 Rack System.

This manual provides full information for installing, configuring and using the Syncro 1496 and 1496R (V.32*bis*) modems.

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 1496 and 1496R 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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1.1 The Syncro 1496 Modem

The Syncro 1496 is a multi-standard autodial modem capable of passing synchronous data at up to 14400 bps over leased (private wire) lines, and PSTN (dial-up) lines.

The modem complies with the following ITU-T Recommendations:

| | |
|-----------------|---|
| V.33 | 14400 or 12000 bps synchronous operation. |
| V.32 | 9600 or 4800 bps synchronous operation. |
| V.32 <i>bis</i> | 14400, 12000 or 7200 bps synchronous operation. |
| V.29 | 9600, 7200 or 4800 bps synchronous operation. |
| V.22 | 1200 bps synchronous operation. |
| V.22 <i>bis</i> | 2400 bps synchronous operation. |

The other principal features of the modem are:

- Synchronous full- or half-duplex operation over 2-wire leased line or PSTN.
- Synchronous full-duplex operation over 4-wire leased line.
- Trellis coded modulation for enhanced performance.
- Near and remote end echo cancellation in V.32 and V.32*bis* modes.
- 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 to V.25 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, which can be from a Syncro 1496 or Syncro 1496R modem at a remote site, with security controls to prevent unauthorised use of this facility.

- A port conforming to ITU-T V.24/V.28 (EIA RS-232-C) standards for connecting the DTE.
- A separate command port for connection to a terminal or PC, so that commands may be entered or calls monitored while the modem is in use.
- Comprehensive test functions to V.54, 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

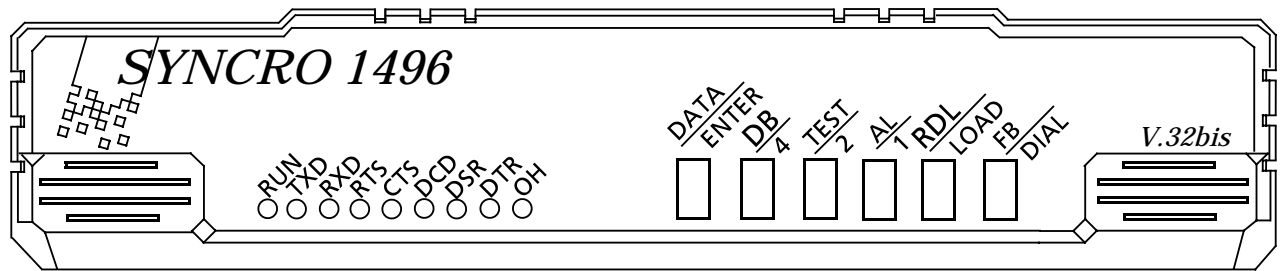


Figure 1-1 The Standalone Modem Front Panel

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

| | |
|------------------------------------|---|
| <u>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 to load a configuration or dial a telephone number. |
| <u>DB</u> 4 | Use as DB to initiate a dial backup call using a stored telephone number. Use as 4 in conjunction with the DIAL , 2 and 1 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. Use as 2 in conjunction with the DIAL , 4 and 1 buttons to select a configuration or telephone number. |
| <u>AL</u> 1 | Use as AL to select an analogue loopback. Use as 1 in conjunction with the DIAL , 4 and 2 buttons to select a configuration or telephone number. |
| <u>RDL</u> LOAD | Use as RDL to select a remote digital loopback. Use as LOAD to select a load configuration option. |
| <u>FB</u> DIAL | Use as FB to revert to the selected fallback speed. Use as DIAL to select a stored telephone number to dial. It is also used in conjunction with the 4 , 2 and 1 buttons to load a factory or user configuration. |

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

1.2.3 The Connections

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

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

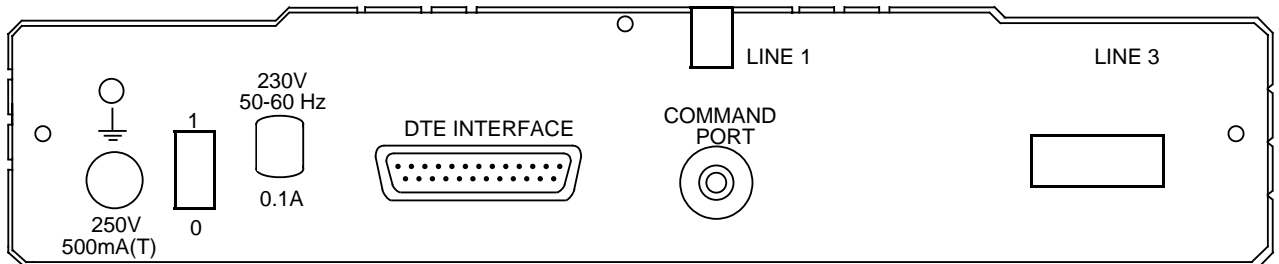



Figure 1-2 The Standalone Modem Rear Panel

| | |
|---|--|
| 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 (230 volt version). 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 1** 3-metre cable fitted with a plug for connection to your leased line.
- LINE 2** Not used.
- LINE 3** 3-metre 4-way line cord fitted with a plug to connect to the dial-up network.

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.

Please refer to Appendix C for country-specific information.

2.1 Pre-Installation

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

- A 25-pin male D-type (ISO 2110) cable to connect the modem to the DTE (your computer or terminal). See Appendix B for details of the pin connections.
- A telephone line (PSTN or leased), terminated with a standard socket.
- For asynchronous command of your modem you will need 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.

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

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

2.2 Equipment Requirements

2.2.1 Data DTE

Your data DTE must operate synchronously. Note the following points:

- If you are using a PC, the standard serial port provided in most models operates asynchronously; to use a PC for synchronous data, you need a Synchronous Communications Adapter (consult your PC supplier).
- Simple terminals (VDUs) are usually asynchronous, although special models designed to work synchronously are available.
- Most wide area and local area networking equipment will operate synchronously.

2.2.2 Controlling the Modem

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

For sending AT commands, you require a separate asynchronous **command terminal** with the following character format:

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

The data rate must be 9600 bps for a standalone modem or rackmount controller card, or 1200 bps for a rackmount modem via a Y cable.

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

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

2.3 Installing the Standalone Modem

2.3.1 Power Supply Connection

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

The standard modem is supplied for use on 230 VAC 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.

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

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

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

2.3.2 DTE Port Connection

The synchronous data DTE must be connected via a cable to the modem's DTE interface connector. A straight-through 25-way cable will be suitable for many synchronous terminals, but there are some which require a cross-over cable. If in doubt, consult the DTE's manual for connection details and compare with information in Appendix B of this manual. See Figure 2-1.

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 2-1.

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

The data format and speed for the command port is fixed at 7 data bits, even parity, 9600 bps.

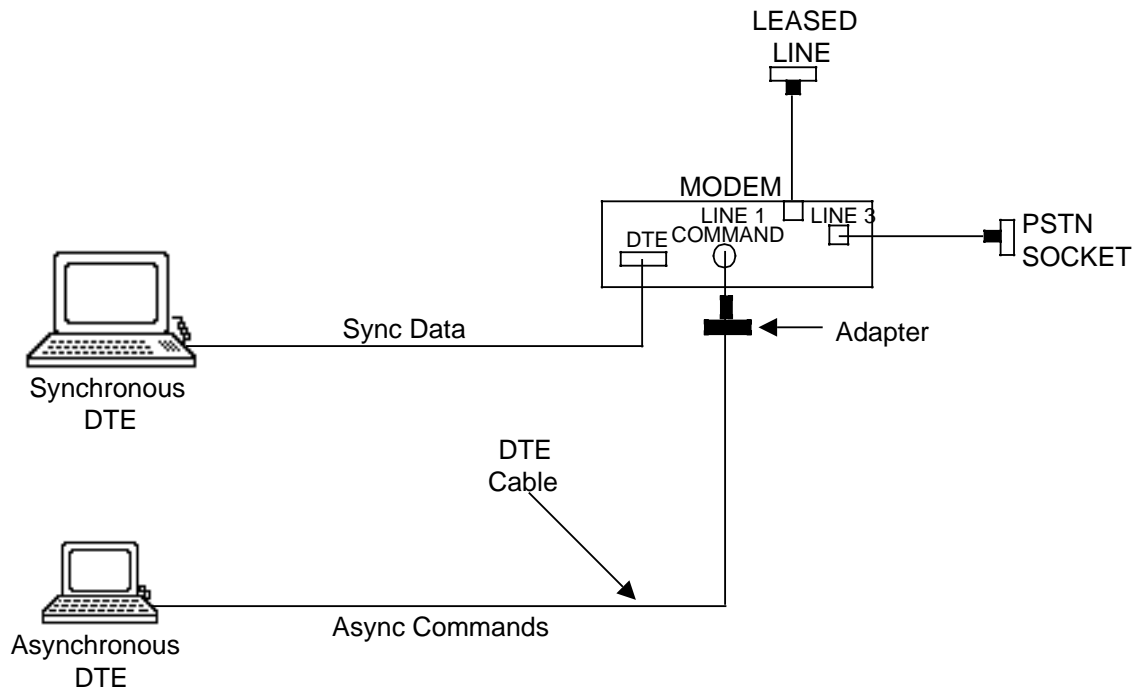


Figure 2-1 Standalone Modem Connections

2.3.4 Telephone Line Connection

Your modem is supplied ready for connection to either a PSTN or Leased Line circuit. The telephone cable marked **LINE 1** is terminated with a standard plug (see Appendix B), for connection to a Leased Line outlet. The socket marked **LINE 3** is used when connection is to be to a 2-wire PSTN circuit.

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.

Whichever of the two circuit types you will be using, connect the modem to the telephone line.

All connections to the telephone network must be via a standard plug and socket, and must not be hard wired.

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 Appendix B.

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. See Appendix B.

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

2.4.4 Telephone Line Connection

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

2.5 Confidence Check

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

2.5.1 Standalone Modem

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

2.5.2 Rackmount Modem

1. Fit the modem in the card guides of the rack, but not pushed fully home.
2. Check that all the front panel buttons are out.
3. Push in and hold in the **DA** button.
4. Push the modem firmly into the rack (while holding in the **DA** button).
5. Keep the **DA** button held in for 3 seconds then release it. The modem is now in its factory default condition. It will send a **RESTART** message to the command terminal.
6. Press in the **TE** button and then the **AL** button. The modem will perform an analogue loop 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 leased 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, ensure that buttons 2 and **DIAL (D)** are in, and that all other buttons are out, before pressing **LOAD (L)**. After pressing **ENTER (I)**, release **LOAD (L)**, 2 and **DIAL (D)**.

3.2 Commanding the Modem

3.2.1 The AT Command Set

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

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

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

The AT commands are listed alphabetically in Chapter 8.

3.2.2 The V.25*bis* Command Set

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

3.3 The AT Command Format

3.3.1 Basic Format

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

AT or at

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

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

For example, if from your keyboard you type:

AT<CR>

the modem will respond with:

OK

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

3.3.2 Example Commands

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

AT*C<CR>

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

AT*S<CR>

3.3.3 Combining Commands

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

AT*C*S<CR>

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

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

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

will give an identical response to the previous sequence.

The only commands that cannot form part of a command string are %D, &F, &L, %W, %X, Z, &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. ATF4). If you omit the number, 0 is assumed (for example ATE is the same as ATE0).

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 for operation. If you are using the PSTN, you will need to make a call.

3.4.1 Dialling

To dial a number from your command 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

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. |

ABORTED indicates that the DTR signal is not present on the DTE interface, i.e. your DTE is not ready.

3.4.3 Connection

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

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

3.4.4 Disconnection

To disconnect the call, type:

ATH

and press **RETURN**. This produces the message:

OK

Note that a call can only be disconnected after it has been fully connected.

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 three 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 protocols,
- 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. Four more standard applications are stored in the "user configuration" locations, described in Section 4.2.

Should the standard 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 | V.32 <i>bis</i> , 14400 bps, 2-wire leased line in answer mode, security control. |
| 1 | V.32 <i>bis</i> , 14400 bps, 2-wire leased line in originate mode, security control. |
| 2 | V.32 <i>bis</i> , 14400 bps, 2-wire leased line, originate mode with autodial backup and security, no autorestor. |
| 3 | V.32 <i>bis</i> , 14400 bps, 2-wire leased line, originate mode with autodial backup, security and autorestor. |
| 4 | V.32 <i>bis</i> , 14400 bps, PSTN, V.25 <i>bis</i> Byte sync dialup, security. |
| 5 | V.32 <i>bis</i> , 14400 bps, PSTN, V.25 <i>bis</i> HDLC sync dialup, security. |
| 6 | V.32 <i>bis</i> , 14400 bps, 4-wire leased line, answer mode. |
| 7 | V.32 <i>bis</i> , 14400 bps, 4-wire leased line, originate mode. |
| 8 | V.33, 14400 bps, 4-wire leased line operation. |
| 9 | V.32 <i>bis</i> , 14400 bps, PSTN, manual dial. |
| 10 | V.32 <i>bis</i> , 14400 bps, PSTN, dial on DTR, security control. |
| 11 | V.33, 14400 bps, 4-wire leased line, originate mode with autodial backup, security and autorestor. |

For convenience, the additional standard configurations stored in the user configuration locations are also listed here:

| | |
|---|---|
| 0 | V.32 <i>bis</i> , 12000 bps, PSTN, for dial backup with manual restoral to the leased line. |
| 1 | V.32 <i>bis</i> , 14400 bps, PSTN, for dial backup with autorestor to the leased line. |
| 2 | V.32 <i>bis</i> , 14400 bps, PSTN, for dial backup with manual restoral to the leased line. |
| 3 | V.29, 9600 bps, 4-wire leased line with 4800 bps fallback. |

These may be user-modified, but can be recalled to the default configurations by resetting the modem.

Factory configurations 4, 5, 9 and 10 are suitable for PSTN operation. The remainder are suitable for leased line (private wire) operation. Configurations 4 and 5 are suitable for DTEs which issue V.25*bis* dialling commands.

The default user configurations are suitable for dial backup operation.

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 : Leased line, V.32bis, answer mode.
Rates : Primary 14400, fallback 12000.
V.24 : Normal.
Commands : AT via the command port.
Typical Use : The modem is set to answer mode and must always be used with an originate modem (e.g. factory configuration 1) at the remote end of the link.

Configuration Screen F0

| | | | | | |
|-----|----------------------|----------------------|------|------------------|---------------|
| F36 | Communication Format | 14400 V32bis | *V0 | Command Mode | AT |
| X6 | Result Codes | ALL | *W0 | DSR Control | NORMAL |
| &B0 | Busy Out Control | DISABLED | "A1 | Leased Line Mode | ANSWER |
| &G0 | Guard tone | OFF | "D0 | Restore on DTR | DISABLED |
| &L1 | Line Mode | 2W LEASE LINE | "E1 | Security Control | ENABLED |
| &Q1 | Operation Mode SYNC | ASYNC DIAL | "N3 | Remote Logon | ORIG & ANS |
| &R0 | RTS/CTS Delay | 0mS | "Q0 | Quality Mon LL | DISABLED |
| &S1 | Switches | ENABLED | /B1 | Carrier | CONSTANT |
| &X0 | Timing Source | INTERNAL | /C1 | Cable Equaliser | ENABLED |
| %B0 | Pin 23 Fallback | DISABLED | /D1 | DCD Threshold | -33dB |
| %E7 | Remote Control | USER & LINE | /F35 | Fallback Format | 12000 V32bis |
| %F0 | Fallback | DISABLED | /G1 | T/2 Equaliser | ENABLED |
| %Q0 | Interface Control | DISABLED | /Q0 | Quality Mon PSTN | DISABLED |
| *B1 | S10 DCD Timeout | 40 Secs | /R1 | S26 Base RTS/CTS | X 1mS |
| *M0 | Data Monitor | OFF | /S1 | Response | EXTENDED |
| *R0 | RTS Clamp | OFF | /T4 | Test Pattern | MARKS/ERR INJ |
| *T1 | DCD Timeout | LOSS | /W1 | S37 Mon. Timeout | 0 Mins |
| *L5 | Dial backup | 2-WIRE ON TIMEOUT | /Y2 | Re-Training | AUTO RETRAIN |

Factory Configuration 1

Operation : Leased line, V.32bis, originate mode.
Rates : Primary 14400, fallback 12000.
V.24 : Normal.
Commands : AT via the command port.
Typical Use : In this mode the modem operates purely as a 2-wire leased line modem, synchronously at 14400 bps. The modem is set to originate mode. This configuration may be used in conjunction with factory configuration 0 at the remote end.

Configuration Screen F1

| | | | | | |
|-----|----------------------|---------------|------|------------------|---------------|
| F36 | Communication Format | 14400 V32bis | *V0 | Command Mode | AT |
| X6 | Result Codes | ALL | *W0 | DSR Control | NORMAL |
| &B0 | Busy Out Control | DISABLED | "A0 | Leased Line Mode | ORIGINATE |
| &G0 | Guard tone | OFF | "D1 | Restore on DTR | ENABLED |
| &L1 | Line Mode | 2W LEASE LINE | "E1 | Security Control | ENABLED |
| &Q1 | Operation Mode SYNC | ASYNC DIAL | "N3 | Remote Logon | ORIG & ANS |
| &R0 | RTS/CTS Delay | 0mS | "Q0 | Quality Mon LL | DISABLED |
| &S1 | Switches | ENABLED | /B1 | Carrier | CONSTANT |
| &X0 | Timing Source | INTERNAL | /C1 | Cable Equaliser | ENABLED |
| %B0 | Pin 23 Fallback | DISABLED | /D1 | DCD Threshold | -33dB |
| %E7 | Remote Control | USER & LINE | /F35 | Fallback Format | 12000 V32bis |
| %F0 | Fallback | DISABLED | /G1 | T/2 Equaliser | ENABLED |
| %Q0 | Interface Control | DISABLED | /Q0 | Quality Mon PSTN | DISABLED |
| *B1 | S10 DCD Timeout | 45 Secs | /R1 | S26 Base RTS/CTS | X 1mS |
| *M0 | Data Monitor | OFF | /S1 | Response | EXTENDED |
| *R0 | RTS Clamp | OFF | /T4 | Test Pattern | MARKS/ERR INJ |
| *T1 | DCD Timeout | LOSS | /W1 | S37 Mon. Timeout | 0 Mins |
| *L0 | Dial backup | DISABLED | /Y2 | Re-Training | AUTO RETRAIN |

Factory Configuration 2

Operation : Leased line, V.32*bis*, automatic dial backup
Rates : Primary 14400, fallback 12000.
V.24 : Normal.
Commands : AT via the command port.
Typical Use : The modem operates in originate mode. Automatic dial backup is enabled and on originating a dial backup connection, the modem will perform a password check on the answering modem. Once verified, transmission is switched to the dial line. Disconnection and return to leased line operation is by AT command, at either end of the link.

A default password has been stored in the modem. If this is deleted, the modem will omit the password check and merely verify the state of the PSTN line before switching to dial backup.

The configuration for dial backup may be stored in a user configuration location and associated with the appropriate telephone number.

The telephone number for automatic dial backup must be stored in the modem in location N8 of the dialling-end modem, which is then the master modem for dial backup operation.

Configuration Screen F2

| | | | | | |
|-----|----------------------|----------------------|------|------------------|---------------|
| F36 | Communication Format | 14400 V32bis | *V0 | Command Mode | AT |
| X6 | Result Codes | ALL | *W0 | DSR Control | NORMAL |
| &B0 | Busy Out Control | DISABLED | "A0 | Leased Line Mode | ORIGINATE |
| &G0 | Guard tone | OFF | "D0 | Restore on DTR | DISABLED |
| &L1 | Line Mode | 2W LEASE LINE | "E1 | Security Control | ENABLED |
| &Q1 | Operation Mode SYNC | ASYNCR DIAL | "N3 | Remote Logon | ORIG & ANS |
| &R0 | RTS/CTS Delay | 0ms | "Q0 | Quality Mon LL | DISABLED |
| &S1 | Switches | ENABLED | /B1 | Carrier | CONSTANT |
| &X0 | Timing Source | INTERNAL | /C1 | Cable Equaliser | ENABLED |
| %B0 | Pin 23 Fallback | DISABLED | /D1 | DCD Threshold | -33dB |
| %E7 | Remote Control | USER & LINE | /F35 | Fallback Format | 12000 V32bis |
| %F0 | Fallback | DISABLED | /G1 | T/2 Equaliser | ENABLED |
| %Q0 | Interface Control | DISABLED | /Q0 | Quality Mon PSTN | DISABLED |
| *B1 | S10 DCD Timeout | 40 Secs | /R1 | S26 Base RTS/CTS | X 1mS |
| *M0 | Data Monitor | OFF | /S1 | Response | EXTENDED |
| *R0 | RTS Clamp | OFF | /T4 | Test Pattern | MARKS/ERR INJ |
| *T1 | DCD Timeout | LOSS | /W1 | S37 Mon. Timeout | 0 Mins |
| *L5 | Dial backup | 2-WIRE ON TIMEOUT | /Y2 | Re-Training | AUTO RETRAIN |

Factory Configuration 3

Operation : Leased line, V.32*bis*, automatic dial backup and restoral.
Rates : Primary 14400, fallback 12000.
V.24 : Normal.
Commands : AT via the command port.
Typical Use : The modem operates with automatic dial backup and restoral to leased line. Dial backup is automatically initiated if the leased line connection is lost.

If the modem subsequently detects that the leased line has recovered, the dial backup connection is automatically broken and transmission is restored to the leased line.

The telephone number for automatic dial backup must be stored in the modem in N8 of the dialling-end modem.

A default password has been stored in the modem. If this is deleted, the modem will omit the password check and merely verify the state of the PSTN line before switching to dial backup. The configuration for dial backup may be stored in a user configuration location. For further information on dial backup see Section 6.4.

Configuration Screen F3

| | | | | | |
|------|----------------------|----------------------|------|------------------|---------------|
| F36 | Communication Format | 14400 V32bis | *V0 | Command Mode | AT |
| X6 | Result Codes | ALL | *W0 | DSR Control | NORMAL |
| &B0 | Busy Out Control | DISABLED | "A0 | Leased Line Mode | ORIGINATE |
| &G0 | Guard tone | OFF | "D0 | Restore on DTR | DISABLED |
| &L1 | Line Mode | 2W LEASE LINE | "E1 | Security Control | ENABLED |
| &Q1 | Operation Mode SYNC | ASYNCR DIAL | "N3 | Remote Logon | ORIG & ANS |
| &R0 | RTS/CTS Delay | 0ms | "Q0 | Quality Mon LL | DISABLED |
| &S1 | Switches | ENABLED | /B1 | Carrier | CONSTANT |
| &X0 | Timing Source | INTERNAL | /C1 | Cable Equaliser | ENABLED |
| %B0 | Pin 23 Fallback | DISABLED | /D1 | DCD Threshold | -33dB |
| %E7 | Remote Control | USER & LINE | /F35 | Fallback Format | 12000 V32bis |
| %F0 | Fallback | DISABLED | /G1 | T/2 Equaliser | ENABLED |
| %Q0 | Interface Control | DISABLED | /Q0 | Quality Mon PSTN | DISABLED |
| *B1 | S10 DCD Timeout | 40 Secs | /R1 | S26 Base RTS/CTS | X 1mS |
| *M0 | Data Monitor | OFF | /S1 | Response | EXTENDED |
| *R0 | RTS Clamp | OFF | /T4 | Test Pattern | MARKS/ERR INJ |
| *T1 | DCD Timeout | LOSS | /W1 | S37 Mon. Timeout | 0 Mins |
| *L13 | Dial backup | 2-WIRE & AUTO-RES | /Y2 | Re-Training | AUTO RETRAIN |

Factory Configuration 4

Operation : PSTN, V.32bis.
Rates : Primary 14400, fallback 12000.
V.24 : DTR conforms to ITU-T 108/2 (call disconnected on loss of DTR).
Commands : AT via the command port. V.25bis Byte via DTE port.
Typical Use : The modem operates as a 2-wire, full duplex 14400 bps dialup modem. Calls are initiated in V.25bis Byte synchronous format via the main data channel, and the command port is active for AT commands.

Configuration Screen F4

| | | | | | |
|-----|----------------------|--------------|------|------------------|---------------|
| F36 | Communication Format | 14400 V32bis | *V2 | Command Mode | V25 BYTE |
| X6 | Result Codes | ALL | *W0 | DSR Control | NORMAL |
| &B0 | Busy Out Control | DISABLED | "A0 | Leased Line Mode | ORIGINATE |
| &G0 | Guard tone | OFF | "D0 | Restore on DTR | DISABLED |
| &L0 | Line Mode | 2W PSTN | "E1 | Security Control | ENABLED |
| &Q3 | Operation Mode SYNC | MANUAL DIAL | "N3 | Remote Logon | ORIG & ANS |
| &R0 | RTS/CTS Delay | 0mS | "Q0 | Quality Mon LL | DISABLED |
| &S1 | Switches | ENABLED | /B1 | Carrier | CONSTANT |
| &X0 | Timing Source | INTERNAL | /C1 | Cable Equaliser | ENABLED |
| %B0 | Pin 23 Fallback | DISABLED | /D0 | DCD Threshold | -43dB |
| %E7 | Remote Control | USER & LINE | /F35 | Fallback Format | 12000 V32bis |
| %F0 | Fallback | DISABLED | /G1 | T/2 Equaliser | ENABLED |
| %Q1 | Interface Control | ENABLED | /Q0 | Quality Mon PSTN | DISABLED |
| *B1 | S10 DCD Timeout | 40 Secs | /R1 | S26 Base RTS/CTS | X 1mS |
| *M0 | Data Monitor | OFF | /S1 | Response | EXTENDED |
| *R0 | RTS Clamp | OFF | /T4 | Test Pattern | MARKS/ERR INJ |
| *T1 | DCD Timeout | LOSS | /W1 | S37 Mon. Timeout | 0 Mins |
| *L0 | Dial backup | DISABLED | /Y2 | Re-Training | AUTO RETRAIN |

Factory Configuration 5

- Operation : PSTN, V.32bis.
Rates : Primary 14400, fallback 12000.
V.24 : DTR conforms to ITU-T 108/2 (call disconnected on loss of DTR).
Commands : AT via the command port, V.25bis HDLC via the DTE port.
Typical Use : The modem operates as a 2-wire, full duplex 14400 bps dialup modem. Calls are initiated in V.25bis HDLC synchronous format via the main data channel, and the command port is active for AT commands.

Configuration Screen F5

| | | | | | |
|-----|----------------------|--------------|------|------------------|---------------|
| F36 | Communication Format | 14400 V32bis | *V3 | Command Mode | V25 HDLC |
| X6 | Result Codes | ALL | *W0 | DSR Control | NORMAL |
| &B0 | Busy Out Control | DISABLED | "A0 | Leased Line Mode | ORIGINATE |
| &G0 | Guard tone | OFF | "D0 | Restore on DTR | DISABLED |
| &L0 | Line Mode | 2W PSTN | "E1 | Security Control | ENABLED |
| &Q3 | Operation Mode SYNC | MANUAL DIAL | "N3 | Remote Logon | ORIG & ANS |
| &R0 | RTS/CTS Delay | 0mS | "Q0 | Quality Mon LL | DISABLED |
| &S1 | Switches | ENABLED | /B1 | Carrier | CONSTANT |
| &X0 | Timing Source | INTERNAL | /C1 | Cable Equaliser | ENABLED |
| %B0 | Pin 23 Fallback | DISABLED | /D0 | DCD Threshold | -43dB |
| %E7 | Remote Control | USER & LINE | /F35 | Fallback Format | 12000 V32bis |
| %F0 | Fallback | DISABLED | /G1 | T/2 Equaliser | ENABLED |
| %Q1 | Interface Control | ENABLED | /Q0 | Quality Mon PSTN | DISABLED |
| *B1 | S10 DCD Timeout | 40 Secs | /R1 | S26 Base RTS/CTS | X 1mS |
| *M0 | Data Monitor | OFF | /S1 | Response | EXTENDED |
| *R0 | RTS Clamp | OFF | /T4 | Test Pattern | MARKS/ERR INJ |
| *T1 | DCD Timeout | LOSS | /W1 | S37 Mon. Timeout | 0 Mins |
| *L0 | Dial backup | DISABLED | /Y2 | Re-Training | AUTO RETRAIN |

Factory Configuration 6

Operation : 4-wire leased line, V.32bis, answer mode.
Rates : Primary 14400, fallback 12000.
V.24 : Normal.
Commands : AT via the command port.
Typical Use : The modem is set to answer mode. Although set to 4-wire operation it is necessary in V.32bis mode to set an originate configuration at the other end of the link. Factory configuration 7 is provided for this purpose.

Configuration Screen F6

| | | | | | |
|-----|----------------------|-----------------|------|------------------|---------------|
| F36 | Communication Format | 14400 V32bis | *V0 | Command Mode | AT |
| X6 | Result Codes | ALL | *W0 | DSR Control | NORMAL |
| &B0 | Busy Out Control | DISABLED | "A1 | Leased Line Mode | ANSWER |
| &G0 | Guard tone | OFF | "D0 | Restore on DTR | DISABLED |
| &L3 | Line Mode | 4W PRIVATE LINE | "E1 | Security Control | ENABLED |
| &Q1 | Operation Mode SYNC | ASYN DIAL | "N3 | Remote Logon | ORIG & ANS |
| &R0 | RTS/CTS Delay | 0mS | "Q0 | Quality Mon LL | DISABLED |
| &S1 | Switches | ENABLED | /B1 | Carrier | CONSTANT |
| &X0 | Timing Source | INTERNAL | /C1 | Cable Equaliser | ENABLED |
| %B0 | Pin 23 Fallback | DISABLED | /D1 | DCD Threshold | -33dB |
| %E7 | Remote Control | USER & LINE | /F35 | Fallback Format | 12000 V32bis |
| %F0 | Fallback | DISABLED | /G1 | T/2 Equaliser | ENABLED |
| %Q0 | Interface Control | DISABLED | /Q0 | Quality Mon PSTN | DISABLED |
| *B1 | S10 DCD Timeout | 40 Secs | /R1 | S26 Base RTS/CTS | X 1mS |
| *M0 | Data Monitor | OFF | /S1 | Response | EXTENDED |
| *R0 | RTS Clamp | OFF | /T4 | Test Pattern | MARKS/ERR INJ |
| *T1 | DCD Timeout | LOSS | /W1 | S37 Mon. Timeout | 0 Mins |
| *L0 | Dial backup | DISABLED | /Y2 | Re-Training | AUTO RETRAIN |

Factory Configuration 7

Operation : 4-wire leased line, V.32bis, originate mode.
Rates : Primary 14400, fallback 12000.
V.24 : Normal.
Commands : AT via the command port.
Typical Use : The modem is set to originate mode. Although set to 4-wire operation it is necessary in V.32bis mode to set an answer configuration at the other end of the link. Factory configuration 6 is provided for this purpose.

Configuration Screen F7

| | | | | | |
|-----|----------------------|-----------------|------|------------------|---------------|
| F36 | Communication Format | 14400 V32bis | *V0 | Command Mode | AT |
| X6 | Result Codes | ALL | *W0 | DSR Control | NORMAL |
| &B0 | Busy Out Control | DISABLED | "A0 | Leased Line Mode | ORIGINATE |
| &G0 | Guard tone | OFF | "D0 | Restore on DTR | DISABLED |
| &L3 | Line Mode | 4W PRIVATE LINE | "E1 | Security Control | ENABLED |
| &Q1 | Operation Mode SYNC | ASYNCR DIAL | "N3 | Remote Logon | ORIG & ANS |
| &R0 | RTS/CTS Delay | 0ms | "Q0 | Quality Mon LL | DISABLED |
| &S1 | Switches | ENABLED | /B1 | Carrier | CONSTANT |
| &X0 | Timing Source | INTERNAL | /C1 | Cable Equaliser | ENABLED |
| %B0 | Pin 23 Fallback | DISABLED | /D1 | DCD Threshold | -33dB |
| %E7 | Remote Control | USER & LINE | /F35 | Fallback Format | 12000 V32bis |
| %F0 | Fallback | DISABLED | /G1 | T/2 Equaliser | ENABLED |
| %Q0 | Interface Control | DISABLED | /Q0 | Quality Mon PSTN | DISABLED |
| *B1 | S10 DCD Timeout | 40 Secs | /R1 | S26 Base RTS/CTS | X 1mS |
| *M0 | Data Monitor | OFF | /S1 | Response | EXTENDED |
| *R0 | RTS Clamp | OFF | /T4 | Test Pattern | MARKS/ERR INJ |
| *T1 | DCD Timeout | LOSS | /W1 | S37 Mon. Timeout | 0 Mins |
| *L0 | Dial backup | DISABLED | /Y2 | Re-Training | AUTO RETRAIN |

Factory Configuration 8

Operation : 4-wire leased line, V.33.
Rates : Primary 14400, fallback 12000.
V.24 : Normal.
Commands : AT via the command port.
Typical Use : The modem operates as a 4-wire leased line modem, synchronously at 14400 bps. The remote modem should also use Factory Configuration 8. The Leased Line Mode, "A, is ignored by this modulation scheme.

Configuration Screen F8

| | | | | | |
|-----|----------------------|-----------------|------|------------------|---------------|
| F28 | Communication Format | 14400 TCM V33 | *V0 | Command Mode | AT |
| X6 | Result Codes | ALL | *W0 | DSR Control | NORMAL |
| &B0 | Busy Out Control | DISABLED | "A0 | Leased Line Mode | ORIGINATE |
| &G0 | Guard tone | OFF | "D0 | Restore on DTR | DISABLED |
| &L3 | Line Mode | 4W PRIVATE LINE | "E1 | Security Control | ENABLED |
| &Q1 | Operation Mode SYNC | ASYNCR DIAL | "N3 | Remote Logon | ORIG & ANS |
| &R0 | RTS/CTS Delay | 0mS | "Q0 | Quality Mon LL | DISABLED |
| &S1 | Switches | ENABLED | /B1 | Carrier | CONSTANT |
| &X0 | Timing Source | INTERNAL | /C1 | Cable Equaliser | ENABLED |
| %B0 | Pin 23 Fallback | DISABLED | /D1 | DCD Threshold | -33dB |
| %E7 | Remote Control | USER & LINE | /F27 | Fallback Format | 12000 TCM V33 |
| %F0 | Fallback | DISABLED | /G1 | T/2 Equaliser | ENABLED |
| %Q0 | Interface Control | DISABLED | /Q0 | Quality Mon PSTN | DISABLED |
| *B1 | S10 DCD Timeout | 40 Secs | /R1 | S26 Base RTS/CTS | X 1mS |
| *M0 | Data Monitor | OFF | /S1 | Response | EXTENDED |
| *R0 | RTS Clamp | OFF | /T4 | Test Pattern | MARKS/ERR INJ |
| *T1 | DCD Timeout | LOSS | /W1 | S37 Mon. Timeout | 0 Mins |
| *L0 | Dial backup | DISABLED | /Y2 | Re-Training | AUTO RETRAIN |

Factory Configuration 9

- Operation : PSTN, V.32bis.
Rates : Primary 14400, fallback 12000.
V.24 : DTR conforms to ITU-T 108/2 (call disconnected on loss of DTR)
Commands : AT via the command port.
Typical Use : This is a dial-up 14400 bps manual dial configuration. Dialling can be either via the command port or the front panel (see Chapter 8 for further information).

Security is enabled so the remote modem must also support this facility and have the password and key set correctly (see Section 5.6 for further information).

Configuration Screen F9

| | | | | | |
|-----|----------------------|--------------|------|------------------|---------------|
| F36 | Communication Format | 14400 V32bis | *V0 | Command Mode | AT |
| X6 | Result Codes | ALL | *W0 | DSR Control | NORMAL |
| &B0 | Busy Out Control | DISABLED | "A0 | Leased Line Mode | ORIGINATE |
| &G0 | Guard tone | OFF | "D0 | Restore on DTR | DISABLED |
| &L0 | Line Mode | 2W PSTN | "E1 | Security Control | ENABLED |
| &Q3 | Operation Mode SYNC | MANUAL DIAL | "N3 | Remote Logon | ORIG & ANS |
| &R0 | RTS/CTS Delay | 0mS | "Q0 | Quality Mon LL | DISABLED |
| &S1 | Switches | ENABLED | /B1 | Carrier | CONSTANT |
| &X0 | Timing Source | INTERNAL | /C1 | Cable Equaliser | ENABLED |
| %B0 | Pin 23 Fallback | DISABLED | /D1 | DCD Threshold | -43dB |
| %E7 | Remote Control | USER & LINE | /F35 | Fallback Format | 12000 V32bis |
| %F0 | Fallback | DISABLED | /G1 | T/2 Equaliser | ENABLED |
| %Q0 | Interface Control | DISABLED | /Q0 | Quality Mon PSTN | DISABLED |
| *B1 | S10 DCD Timeout | 40 Secs | /R1 | S26 Base RTS/CTS | X 1mS |
| *M0 | Data Monitor | OFF | /S1 | Response | EXTENDED |
| *R0 | RTS Clamp | OFF | /T4 | Test Pattern | MARKS/ERR INJ |
| *T1 | DCD Timeout | LOSS | /W1 | S37 Mon. Timeout | 0 Mins |
| *L0 | Dial backup | DISABLED | /Y2 | Re-Training | AUTO RETRAIN |

Factory Configuration 10

Operation : PSTN, V.32bis.
Rates : Primary 14400, fallback 12000.
V.24 : DTR Dialling.
Commands : AT via the command port.
Typical Use : The modem operates as an autodial and autoanswer modem. Dialling is initiated when the terminal raises DTR. The telephone number to be used must be stored in location N0. S-register S25 must be set to 0.

Configuration Screen F10

| | | | | | |
|-----|----------------------|--------------|------|------------------|---------------|
| F36 | Communication Format | 14400 V32bis | *V0 | Command Mode | AT |
| X6 | Result Codes | ALL | *W0 | DSR Control | NORMAL |
| &B0 | Busy Out Control | DISABLED | "A0 | Leased Line Mode | ORIGINATE |
| &G0 | Guard tone | OFF | "D0 | Restore on DTR | DISABLED |
| &L0 | Line Mode | 2W PSTN | "E1 | Security Control | ENABLED |
| &Q2 | Operation Mode SYNC | DTR DIAL | "N3 | Remote Logon | ORIG & ANS |
| &R0 | RTS/CTS Delay | 0mS | "Q0 | Quality Mon LL | DISABLED |
| &S1 | Switches | ENABLED | /B1 | Carrier | CONSTANT |
| &X0 | Timing Source | INTERNAL | /C1 | Cable Equaliser | ENABLED |
| %B0 | Pin 23 Fallback | DISABLED | /D0 | DCD Threshold | -43dB |
| %E7 | Remote Control | USER & LINE | /F35 | Fallback Format | 12000 V32bis |
| %F0 | Fallback | DISABLED | /G1 | T/2 Equaliser | ENABLED |
| %Q0 | Interface Control | DISABLED | /Q0 | Quality Mon PSTN | DISABLED |
| *B1 | S10 DCD Timeout | 40 Secs | /R1 | S26 Base RTS/CTS | X 1mS |
| *M0 | Data Monitor | OFF | /S1 | Response | EXTENDED |
| *R0 | RTS Clamp | OFF | /T4 | Test Pattern | MARKS/ERR INJ |
| *T1 | DCD Timeout | LOSS | /W1 | S37 Mon. Timeout | 0 Mins |
| *L0 | Dial backup | DISABLED | /Y2 | Re-Training | AUTO RETRAIN |

Factory Configuration 11

- Operation** : 4-wire leased line, V.33 TCM, auto dial-backup and restoral.
- Rates** : Primary 14400, fallback 12000.
- V.24** : Normal.
- Commands** : AT via the command port.
- Typical Use** : Initiation of dial backup is automatic on loss of signal. The telephone number for automatic dial backup must be stored in the modem in N8 of the dialling-end modem, along with the required PSTN backup configuration.

The remote modem should also use factory configuration 11. No number is stored in N8, indicating that it is the answering end of the link. The PSTN backup configuration should be loaded into directory location N10.

With user configuration Z1 or Z2 stored alongside the dial backup number, once connected the user configuration is loaded, typically V.32*bis* 14400 bps, and transmission is switched to the dialup line. When the leased line has been restored and checked, data automatically reverts to V.33 leased line operation and the dialup line is disconnected. For full details on dial backup while operating in V.33 mode, see Section 6.4 of this manual.

Configuration Screen F11

| | | | | | |
|------|----------------------|----------------------|------|------------------|---------------|
| F28 | Communication Format | 14400 TCM V33 | *V0 | Command Mode | AT |
| X6 | Result Codes | ALL | *W0 | DSR Control | NORMAL |
| &B0 | Busy Out Control | DISABLED | "A0 | Leased Line Mode | ORIGINATE |
| &G0 | Guard tone | OFF | "D0 | Restore on DTR | DISABLED |
| &L3 | Line Mode | 4W PRIVATE LINE | "E1 | Security Control | ENABLED |
| &Q1 | Operation Mode SYNC | ASYNCR DIAL | "N3 | Remote Logon | ORIG & ANS |
| &R0 | RTS/CTS Delay | 0ms | "Q0 | Quality Mon LL | DISABLED |
| &S1 | Switches | ENABLED | /B1 | Carrier | CONSTANT |
| &X0 | Timing Source | INTERNAL | /C1 | Cable Equaliser | ENABLED |
| %B0 | Pin 23 Fallback | DISABLED | /D1 | DCD Threshold | -33dB |
| %E7 | Remote Control | USER & LINE | /F27 | Fallback Format | 12000 TCM V33 |
| %F0 | Fallback | DISABLED | /G1 | T/2 Equaliser | ENABLED |
| %Q0 | Interface Control | DISABLED | /Q0 | Quality Mon PSTN | DISABLED |
| *B1 | S10 DCD Timeout | 40 Secs | /R1 | S26 Base RTS/CTS | X 1mS |
| *M0 | Data Monitor | OFF | /S1 | Response | EXTENDED |
| *R0 | RTS Clamp | OFF | /T4 | Test Pattern | MARKS/ERR INJ |
| *T1 | DCD Timeout | LOSS | /W1 | S37 Mon. Timeout | 0 Mins |
| *L13 | Dial backup | 2-WIRE & AUTO-RES | /Y2 | Re-Training | AUTO RETRAIN |

4.2 User Configurations

Your modem contains four "user configurations". Initially, these contain four default configurations (effectively an extension of the factory configurations in Section 4.1). Details of these are in Section 4.2.1.

Should none of the factory or default configurations be exactly what you require, you can use the procedure in Section 4.2.2 to create your own customised configuration(s).

4.2.1 Default User Configurations

The default configurations are designed mainly for use on dial backup connections.

User Configuration 0

Operation : PSTN, V.32*bis*, manual restoral.
Rates : Primary 12000, fallback 7200.
V.24 : Normal.
Commands : AT via the command port
Typical Use : This configuration is suitable for use over low quality backup circuits, and where it is desirable for the user to decide when the system should revert to the leased line.

```
Configuration Screen Z0

F35  Communication Format  12000 V32bis  *V0  Command Mode      AT
X6   Result Codes        ALL          *W0  DSR Control        NORMAL
&B0  Busy Out Control    DISABLED    "A1  Leased Line Mode  ANSWER
&G0  Guard tone         OFF         "D0  Restore on DTR    DISABLED
&L0  Line Mode           2W PSTN    "E1  Security Control  ENABLED
&Q1  Operation Mode SYNC ASYNC DIAL "N3  Remote Logon      ORIG & ANS
&R0  RTS/CTS Delay      0mS       "Q0  Quality Mon LL    DISABLED
&S1  Switches           ENABLED    /B1  Carrier           CONSTANT
&X0  Timing Source      INTERNAL   /C1  Cable Equaliser   ENABLED
%B0  Pin 23 Fallback    DISABLED   /D0  DCD Threshold     -43dB
%E7  Remote Control     USER & LINE /F37 Fallback Format    7200 V32bis
%F0  Fallback           DISABLED   /G1  T/2 Equaliser     ENABLED
%Q0  Interface Control  DISABLED   /Q0  Quality Mon PSTN  DISABLED
*B1  S10 DCD Timeout    40 Secs   /R1  S26 Base RTS/CTS X 1mS
*M0  Data Monitor       OFF        /S1  Response          EXTENDED
*R0  RTS Clamp          OFF        /T4  Test Pattern      MARKS/ERR INJ
*T1  DCD Timeout        LOSS      /W1  S37 Mon. Timeout  0 Mins
*L5  Dial backup        2-WIRE ON /Y2  Re-Training       AUTO RETRAIN
                                TIMEOUT
```

User Configuration 1

Operation : PSTN, V.32bis, autorestoreal.
Rates : Primary 14400, fallback 12000.
V.24 : Normal.
Commands : AT via the command port.
Typical Use : This configuration can be used in systems where non-stop operation is desirable. Data transmission automatically reverts to the leased line when it is restored.

Configuration Screen Z1

| | | | | | |
|------|----------------------|----------------------|------|------------------|---------------|
| F36 | Communication Format | 14400 V32bis | *V0 | Command Mode | AT |
| X6 | Result Codes | ALL | *W0 | DSR Control | NORMAL |
| &B0 | Busy Out Control | DISABLED | "A1 | Leased Line Mode | ANSWER |
| &G0 | Guard tone | OFF | "D0 | Restore on DTR | DISABLED |
| &L0 | Line Mode | 2W PSTN | "E1 | Security Control | ENABLED |
| &Q1 | Operation Mode SYNC | ASYNCR DIAL | "N3 | Remote Logon | ORIG & ANS |
| &R0 | RTS/CTS Delay | 0ms | "Q0 | Quality Mon LL | DISABLED |
| &S1 | Switches | ENABLED | /B1 | Carrier | CONSTANT |
| &X0 | Timing Source | INTERNAL | /C1 | Cable Equaliser | ENABLED |
| %B0 | Pin 23 Fallback | DISABLED | /D0 | DCD Threshold | -43dB |
| %E7 | Remote Control | USER & LINE | /F35 | Fallback Format | 12000 V32bis |
| %F0 | Fallback | DISABLED | /G1 | T/2 Equaliser | ENABLED |
| %Q0 | Interface Control | DISABLED | /Q0 | Quality Mon PSTN | DISABLED |
| *B1 | S10 DCD Timeout | 40 Secs | /R1 | S26 Base RTS/CTS | X 1mS |
| *M0 | Data Monitor | OFF | /S1 | Response | EXTENDED |
| *R0 | RTS Clamp | OFF | /T4 | Test Pattern | MARKS/ERR INJ |
| *T1 | DCD Timeout | LOSS | /W1 | S37 Mon. Timeout | 0 Mins |
| *L13 | Dial backup | 2-WIRE & AUTO-RES | /Y2 | Re-Training | AUTO RETRAIN |

User Configuration 2

- Operation : PSTN, V.32bis, manual restoral.
Rates : Primary 14400, fallback 12000.
V.24 : Normal.
Commands : AT via the command port.
Typical Use : This configuration is normally used in a larger system when it is desirable for the user to decide when the system should revert to the leased line.

Configuration Screen Z2

| | | | | | |
|-----|----------------------|---------------|------|------------------|---------------|
| F36 | Communication Format | 14400 V32bis | *V0 | Command Mode | AT |
| X6 | Result Codes | ALL | *W0 | DSR Control | NORMAL |
| &B0 | Busy Out Control | DISABLED | "A1 | Leased Line Mode | ANSWER |
| &G0 | Guard tone | OFF | "D0 | Restore on DTR | DISABLED |
| &L0 | Line Mode | 2W PSTN | "E1 | Security Control | ENABLED |
| &Q1 | Operation Mode SYNC | ASYNCR DIAL | "N3 | Remote Logon | ORIG & ANS |
| &R0 | RTS/CTS Delay | 0mS | "Q0 | Quality Mon LL | DISABLED |
| &S1 | Switches | ENABLED | /B1 | Carrier | CONSTANT |
| &X0 | Timing Source | INTERNAL | /C1 | Cable Equaliser | ENABLED |
| %B0 | Pin 23 Fallback | DISABLED | /D0 | DCD Threshold | -43dB |
| %E7 | Remote Control | USER & LINE | /F35 | Fallback Format | 12000 V32bis |
| %F0 | Fallback | DISABLED | /G1 | T/2 Equaliser | ENABLED |
| %Q0 | Interface Control | DISABLED | /Q0 | Quality Mon PSTN | DISABLED |
| *B1 | S10 DCD Timeout | 40 Secs | /R1 | S26 Base RTS/CTS | X 1mS |
| *M0 | Data Monitor | OFF | /S1 | Response | EXTENDED |
| *R0 | RTS Clamp | OFF | /T4 | Test Pattern | MARKS/ERR INJ |
| *T1 | DCD Timeout | LOSS | /W1 | S37 Mon. Timeout | 0 Mins |
| *L5 | Dial backup | 2W ON TIMEOUT | /Y2 | Re-Training | AUTO RETRAIN |

User Configuration 3

Operation : 4-wire leased line, V.29
Rates : Primary 9600, fallback 4800
V.24 : Normal.
Commands : AT via the command port
Typical Use : This configuration is normally used in 4-wire synchronous multidrop applications.

User Configuration Screen Z3

| | | | | | |
|-----|----------------------|-----------------|------|------------------|---------------|
| F15 | Communication Format | 9600 V29 | *V0 | Command Mode | AT |
| X6 | Result Codes | ALL | *W0 | DSR Control | NORMAL |
| &B0 | Busy Out Control | DISABLED | "A1 | Leased Line Mode | ANSWER |
| &G0 | Guard tone | OFF | "D0 | Restore on DTR | DISABLED |
| &L3 | Line Mode | 4W PRIVATE LINE | "E1 | Security Control | ENABLED |
| &Q1 | Operation Mode SYNC | ASYNC DIAL | "N3 | Remote Logon | ORIG & ANS |
| &R0 | RTS/CTS Delay | 15mS | "Q0 | Quality Mon LL | DISABLED |
| &S1 | Switches | ENABLED | /B1 | Carrier | CONSTANT |
| &X0 | Timing Source | INTERNAL | /C1 | Cable Equaliser | ENABLED |
| %B0 | Pin 23 Fallback | DISABLED | /D1 | DCD Threshold | -33dB |
| %E7 | Remote Control | USER & LINE | /F13 | Fallback Format | 4800 V29 |
| %F0 | Fallback | DISABLED | /G1 | T/2 Equaliser | ENABLED |
| %Q0 | Interface Control | DISABLED | /Q0 | Quality Mon PSTN | DISABLED |
| *B1 | S10 DCD Timeout | 40 Secs | /R1 | S26 Base RTS/CTS | X 1mS |
| *M0 | Data Monitor | OFF | /S1 | Response | EXTENDED |
| *R0 | RTS Clamp | OFF | /T4 | Test Pattern | MARKS/ERR INJ |
| *T1 | DCD Timeout | LOSS | /W1 | S37 Mon. Timeout | 0 Mins |
| *L0 | Dial backup | DISABLED | /Y2 | Re-Training | AUTO RETRAIN |

4.2.2 Customised User Configurations

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

To achieve this:

1. Choose the factory or user default configuration that is closest to the configuration you want (see Sections 4.1 and 4.2.1) 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. Power off the modem and ensure all buttons are in the 'Out' position.
2. Press the **LOAD** button.
3. Select your configuration by pressing the appropriate buttons shown in Table 4-1.

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

Table 4-1 Loading a Configuration

4. Press and hold the **DATA** button whilst powering the modem ON. Continue to hold the **DATA** button depressed for three seconds.
5. Release the **DATA** button and return all other buttons to the 'Out' position.

The **RUN** indicator illuminates to confirm configuration loaded.

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.

&Fn Recall factory configuration
Zn Recall user configuration
&Wn Save user configuration
*C Display active configuration

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

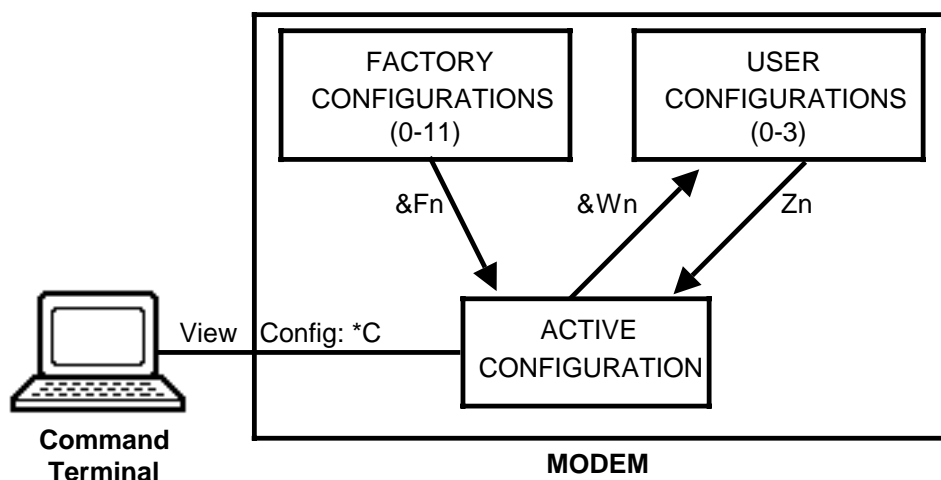


Figure 4-1 Modem Software Configurations

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

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

The relevant commands are summarised in Table 4-2.

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

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

Table 4-2 Configuration Recall and Save Commands

4.5 Resetting the Modem

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

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

The message:

```
RESTART  
199
```

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

This clears all customised 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.

The most important commands are:

| | |
|----|--|
| F | to select the communications format |
| &Q | to determine how to perform with DTR |
| *T | to disconnect the modem on loss of carrier |

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.

| | |
|----|----------------------------|
| "A | Originate or answer mode |
| E | Echo commands |
| Q | Quiet mode |
| &S | Front panel switch control |
| X | Response codes |
| /S | Extra response codes |
| V | Verbose response codes |

Originate/Answer Mode

For V.32, V.32*bis*, V.22 and V.22*bis* leased line operation, one modem must be set to 'originate' mode and the other to 'answer' mode.

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

5.2 DTE Interface Commands

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

The commands directly affecting the interface are:

| | |
|----|---|
| &Q | DTR dialling control |
| &R | RTS/CTS control |
| *R | RTS clamp |
| *W | DSR control |
| /O | DSR control while tests active |
| %Q | DSR, DCD and CTS controls in <i>V.25bis</i> mode. |

Various timeout control commands affect the interface:

| | |
|----|------------------------------------|
| /A | RTS timeout control |
| *B | Carrier and RTS timeout period |
| *M | Inactivity data monitor |
| *T | Carrier timeouts |
| /W | Inactivity data monitor timer base |

5.3 Modulation Format

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

The commands are:

| | |
|----|-----------------------------|
| F | Communications format |
| /F | Fallback format |
| /Q | PSTN quality monitor |
| %B | Pin 23 fallback request |
| %F | Manual fallback request |
| &X | Modem timing |
| "Q | Leased line quality monitor |
| "G | Good quality threshold |
| "P | Poor quality threshold |
| "M | Signal quality summary |

Primary Format

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

Fallback Format

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

Automatic fallback/fallforward operation depending on signal quality may be selected by the /Q or "Q command. Thresholds are set by the "G and "P commands. The status may be inspected by the "M command.

5.4 Line Commands

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

| | |
|----|-------------------------------|
| /B | Constant carrier when on-line |
| /C | Cable equaliser |
| /G | T/2 equaliser |
| /P | Echo protect tone |
| /Y | Training sequence |

5.5 Remote Configuration

Remote configuration enables you to obtain a copy of a remote modem's active configuration, alter it, and send it back to become the remote modem's new active configuration. Security control may be used to prevent unauthorised remote configuration (see Section 5.6).

The commands involved are:

| | |
|-----------|---|
| %E | Remote configuration control |
| %X | Remote up-load |
| %Z | Modify the remote configuration |
| %W | Stop modifying the remote configuration |
| %D | Remote down-load |

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

You must ensure that the setting of command **%E** allows remote configuration.

Then, use the following commands:

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

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

5.6 Security Control

The commands for the security control feature are:

| | |
|----|-------------------------|
| "E | Enable security control |
| "Z | Password store |
| "W | Key store |

Security control is a valuable feature when operating a modem with dial backup enabled. It will guard against the modem being forced to enter dial backup from either a 'wrong number' or a malicious caller.

When the link is initially established, the master modem sends its key ("W) to the remote modem. This is checked against the remote modem's own key. If they match, the remote modem will then send its password ("Z) to the master modem where it is checked against the password of the master modem.

If the key and password are not identical in both modems, the link will not be authenticated.

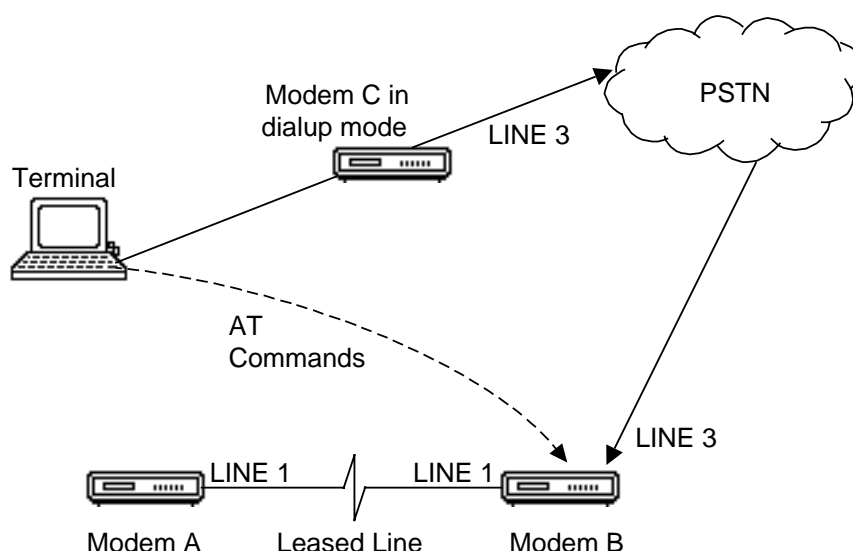
5.7 Remote Log-On Commands

The relevant commands are:

| | |
|----|--|
| "N | Enable remote log-on |
| "X | Dial remote modem |
| "K | Terminate remote log-on |
| "J | Terminate remote log-on and initiate dial backup |

Remote log-on allows AT commands to be executed on a remote modem via a PSTN connection from another modem; a useful feature for reconfiguring and testing a remote modem.

The diagram depicts an asynchronous terminal connected to the command port of a modem (C) in dialup mode, which connects via the PSTN to the PSTN interface of the remote modem B.



The modem used for dialup can either be a separate modem as shown above, or the modem at the local end of the leased line connection, reconfigured temporarily for PSTN operation.

The remote modem must have "N2 or "N3 set.

Security Control (see Section 5.6) should be enabled ("E1) on both the local and remote modems, to ensure that only a valid operator can gain access to the remote modem.

To log-on to the remote modem:

1. Ensure that both modems involved in the remote log-on have "N and "E set correctly. (The default in all factory and user configurations is "N3 and "E1, which will allow correct operation.)
2. Load an appropriate PSTN configuration into the modem being used for the PSTN connection (see Chapter 4 for a description of available configurations).
3. Dial into the remote modem using **AT"Xnnn** where nnn is the telephone number of the remote modem's LINE 3 (PSTN 1).
4. To confirm the remote log-on, both the local and remote modem's command ports will display the message REMOTE CONTROL GRANTED.

Once the remote log-on has been granted, all commands entered on the command port of the local modem are transmitted to the remote modem. All responses from the remote modem are sent back to the local modem's command port terminal.

To log-off from the remote modem:

Either enter **AT"K** just to log-off, or enter **AT"J** to log-off and initiate a dial backup attempt. In this case the dial backup number must have been stored in memory location N8.

Note: Analogue loopback is not available when the remote log-on facility is in use. Use of the A/ sequence is not supported either.

5.8 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

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 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 |

In addition, appropriate dialling modifiers may also be included (see Section 6.2.4).

Modifiers are explained in detail in Chapter 8.

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 |
| &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 (see the Appendix entitled 'Technical Guide').

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

6.2.3 Autodialling by DTR

The autodial by DTR facility works as follows:

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

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

6.2.4 Dialling by Command

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

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

U Redial until answered.
/nnn Dial alternative number nnn.

6.2.5 Connection Sequence

Details of the events for a successful or unsuccessful connection were given in Section 3.4.

6.2.6 The Blacklist

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

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

The following conditions apply to this feature:

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

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

6.3 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 three rings.

When an incoming call is detected, the modem goes off-hook and sends answer tone to the remote modem.

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.

6.4 Dial Backup

The relevant commands are:

| | |
|----|------------------------------|
| "B | Initiate dial backup |
| "D | Revert to leased line on DTR |
| "L | Manual revert to leased line |
| *L | Dial backup facility |

Dial backup is the facility that enables your modem to initiate or receive a call on its PSTN line if there is a failure on the leased line circuit.

Your modem can store up to twenty telephone numbers for autodialling over the PSTN. Stored directory location 8 is used for the single line dial backup number.

In the case of leased line failure, dial backup is initiated either automatically or manually depending on the setting of the *L command. To initiate dial backup manually you need only press the **DB** button, and the modem will autodial the backup number stored. Manual dial backup can also be initiated by software command "B. However, the modem will only initiate dial backup if a telephone number is stored in N8.

If there is no number stored in position N8, the modem will act as a slave modem and wait to be dialled from the master modem at the other end of the failed leased line.

When your modem goes from leased line to dial backup mode, the PSTN settings to which it will need to operate (data rate etc) are normally determined by one of the stored user configurations.

Master and Slave

The dial backup procedures described in this section refer to "master" and "slave" modems. The master modem is the modem which initiates the dial backup calls. It is assigned by storing a telephone number in location N8 by the command:

```
ATN8&Z <telephone number><CR>
```

A slave modem expects the dial backup to be initiated by receiving a call on the PSTN from a master modem. To assign your modem to act as a slave, directory location N8 must **not** contain a telephone number – enter the command:

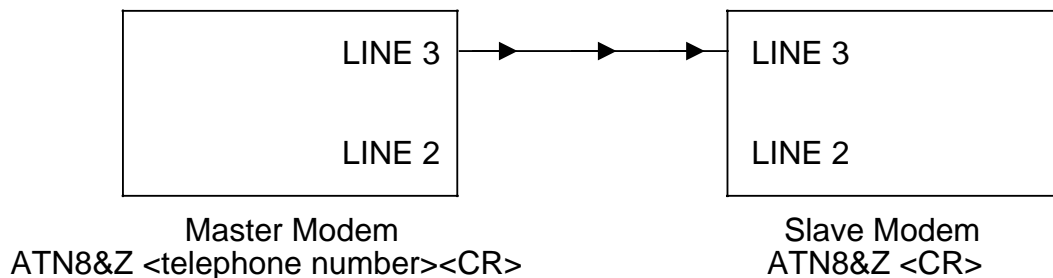
```
ATN8&Z<CR>
```

All dial backup configurations require one modem to be a master and one modem to be a slave.

6.4.1 Single Call Dial Backup

This configuration will cause the modem to work as a full duplex 2-wire link when operating on the PSTN.

The master modem will dial out on LINE 3 using the telephone number stored in N8. The slave modem will answer an incoming call on LINE 3.



Example of Dial Backup Using Configuration Recall

With a modem operating in 4-wire leased line V.33 14400 bps mode with dial backup enabled such as factory configuration 11, it is required that transmission should be switched to V.32*bis* when the modem operates in dial backup.

To achieve this the modem will have to alter its configuration from the one that it is using on the leased line, to the preferred configuration on the PSTN, during the time between the failure of the leased line and data transmission over the PSTN.

We have already explained in Section 6.1.1 how <Ctrl-F> can be used to store a modem configuration with a telephone number. By using this powerful feature you can store the required V.32*bis* configuration together with the backup telephone number in directory location N8 of the master modem. When the modem goes into dial backup mode, it will dial the number stored in N8 and automatically load the associated configuration.

The slave modem can only reply if it too has switched from the leased line configuration to an appropriate PSTN configuration. Using <Ctrl-F>, load the configuration into directory location N10 of the slave modem:

ATN10&Z<Ctrl-F> <Configuration No> Zn <CR>

where n is the user configuration number.

(Note that when configuring a directory location of a rackmounted modem, there is no prompt message asking for a configuration number.)

On answering a call from the master modem, the answering modem looks at the directory location held in S-register S43. If the <Ctrl-F> character is present, the associated configuration is loaded. The directory location held in S43 can be altered to any of the possible locations 0-20 (the default for S43 is directory location 10).

When transmission is restored to the leased line, both modems will revert to their original configuration.

For your convenience three V.32*bis* backup configurations have been pre-stored in user configuration locations 0, 1 and 2. These were described in Section 4.2.

6.4.2 Automatic Dial Backup with Autorestoral

When configured for automatic dial backup with autoestoral, each modem monitors the leased line. If the master modem detects a loss of carrier for a period greater than that stored in S10, then it initiates a dial backup.

When the dial backup calls have been established and data is routed via the PSTN, the leased line is monitored for recovery by a series of special tones. On detecting that the leased line has recovered and is working in both directions (for a period greater than that stored in S57 if you are using 2-wire, the period of time being fixed at 20 seconds on a 4-wire leased line circuit), the master modem will signal the slave modem to drop the PSTN call and return to leased line operation.

6.4.3 Manual Dial Backup Via the Front Panel

If manual dial backup is enabled (*L1 being set), pressing the front panel **DB** button on the master modem will initiate a dial backup. To return to leased line operation, release the **DB** button on the master modem.

6.4.4 Manual Dial Backup Via Software Command

If manual dial backup is enabled (*L1 being set), issuing the command "B will force the modem into dial backup mode, regardless of the state of the leased line. To return to leased line operation, issue the command "L.

6.5 Rate Adaption (Fallback/Fallforward)

Rate adaption is the facility which allows your modem to change its connection speed to the remote modem. This may be achieved either manually or automatically.

6.5.1 Manual Fallback

Fallback operation may be selected by the following methods:

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

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

6.5.2 Auto Fallback

Auto fallback is the facility which allows your modem to change its connection speed in response to the prevailing line conditions.

The relevant commands are:

| | |
|----|-------------------------------|
| "Q | Leased line quality monitor |
| /Q | PSTN quality monitor |
| "G | Good signal quality threshold |
| "P | Poor signal quality threshold |
| "M | Signal quality summary |

When enabled, the signal quality monitor facility monitors the quality of the signal received from the line. If the quality falls below that set by the "P command, the modem will request a fallback to a slower connection speed.

Once the signal quality increases beyond that set by the "G command, the modem falls forward to a faster connection speed, up to the maximum defined by the primary modulation format (set by the F command).

The PSTN quality monitor may also initiate a re-dial, if the line quality does not improve.

If you encounter operational problems please refer to the Appendix entitled Country-Specific Information before starting diagnostic tests.

7.1 Introduction

Operational problems may be caused by any of the following:

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

The modem can run the following diagnostic tests to help locate the source of operational problems:

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

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

Tests can be activated by:

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

Sequence of Testing

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

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

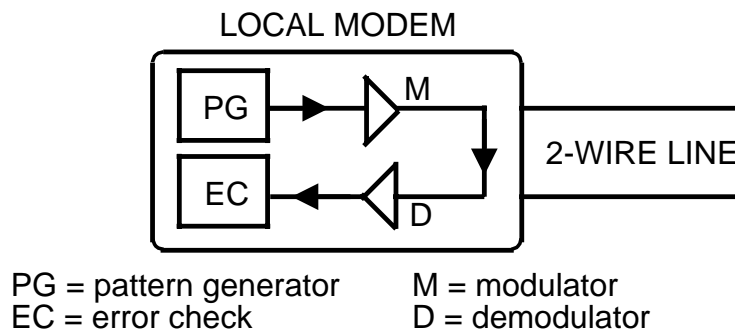
Analysis of each test result should indicate the source of possible faults.

7.2 Test Details

7.2.1 Local Analogue Loopback

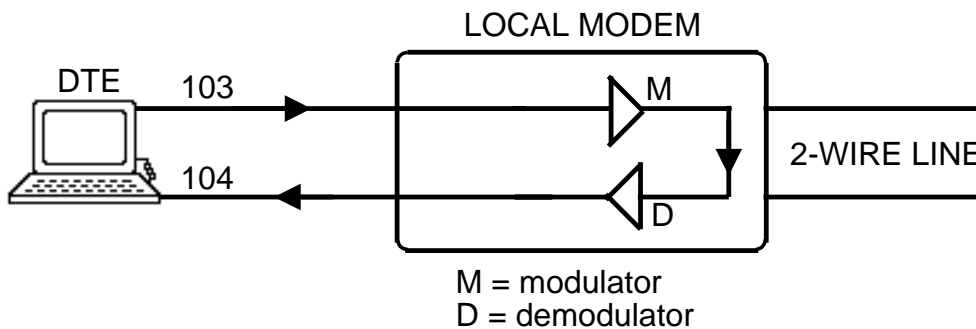
Using the Modem's Test Pattern Generator (Self-Test)

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



Using an External Test Source

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

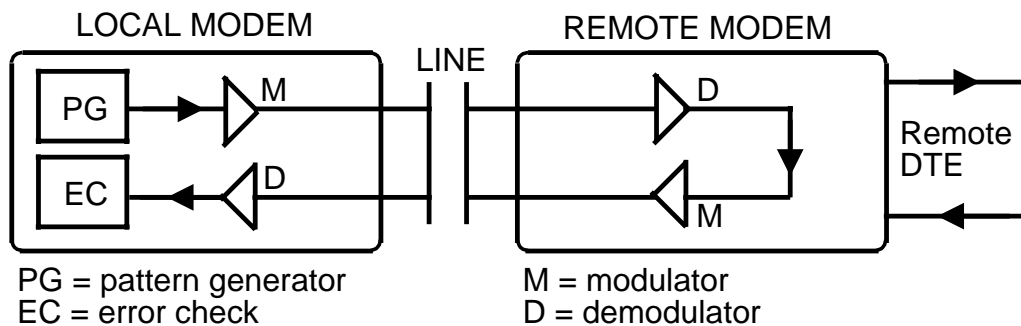


7.2.2 Remote Digital Loopback

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

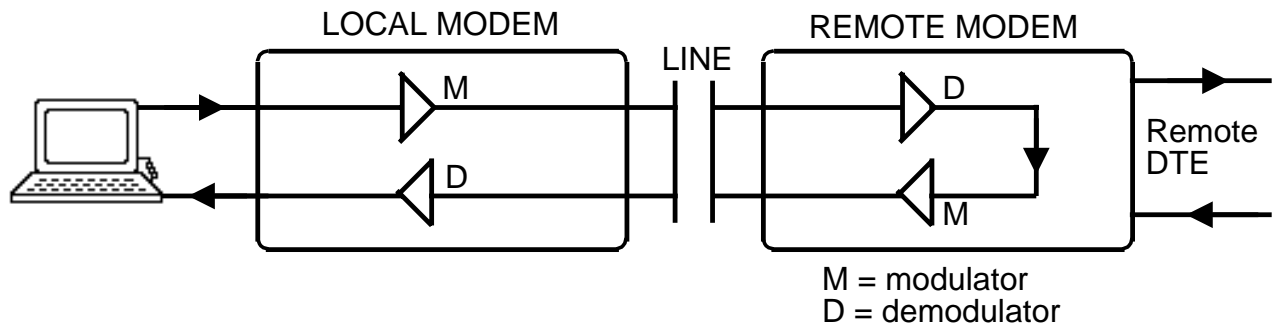
Using the Modem's Test Pattern Generator (Self-Test)

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



Using an External Test Source

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



7.3 Testing via the Front Panel

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

7.3.1 Local Analogue Loopback

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

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

Using an External Test Source

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

7.3.2 Remote Digital Loopback

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

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

Using an External Test Source

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

7.4 Testing by Command

The following commands are available for testing:

| | |
|----|------------------------------|
| &T | Select modem test operation |
| /T | Test pattern |
| &B | Delay busyding |
| I | Display modem identity codes |

7.4.1 Local Analogue Loopback

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

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

If you selected &T8 (with self-test), the test sequence is automatic and the circuit is checked for errors. Errors may be injected with the command **AT&T99**.

5. To terminate the test manually, enter the command **AT&T0** and press **RETURN**. The modem responds with the message **OK**.

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

7.4.2 Remote Digital Loopback

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

1. Ensure that your modem has established a connection with a remote modem.
2. If required, set the test timer with the command **ATS18=n** (n = 1 to 255 seconds).
3. Ensure that the remote modem is conditioned to accept an RDL test (&T4).
4. Enter the command **AT&T6** (without self-test) or **AT&T7** (with self-test) and press **ENTER**.
5. If you selected &T6 (without self-test), you must transmit a test message. This should be echoed back via the remote modem's digital loopback connection.

If you selected &T7 (with self-test), the test sequence is automatic and the circuit is checked for errors. Errors may be injected with the command **AT&T99**.

6. To terminate the test manually, enter the command **AT&T0** and press **RETURN**. The modem responds with the message **OK**.

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

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

7.5 Analogue Parameters

The command is:

"S Display analogue parameters

Analogue parameters give information on the quality of the line over which the modem is transmitting data. These parameters are derived from the performance of the modem, and provide an indication of the line/modem characteristics. They should not be taken as calibrated measurements.

Note: Unless you are familiar with the data given by the analogue parameters, you should not contact your communications network provider until you are confident that a line problem exists.

Analogue parameters can only be displayed once the modem is trained and receiving valid carrier from the remote modem. Any attempt to access them with the modem off-line (or during training) will result in the message ERROR being returned.

Analogue Parameters are displayed in the following format:

Local Modem Analogue Parameters

| | | |
|----|------------------|-------------------|
| 01 | Rx Level | -20 dBm |
| 07 | Round Trip Delay | 10 ms |
| 08 | Far End Echo | -84 dBm |
| 09 | Phase Roll | 0 Hz |
| 11 | EQM Value | 0000 |
| 12 | Signal Quality | 1 |
| 13 | Signal Noise | 44 dB |
| 14 | Estimated BER | <10 ⁻⁸ |

An explanation of the parameters displayed is as follows:

01 Receive Level:

This is the level of the received carrier as seen by the modem. An attenuation figure for the communications line can be calculated using this information. Normally, in the UK, modems on leased lines transmit at -13 dBm, and on the PSTN at -9 dBm.

Example: Receive level is -20 dBm. The remote modem is transmitting at -13 dBm, therefore the attenuation is -20 minus -13 = -20 +13 = -7 dBm (a loss of 7 dBs).

07 Round Trip Delay:

This is a measurement of the time taken for the data to be transmitted once from local to remote and back again. By dividing this delay by 2, the time taken for data to reach the remote end can be obtained.

This information is particularly useful on internationally dialled connections, to determine if the path chosen is satellite or cable. Cable exhibits a much lower round trip delay time and may be more suitable for systems that require a fast response time. Typical delays for transatlantic satellites are in the order of 800 ms, and for transatlantic cable 150 ms.

08 Far End Echo:

This is a measurement of the amount of transmitted signal reflected back toward the transmitting modem from the remote end. Because V.32 uses an echo-cancelling principle to transmit data, an echo level that is too high can cause data errors and the modems to retrain, causing breaks in service. A far-end echo figure of greater than -40 dBm would be a large amount of far-end echo.

09 Phase Roll:

Phase roll is caused by the combination of two effects, Far End Echo and Frequency Shifts. The effect of phase roll will cause bursts of errors to occur at regular intervals: the figure given will be a measurement of the frequency offset on the communications line in Hertz (Hz). V.32 will normally work with levels of phase roll up to 7 Hz; however this will also depend on the amount of far-end echo.

11 EQM Value:

Eye Quality Monitor (EQM) is a value produced by the modem to indicate the quality of the received signal, and is a measurement of deviation from the ideal signal. The larger the value, the worse the received signal.

Note: This value is used to calculate other parameters and should not be used on its own as a measurement of line quality.

12 Signal Quality:

This value is the most useful and most important, and should be used if you are unsure of how to interpret the other values given. It is an overall estimation of the line quality expressed as a numeric value between 1 and 15. It is calculated from the EQM value and bit error

rate information. The lower the value the better the quality of service, as indicated below.

| Value | Performance |
|--------------|--------------------|
| 1-2 | Very good |
| 2-4 | Good |
| 4-6 | Fair |
| 6-10 | Bad |
| 10-12 | Very Bad |
| 12-15 | Unusable |

13 Signal Noise:

This is a measurement of the difference in level of signal, to the level of random noise on the communications line, expressed in dB. Each modulation scheme has a different minimum level of signal to noise at which it will perform satisfactorily. For example, V.32 will require a minimum level of about 20 dB, whereas V.33 will require a minimum level of about 27 dB. These figures will vary with different line types and speed of transmission. In general the larger the figure the better; a very low signal to noise will indicate a poor communications line.

14 Estimated BER (Bit Error Rate)

This is an estimation of errors that can be expected when transmitting data, expressed as 'greater than' or 'less than' a figure of 10^{-n} , n being a value between 1 and 8.

Example: A BER of $<10^{-8}$ will indicate a bit error rate of less than 1 bit in every 100 million bits sent; a BER of $<10^{-7}$ would indicate a bit error rate of less than 1 bit in every 10 million bits sent, and so on down to $<10^{-1}$ which indicates a bit error rate of greater than 1 bit in every 100 bits sent.

7.6 Additional Modem Status Codes

To provide the user with more information on the status of the modem, the *S response (see Chapter 9) has been expanded. These codes are used by the Network 16 Network Management System, or the local user, to access the detailed operating characteristics of the modem.

The results are output in hexadecimal format only, and may consist of single- or multiple-byte responses.

Enter commands in the following format:

***Snn** where nn is required result in the range 1 to 20.

Note that *S13 to *S15 are not supported by the modem: the code 000 will be returned.

***S1 DTE Input Pins**

Result displays status of V.24 DTE pins.

| Bit | Set | Definition |
|------------|------------|--|
| 0 | 0 | Pin 20 low, Data Terminal Ready OFF |
| | 1 | Pin 20 high, Data Terminal Ready ON |
| 1 | 0 | Pin 4 low, Request To Send OFF |
| | 1 | Pin 4 high, Request To Send ON |
| 2 | 0 | Not used |
| 3 | 0 | Pin 23 high, high modem speed requested |
| | 1 | Pin 23 low, low speed (fallback) requested |
| 4 | 0 | Pin 21 low, No V.54 RDL requested |
| | 1 | Pin 21 high, V.54 RDL requested |
| 5 | 0 | Pin 18 low, No V.54 AL requested |
| | 1 | Pin 18 low, V.54 AL requested |
| 6 | 0 | Not used |
| 7 | 0 | Not used |

***S2 DCE Output Pins**

Result displays status of V.24 DCE pins.

| Bit | Set | Definition |
|------------|------------|-------------------------------|
| 0 | 0 | Pin 6 low, Data Set Ready OFF |
| | 1 | Pin 6 high, Data Set Ready ON |

| | | |
|---|---|------------------------------------|
| 1 | 0 | Pin 8 low, Data Carrier Detect OFF |
| | 1 | Pin 8 high, Data Carrier Detect ON |
| 2 | 0 | Pin 5 low, Clear To Send OFF |
| | 1 | Pin 5 high, Clear To Send ON |
| 3 | 0 | Pin 25 low, test indicate OFF |
| | 1 | Pin 25 high, test indicate ON |
| 4 | 0 | Pin 21 low, bad signal quality |
| | 1 | Pin 21 high, good signal quality |
| 5 | 0 | Not used |
| 6 | 0 | Not used |
| 7 | 0 | Not used |

***S3 Modem Status**

Result displays modem status.

| Bit | Set | Definition |
|------------|------------|---|
| 0 | 0 | Offline (PSTN 1 or LL) |
| | 1 | Online (PSTN 1 or LL) |
| 1 | 0 | See notes below |
| 2 | 0 | See notes below |
| 3 | 0 | Normal full speed operation |
| | 1 | Fallback operation |
| 4 | 0 | Not used |
| 5 | 0 | Modem not in dial backup |
| | 1 | Modem in dial backup and connected |
| 6 | 0 | Not used |
| 7 | 0 | Dial backup enabled by Network 16 controller |
| | 1 | Dial backup disabled by Network 16 controller |

Note:

| Bit1 | Bit2 | Definition |
|-------------|-------------|--|
| 0 | 0 | No modem warm, cold or checksum error restart occurred since last read |
| 0 | 1 | Mains power has been lost since last read |
| 1 | 0 | Checksum error and restart occurred since last read |
| 1 | 1 | Modem restart occurred since last read |

***S9 Display Combination**

Displays results from *S1, *S2 and *S3 (see *S20)

***S10 Front Panel Buttons**

Result displays status of front panel buttons.

| Bit | Set | Definition |
|------------|------------|---------------------------|
| 0 | 0 | Button 1 Out (future use) |
| | 1 | Button 1 In (future use) |
| 1 | 0 | Button 2 Out (future use) |
| | 2 | Button 2 In (future use) |
| 2 | 0 | DATA button Out |
| | 1 | DATA button In |
| 3 | 0 | DB button Out |
| | 1 | DB button In |
| 4 | 0 | TEST button Out |
| | 1 | TEST button In |
| 5 | 0 | AL button Out |
| | 1 | AL button In |
| 6 | 0 | RDL button Out |
| | 1 | RDL button In |
| 7 | 0 | FB button Out |
| | 1 | FB button In |

***S11 Modem Connection Speed**

Result displays modem connection speed.

| Speed | Decimal value |
|--------------|----------------------|
| Offline | 000 |
| 1200 bps | 007 |
| 2400 bps | 008 |
| 4800 bps | 009 |
| 7200 bps | 010 |
| 9600 bps | 011 |
| 12000 bps | 012 |
| 14400 bps | 013 |

***S12 Modulation Format**

Result displays modem modulation format.

| Speed | Decimal value |
|---|----------------------|
| Not known, i.e. modem offline and or no DCD | 000 |
| Format set to V.22 1200 bps | 004 |

| | |
|---|-----|
| Format set to V.22 <i>bis</i> 2400 bps | 005 |
| Format set to V.29 4800 bps | 013 |
| Format set to V.29 7200 bps | 014 |
| Format set to V.29 9600 bps | 015 |
| Format set to V.32 4800 bps | 021 |
| Format set to V.32 9600 bps | 022 |
| Format set to V.32 9600 bps TCM | 024 |
| Format set to V.33 12000 bps TCM | 027 |
| Format set to V.33 14400 bps TCM | 028 |
| Format set to V.32 <i>bis</i> 12000 bps | 035 |
| Format set to V.32 <i>bis</i> 14400 bps | 036 |
| Format set to V.32 <i>bis</i> 7200 bps | 037 |

*S16 Last Loopback Test Result

*S16 is used to store the last test result produced by the modem when performing an AL or RDL with self test. This byte is only updated when another test result is received.

When a test starts, this value is set to 000. While the test is in operation this counter will be updated every time an error is detected, allowing a user to monitor the state of a test.

*S17 Dial Backup Progress Monitor

*S17 is used to map the progress of automatic dial backup and restoral operation, as below:

| Bit 0 | | Definition |
|--------------|--------------|---|
| 0 | | Normal leased line operation |
| 1 | | Leased line failed, automatic dial backup in progress |
| Bit 2 | Bit 1 | |
| 0 | 0 | Leased line stopped, AT command backup requested |
| 0 | 1 | Leased line stopped, Manual dial backup requested |
| 1 | 0 | Future use |
| 1 | 1 | Leased line failed, DCD timeout |
| Bit 3 | Bit 4 | |
| 0 | 0 | Line 1 awaiting dial backup call |
| 0 | 1 | Line 1 dialling call |
| 1 | 0 | Line 1 call failed |
| 1 | 1 | Line 1 call connected |

Bit 6

0 Leased line not ready for restoral
1 Leased line ready for restoral

Bit 7

0 Dial backup not completed yet
1 Dial backup complete and operational

***S20 Display Combination**

Displays results from *S1 to *S3, and *S10 to *S17 (see *S9).

8.1 Introduction

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

& * / % " -

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

In addition to the commands that must have the AT prefix, there is one which does not require the prefix or the terminator:

A/ Repeat Last Command(s)

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

8.2 The Commands

A Answer (Go Off-Hook)

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

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

NO CARRIER

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

ABORTED

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

DIALTONE

/A RTS Timeout Control

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

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

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

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

S-register S10 determines the duration of the RTS timeout (S10 is measured in increments of 1 second or 0.1 of a second, depending on the setting of the *B command). S-register S56 determines the anti-

streaming timeout. Setting a register to zero disables the associated timeouts.

"A Originate/Answer Mode

This command applies to V.32, V.32*bis*, V.22 and V.22*bis* operation. In a 2-wire full-duplex leased line system, one modem must be in 'originate mode', with the associated modem in 'answer mode'.

"A0 Originate mode.

"A1 Answer mode.

-A DTR Busy Out

This command is only relevant when &Q14 is set. It is used to select the type of busy-out performed.

-A0 Busy-out the line.

-A1 Busy-out the line and enable local analogue loopback.

&B Delayed Busying

This command is used for maintenance purposes to prevent incoming calls, or to bring out of service a modem from a hunting group.

&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

This command causes the modem to output carrier over a point-to-point connection regardless of the state of RTS, instead of the normal condition to output carrier only when RTS from the DTE is high.

/B0 Carrier output controlled by RTS.

/B1 Carrier output constant.

%B Pin 23 Fallback Request

This command selects how your modem will react to the state of pin 23. To use this, the DTE must control pin 23 equivalently to operating the **FB** button. This command is only active if Link 14 on the standalone modem or Link 7 on the rackmount modem is in position 2 (see the Appendix entitled 'Technical Guide'.)

%B0 State of pin 23 ignored. Default.

%B1 State of pin 23 actioned:

High = Primary rate.

Low = Fallback rate.

"B Initiate Dial Backup

If manual dial backup is enabled by the command *L1 being set and a telephone number being stored in N8, then issuing the "B command will cause the modem to go into dial backup mode regardless of the state of the leased line (refer to the dial backup section (6.4) for details).

***C Display Active Configuration**

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

Examples of configuration screens are given in Section 4.1.3.

/C Cable Equaliser

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

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

The equaliser should normally be enabled for all modes. It should only be disabled if both the local and remote modems are attached to the same PABX.

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**.

Dialling Modifiers

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

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

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

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

, Pause Before Dialling

A comma will cause the modem to pause for the period of time set in S-register S8, for example after a prefix, before

continuing to dial. Multiple pauses may be used. (The factory default for S8 is 4 seconds.)

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

W Wait for Dial Tone

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

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

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

! Flash or Time Break

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

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

U Redial Until Answered

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

ATDU nn where nn is the telephone number.

Most countries have rules governing the number of rediallings allowed and the interval between them: see details in Section 6.2.6 and Appendix C. Attempts to continue dialling after the limit is reached produce the message:

BLACKLIST

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

/ Dial Alternative Number

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

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

This facility cannot be used within the modem's telephone directory.

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.

/D2 Carrier threshold -26 dB to -31 dB.

/D3 Carrier threshold -16 dB to -21 dB.

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

When &L0 is selected, this command is automatically set to /D0.

%D Remote Down-Load

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

"D Revert to Leased Line on DTR

This command is not to be used if *L13 (2-wire autorestore) is set.

"D0 Normal mode.

"D1 Restore to leased line operation when DTR is raised.

When in dial backup mode, if "D1 is set, your modem will attempt to restore to the leased line only on DTR being raised: it does not matter if the leased line has recovered or not, the modem will attempt to pass data over the leased line.

E Echo Commands

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

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

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

%E Remote Configuration Control

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

- a) Will the local modem accept remote configuration commands from the attached DTE?
- b) Will the local modem accept as its active configuration, a configuration sent from the remote modem?
- c) Will the local modem accept commands from the remote modem to send the local modem's current active configuration to the remote modem?

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

Care must be taken when changing the configuration of a remote modem. For example, if the remote modem's active configuration is

%E7 and it is subsequently changed to %E4 you will have no further configuration control over the remote modem.

A working example of this and the other remote configuration commands is given in Section 5.5.

"E Security Control

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

- "E0 Security disabled.
- "E1 Security enabled. Default.

If security is enabled, you need to use commands "W and "Z. See also Section 5.6.

F Communications Format

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

- F4 V.22, 1200 bps.
- F5 V.22*bis*, 2400 bps.
- F13 V.29, 4800 bps.
- F14 V.29, 7200 bps.
- F15 V.29, 9600 bps.
- F21 V.32, 4800 bps
- F22 V.32, 9600 bps.
- F24 V.32, 9600 bps TCM (trellis code modulation).
- F27 V.33, 12000 bps.
- F28 V.33, 14400 bps.
- F35 V.32*bis*, 12000 bps.
- F36 V.32*bis*, 14400 bps.
- F37 V.32*bis*, 7200 bps.

&F Recall Factory Configuration

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

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

/F Fallback Format

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

| | |
|-------------|---|
| /F4 | V.22, 1200 bps. |
| /F5 | V.22 <i>bis</i> , 2400 bps. |
| /F13 | V.29, 4800 bps. |
| /F14 | V.29, 7200 bps. |
| /F15 | V.29, 9600 bps. |
| /F21 | V.32, 4800 bps |
| /F22 | V.32, 9600 bps. |
| /F24 | V.32, 9600 bps TCM (trellis code modulation). |
| /F27 | V.33, 12000 bps. |
| /F28 | V.33, 14400 bps. |
| /F35 | V.32 <i>bis</i> , 12000 bps. |
| /F36 | V.32 <i>bis</i> , 14400 bps. |
| /F37 | V.32 <i>bis</i> , 7200 bps. |

%F Fallback Request

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

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

&G Guard Tone Enable

Normally only used in V.22/V.22*bis* modes, this command allows you to set the guard tone frequency.

| | |
|----------------|-------------------------------|
| &G0 | Guard tone disabled. Default. |
| &G1 | Guard tone is 550 Hz. |
| &G2 | Guard tone is 1800 Hz. |

/G T/2 Equaliser

This command is used to enable or disable the T/2 equaliser.

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

Normally enabled for short and medium length circuits. Very long and international circuits with significant line echoes will operate better with T/2 disabled.

"G Good Quality Threshold

This command sets the good signal quality threshold for use by the signal quality monitor. It indicates the point at which a fallforward to a higher transmission speed will take place.

"Gn where n is the threshold value (0-15) in S-register S28.

H Go On-Hook

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

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 164 for standalone, or 162 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 162 for standalone, or 164 for rackmount. (The hex format is A2 for the standalone and A4 for the rackmount.)
- I6** Display serial number.

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.

To enter a new serial number enter **AT19<CR>**. Modem responds ERROR. Enter **AT*Q9xxxxx<CR>** where xxxxx is the serial number. A new serial number can only be entered if RAM corruption has occurred (i.e. remove the battery strap and power cycle the modem before entering the new serial number).

"J Terminate Remote Log-On and Initiate Dial Backup

This command logs off from a remote modem (previously logged-on by the "X command), and initiates a dial backup connection.

K Call Timer

This command will access the call timer within your modem.

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

"K Terminate Remote Log-On

This command logs off from a remote modem (previously logged-on to by the "X command).

&L Line Type

This command is used to set your modem to PSTN or to 2- or 4-wire leased line operation.

&L0 Enable 2-wire PSTN operation.

&L1 Enable 2-wire leased line operation.

&L3 Enable 4-wire leased line operation.

When you select leased line operation, the connection to the line is made via the cord labelled **LINE 1**. When you select PSTN operation, connection is via a cord that you must connect to the **LINE 3** socket.

***L Dial Backup Facility**

This command is used to enable or disable the dial backup facility. Available in single line (2-wire) format.

***L** Disable dial backup.

***L1** Manual dial backup.

***L5** 2-wire dial backup on loss of carrier.

***L13** 2-wire dial backup on loss of carrier, with automatic restoral to leased line.

"L Manual Revert to Leased Line

Issuing this command will cause the modem to disconnect its PSTN backup line and revert to the leased line.

***M Inactivity Data Monitor**

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

- *M0** Data monitor disabled. Default.
- *M1** Transmitted data (from DTE) is monitored.
- *M2** Received data (from line) is monitored.
- *M3** Both transmitted data and received data are monitored.
- *M4** Unconditional abort.

The length of monitoring time is stored in S-register S37, which can be set between 0 and 255 minutes. Unconditional abort will cause a disconnection after the timeout in S37 expires, regardless of data activity.

"M Signal Quality Summary

This command displays the current signal quality status together with the good and bad signal quality thresholds, for example:

```
at"m
Signal Quality is currently      : 1
Signal: Noise is currently      : 44dB
Estimated BER                   : <10-8
Poor Quality level is set at    : 15
Good Quality level is set at    : 9
OK
```

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 secure phone numbers, i.e. phone numbers that you do not wish to appear on the screen.

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

AT N1&Z <0123456789>

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

For example, if the number is stored as:

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

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

Mainframe

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

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

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

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

Enter the command:

AT N1&Z 0123456789 <Ctrl-F>

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

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

Press RETURN and the OK message appears.

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

&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 Telephone Directory for Free Space**

This command checks your modem's telephone directory for free locations.

"N Enable Remote Log-on

This command allows a modem to accept a remote dial connection to log-on to it (see Section 5.7).

"N0 Remote log on is disabled.
"N1 Remote log on enabled, originate only.
"N2 Remote log on enabled, answer only.
"N3 Remote log on enabled, originate and answer.

&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.

/P Echo Protect Tone

This command only applies to V.33 and V.29 operation.

- /P0** Disabled. Default.
- /P1** Response codes are **not** sent.
- /P2** Response codes are **not** sent in answer mode and **are** sent in originating mode.

This tone precedes the training sequence of the modem and is primarily used in half duplex modes over long distance and international circuits.

"P Poor Quality Threshold

This command sets the poor quality threshold for use by the signal quality monitor. It indicates the point at which a fallback to a lower transmission speed will take place.

- "Pn** where n is the threshold value (0-15) in S-register S28.

Q Quiet Mode

This command determines whether response codes are sent to the command port 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 Interaction with DTR Signal

This command determines 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.)

- &Q1** The modem will autoanswer and autodial 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** 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** DTR is treated as defined in ITU-T circuit 108/2. The modem will not dial or answer when DTR is low. When on-line, if DTR goes low, the modem disconnects.
- &Q10** 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.
- &Q14** The modem will autoanswer or autodial when DTR is low, but will disconnect if DTR does not go high after the time defined in S-register S25. If the modem is off-line and DTR goes low, the modem will wait for the time defined in S-register S25 before busy-ing-out the telephone line.
 If the modem is on-line and DTR goes low, the modem will wait for the time defined in S-register S25 before disconnecting the call, and then after a further five seconds will busy-out the telephone line.
 The busy-out can be cleared by using the command options &B0, &T0 or by raising DTR for a time defined in S-register S25.

/Q PSTN Quality Monitor

This command sets the PSTN quality monitor mode. Note that when auto-fallback is enabled, manual fallback is disabled.

- /Q0** Disables PSTN quality monitor. Default.
- /Q1** Fallback when bad signal quality occurs.
- /Q2** Fallback then re-dial when bad signal quality occurs.

%Q Interface Control

This command applies to *V.25bis* operation only. It defines how the modem handles DSR, DCD and CTS controls signals.

- %Q0** Normal DSR, DCD and CTS control.
- %Q1** DSR, DCD and CTS follow DTR.

"Q Leased Line Quality Monitor

This command sets the leased line quality monitor mode. Note that when auto-fallback is enabled, manual fallback is disabled.

- "Q0** Disables leased line quality monitor. Default.
- "Q1** Fallback on bad signal quality.

&R RTS/CTS Control

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

- &R0** The RTS-CTS delay is set by the modem modulation (see the F and /F commands), when on-line and ready for data. Default.
- &R1** RTS is ignored.

***R RTS Clamp**

This command only applies to V.32 and *V.32bis* operation when simulated switched carrier operation (/B0) is active. It is used to determine how the modem interacts with the RTS signal from the DTE.

- *R0** Normal RTS interaction.
- *R1** RTS ignored when DCD active.

"R Manual Retrain

This command will cause the modem to initiate a retrain to synchronise with the remote modem. This is usually used only for test purposes.

Sn? Display Single S-Register Setting

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

The &O command selects the format for this display.

Sn= Set an S-Register to a Value

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

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

&S Front Panel Switch Control

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

&S0 Front panel switches disabled.

&S1 Front panel switches enabled with AL selecting an analogue loop. Default.

&S2 Front panel switches enabled with AL busyng the telephone line.

&S3 Front panel switches enabled with AL selecting an analogue loop and busyng the telephone line.

Busyng 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. For *Snn expanded responses, see Section 7.6.

/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.

"S Display Analogue Parameters

This command displays a set of analogue parameters relating to the local modem and line (see Section 7.5).

&T Select Modem Test Operation

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

- &T0** Stops test currently in progress.
- &T1** Selects Local Analogue Loopback without self-test.
- &T4** Enables the local modem to run a Remote Digital Loopback when requested by the remote modem. Default.
- &T5** Prohibits the local modem from running a Remote Digital Loopback when requested by the remote modem.
- &T6** Initiates Remote Digital Loopback without self-test (ITU-T V.54 Loop 2).
- &T7** Initiates Remote Digital Loopback with self-test (ITU-T V.54 loop 2).
- &T8** Initiates Local Analogue Loopback with self-test.
- &T99** Inject an error.

***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 a timeout which will cause a disconnection on loss of carrier.

***T0** Loss-of-carrier timeout disabled.

***T1** Loss-of-carrier timeout enabled. Default.

Register S10 determines the length of the loss-of-carrier timeout.

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

/T Test Pattern

This command enables you to select whether the error injection facility is enabled or not.

/T0 MARKS pattern.

/T4 MARKS pattern with error injection.

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 V.25bis Command Mode**

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

- *V0** Modem accepts AT commands.
- *V2** Modem accepts Byte synchronous *V.25bis* control.
- *V3** Modem accepts HDLC synchronous *V.25bis* control.

&W Save User Configuration

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

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

***W DSR Control**

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

/W Inactivity Data Monitor Timer Base

This command sets the timer base for S-register S37 (Inactivity Data Monitor) for either seconds or minutes.

- /W0** Base in seconds.
- /W1** Base in minutes (default).

%W Stop Modifying the Remote Configuration

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

"W Key Store

This command is used to store an integer from 1-59999 as a key.

"Waaa where aaa is the key

See Section 5.6.

X Response Codes

Response codes are sent by the modem in response to commands.

This command is used:

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

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

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

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

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

| COMMAND | | | | | | RESPONSE CODE | | COMMENTS | |
|---------|----|----|----|----|----|---------------|-------|---------------------------|---------------------------|
| X0 | X1 | X2 | X3 | X4 | X5 | X6 | TERSE | | VERBOSE |
| * | * | * | * | * | * | * | 0 | OK | Command actioned |
| * | * | * | * | * | * | * | 1 | CONNECT | Connected |
| * | * | * | * | * | * | * | 2 | RING | Incoming ring detected |
| * | * | * | * | * | * | * | 3 | NO CARRIER | Modem carrier lost |
| * | * | * | * | * | * | * | 4 | ERROR | Command syntax error |
| | | * | * | * | * | * | 6 | NO DIAL TONE | No dial tone detected |
| | | | * | * | * | * | 7 | BUSY | Number engaged |
| * | * | * | * | * | * | * | 8 | NO ANSWER | Number does not answer |
| | | * | * | * | * | * | 12 | RDL GRANTED | Test modes only |
| * | * | * | * | * | * | * | 13 | RDL DENIED | Test modes only |
| * | * | * | * | * | * | * | 15 | ABORTED | Connection aborted |
| * | * | * | * | * | * | * | 16 | TIMEOUT | Connection timed-out |
| * | * | * | * | * | * | * | 26 | BLACKLIST | |
| | | * | * | * | * | * | 28 | CONNECT 4800 | Connected at 4800 bps |
| | | | | | | * | 29 | CONNECT 7200 | Connected at 7200 bps |
| | | * | * | * | * | * | 30 | CONNECT 9600 | Connected at 9600 bps |
| | | * | * | * | * | * | 31 | VOICE | Voice call detected |
| | | | | | * | * | 32 | RINGING | Telephone ringing |
| | | * | | * | | * | 33 | DIAL TONE | Dial tone, call cleared |
| * | * | * | * | * | * | * | 34 | PRIVATE LINE | Leased line mode |
| * | * | * | * | * | * | * | 36 | RETRAIN | |
| | | | | | * | * | 40 | NOT STORED | User Config not stored |
| * | * | * | * | * | * | * | 41 | BUSY TONE | |
| | | * | * | * | * | * | 42 | CONNECT 12000 | Connected at 12000 bps |
| | | * | * | * | * | * | 43 | CONNECT 14400 | Connected at 14400 bps |
| | | | | | * | * | 50 | PRIVATE LINE FAILED | |
| | | | | | * | * | 51 | PRIVATE LINE READY | |
| | | | | | | | | FOR RESTORAL | |
| | | | | | * | * | 52 | /PSTN 1 | |
| | | | | | * | * | 54 | DIALLING | |
| | | | | | * | * | 56 | AUTORESTORAL PRIMARY | |
| | | | | | * | * | 57 | AUTORESTORAL SECONDARY | |
| | | | | | * | * | 58 | PRIVATE LINE RESTORED | |
| | | | | | * | * | 59 | DIAL BACKUP FAILED | |
| | | | | | * | * | 60 | REMOTE CONTROL GRANTED | |
| | | | | | * | * | 61 | REMOTE CONTROL DENIED | |
| | | | | | * | * | 62 | MONITOR GRANTED | |
| | | | | | * | * | 63 | MONITOR DENIED | |
| | | | | | * | * | 64 | RECONFIGURE GRANTED | |
| | | | | | * | * | 65 | RECONFIGURE DENIED | |
| | | | | | * | * | 66 | RECONFIGURE FAILED | |
| | | | | | * | * | 67 | MONITOR FAILED | |
| | | | | | * | * | 68 | REMOTE CONTROL FAILED | |
| | | | | | * | * | 69 | REMOTE CONTROL TERMINATED | |
| | | | | | * | * | 70 | ACCESS GRANTED | Secure access successful |
| | | | | | * | * | 71 | ACCESS DENIED | Secure access failed |
| | | | | | * | * | 79 | NO SECURITY | |
| | | | | | * | * | 80 | /LOSS OF RTS | Extended timeout response |
| | | | | | * | * | 81 | /CONSTANT RTS | Extended timeout response |
| | | | | | * | * | 82 | /CONSTANT CARRIER | |
| | | | | | * | * | 83 | /DTE | Extended timeout response |
| | | | | | * | * | 84 | /LINE | Extended timeout response |
| | | | | | * | * | 110 | /AL | Extended timeout response |
| | | | | | * | * | 119 | TEST TERMINATED | Timeout response |

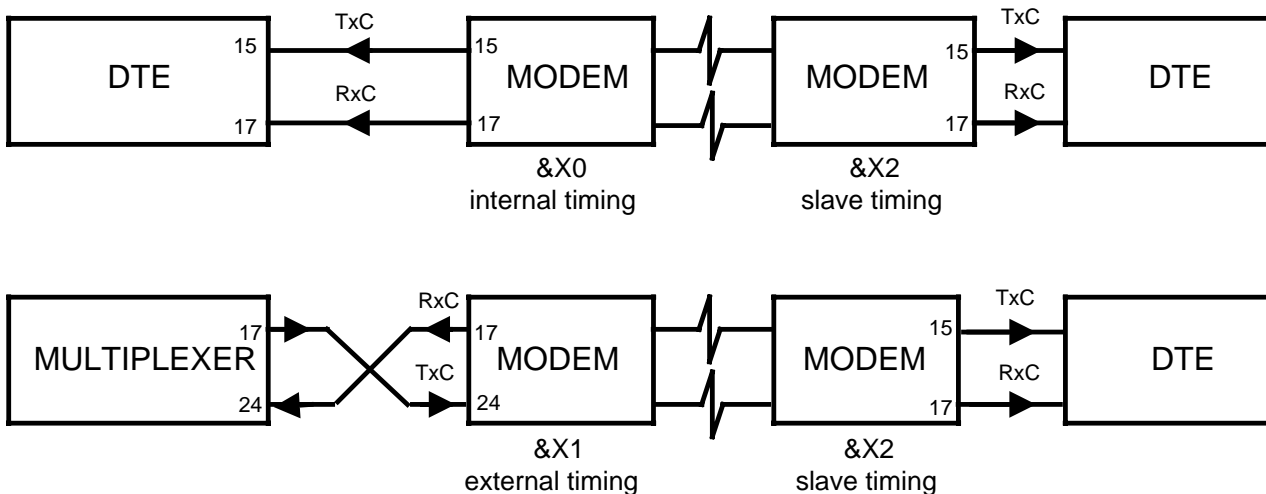
Responses marked / will appear only when /S1 is set.

&X Modem Timing

This command determines the timing source for the modem transmitter.

- &X0** Internal timing (supplied by the modem). Use in simple 2-wire or 4-wire point-to-point applications, whether PSTN or leased line. Default.
- &X1** External timing (supplied to modem on pin 24). Use where the modem link is an extension of a network which requires timing synchronisation throughout.
- &X2** Slave timing (derived from receive timing). Use where a link requires one timing source for both transmission directions, and the timing is determined by the remote device.

The following diagrams illustrate the use of &X command:



%X Remote Up-Load

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

"X Dial and Log-On to Remote Modem

This command causes the modem, previously loaded with an appropriate telephone number and PSTN configuration, to dial the number and log-on to the remote modem.

"Xnnn where nnn is the telephone number of the remote modem's LINE 3 (PSTN 1)

See Section 5.7.

/Y Training Sequence

This command allows you to select the method of modem training.

/Y0 Training disabled.
/Y1 Train on data.
/Y2 Auto retrain. Default.

Auto retrain causes a receiving modem to issue a training sequence to the remote modem if the error rate becomes too high.

Z Recall User Configuration

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

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

%Z Modify the Remote Configuration

This command allows you to alter the locally-held copy of the remote modem's active configuration. Subsequent commands will affect only this copy, until the %W command is issued. (The &L and "E commands cannot be downloaded from one modem to another.)

"Z Password Store

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

AT"Znnnnnnnn where nnnnnnnn is the password.

Note that passwords are case-sensitive.

See Section 5.6.

Refer to the Appendix entitled Country-Specific Information for details of any restrictions of S-registers.

9.1 Introduction

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

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

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

This table lists all non-bit-mapped S-registers. UK regulations impose certain minimum and maximum values. These are described in Appendix C.

| REG | RANGE | UNITS | DESCRIPTION | NOTES/DEFAULT |
|-----|-------|---------------|---------------------------|--|
| 0 | 0-255 | rings | Ring to answer on | 0 disables autoanswer |
| 1 | 0-255 | rings | Incoming rings | Counter |
| 2 | 0-127 | ASCII | Escape code character | Default = 43 (1B) |
| 3 | 0-127 | ASCII | Carriage return character | Default = 13 (0D) |
| 4 | 0-127 | ASCII | Line feed character | Default = 10 (0A) |
| 5 | 0-127 | ASCII | Backspace character | Default = 08 (08) |
| 6 | 0-7 | seconds | Wait for dialtone | Default = 4 |
| 7 | 0-54 | seconds | Wait for carrier | For dial-up operation |
| 8 | 0-8 | seconds | Pause time for comma | Default = 4 |
| 9 | 0-255 | seconds | DCD detect time | Validation time Default = 10 |
| 10 | 0-255 | 0.1 seconds | Loss of DCD to hang-up | *B1 selects 1 second units Default = 40 |
| 12 | 0-255 | 0.5 seconds | Escape code guard timer | Default = 50 |
| 18 | 0-255 | seconds | Test timer | Default = 0 (manual) |
| 20 | 0-255 | seconds | Bad signal quality | Time before action Default = 0 |
| 25 | 0-255 | seconds | Delay to DTR timer | For &Q1 setting Default = 0 |
| 26 | 0-255 | 0.001 seconds | RTS to CTS delay | /R0 selects 0.01 s units Default = 0 |
| 28 | 0-15 | units | Bad signal quality | Threshold Default = 0 |
| | 0-15 | units | Good signal quality | Threshold Default = 0 |
| 36 | 0-6 | attempts | Max no of dial attempts | Default = 6 |
| 37 | 0-255 | minutes | Data inactivity timer | /W selects 1 s units Default = 0 |
| 38 | 0-255 | ASCII | ATI0 response value | For software compatibility |
| 57 | 0-255 | seconds | Auto restoral timeout | 2-wire only Default = 30 |
| 92 | 0-255 | seconds | Good signal quality | Time before action Default = 40 |

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

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

10.1 Command Structure

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

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

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

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

- **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 and odd parity.

10.2 Commands

Summary

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

PRInnn

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

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

PRNxx;nnn

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

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

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

RLI Request identity number.

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

10.3 Responses

Summary

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

Description

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

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

DLC Delayed call message.

DLCx

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

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

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

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

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

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

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

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

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

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

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

LSN05;567891234;ZPSTTT
EOL

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

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

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

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

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

This appendix reflects the UK modem specification. Please refer to the appendix entitled Country-Specific information to check if your modem variant differs from this specification.

Transmitter/Receiver

| | |
|-------------------|--|
| Modulation | 16 state V.22bis and 4 state V.22 compliant. 128 state V.32bis, 64 state V.32bis and 16 state V.32bis compliant. 128 state V.33 and 64 state V.33 compliant. 32 state V.32 TCM compliant. 16 state V.32 and 4 state V.32 compliant. 16 state QAM V.29 compliant 9600/7200/4800 bps. Receive levels 0 to -43 dBm. |
| Carrier Threshold | -16 dB to -48 dB. DCD level programmable. |
| Operation | 4-wire full duplex. 2-wire full duplex. 2-wire simulated switched carrier. 4-wire simulated switched carrier. |
| Modes | 4-wire private line, one call dial backup. 2-wire private line, one call dial backup. |
| Output level | Selectable -2 dBm to -15 dBm. (UK versions set to -9 dBm for PSTN operation or -13 dBm for leased line). |
| Data Format | Synchronous. |
| 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 dependent on modulation format. |
| Equaliser | Automatic adaptive equaliser. Near and far end echo canceller. |

Autodial – Autoanswer

| | |
|--------|---|
| Method | Pulse dial. 10 pps rate. Make period 33 msec. Break period 67 msec (UK version). Interdigit period 800 msec. Tone dial. On time 101 msec. ID time 101 msec. Duty cycle 50%. |
|--------|---|

| | |
|----------------|--|
| Line Interface | 600 ohm impedance. Old and new dial tone detection. Secondary dial tone detection for PABX use. Progress tones and answer tone detection. |
|----------------|--|

| | |
|------------|-----------------------|
| Autoanswer | ITU-T V.25 compliant. |
|------------|-----------------------|

| | |
|------|---------------------------------|
| Busy | Busy out via AT command or DTR. |
|------|---------------------------------|

| | |
|------------|--|
| Disconnect | Call cleared selectable on loss of DTR, and/or no carrier for n seconds. |
|------------|--|

| | |
|----------------|---|
| Test Functions | Local analogue loop or remote digital loop. Test functions selectable via front panel switches, AT commands or on pins 18 and 21 of the DTE. |
|----------------|---|

Facilities

| | |
|--------------|---|
| Command Sets | Extended AT command set. Asynchronous commands entered via the separate command port. V.25 <i>bis</i> byte synchronous and HDLC. Synchronous commands entered via the DTE interface. |
|--------------|---|

| | |
|--------|---|
| Memory | Non-volatile memory. 12 preset factory, and 4 user defined configurations. 21 stored telephone numbers. |
|--------|---|

Physical Description

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

The standalone modem has two serial ports. The DTE port is used to pass user data, and may also be used to enter *V.25bis* commands. The command port is used to enter AT commands only.

B.1 DTE Port

B.1.1 Interface

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

| PIN | NAME/FUNCTION | COMMENTS | DIRECTION |
|-----|---------------------------|------------------------|-----------|
| 1 | (GRD) Chassis Ground | Connect one end only | COMMON |
| 2 | (TXD) Transmit Data | Data from DTE | IN |
| 3 | (RXD) Receive Data | Data from DCE | OUT |
| 4 | (RTS) Request to Send | Control from DTE | IN |
| 5 | (CTS) Clear to Send | Control from DCE | OUT |
| 6 | (DSR) Data Set Ready | Control from DCE | OUT |
| 7 | (GND) Signal Ground | Signal reference | COMMON |
| 8 | (DCD) Data Carrier Detect | Control from DCE | OUT |
| 9 | (+12) 12 volt test | Test | OUT |
| 10 | (-12) 12 volt test | Test | OUT |
| 14 | (TXD) Command Port | Parallel to comm port | IN |
| 15 | (TXCLK) Transmit Clock | TX data clock from DCE | OUT |
| 16 | (RXD) Command Port | Parallel to comm port | OUT |
| 17 | (RXCLK) Receive Clock | RX data clock from DCE | OUT |
| 18 | Analogue loop/Make Busy | Test | IN |
| 20 | (DTR) Data Terminal Ready | Control from DTE | IN |
| 21 | Remote digital loop | Control from DTE | IN |
| 22 | (RI) Ring Indicator | Control from DCE | OUT |
| 23 | Data Rate Select | Control from DTE | IN |
| 24 | (TC) External TX Clock | Control from DTE | IN |
| 25 | Test Indicator | Control from DCE | OUT |

DTE refers to the computer or terminal attached to DTE interface. DCE refers to your modem.

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 have cross-over connections.

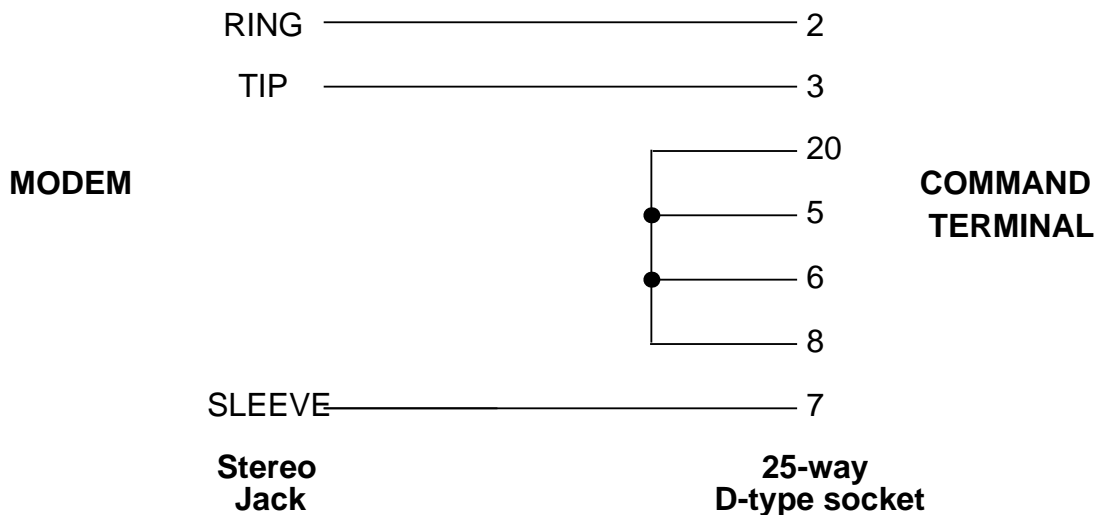
B.2 Command Port

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 |

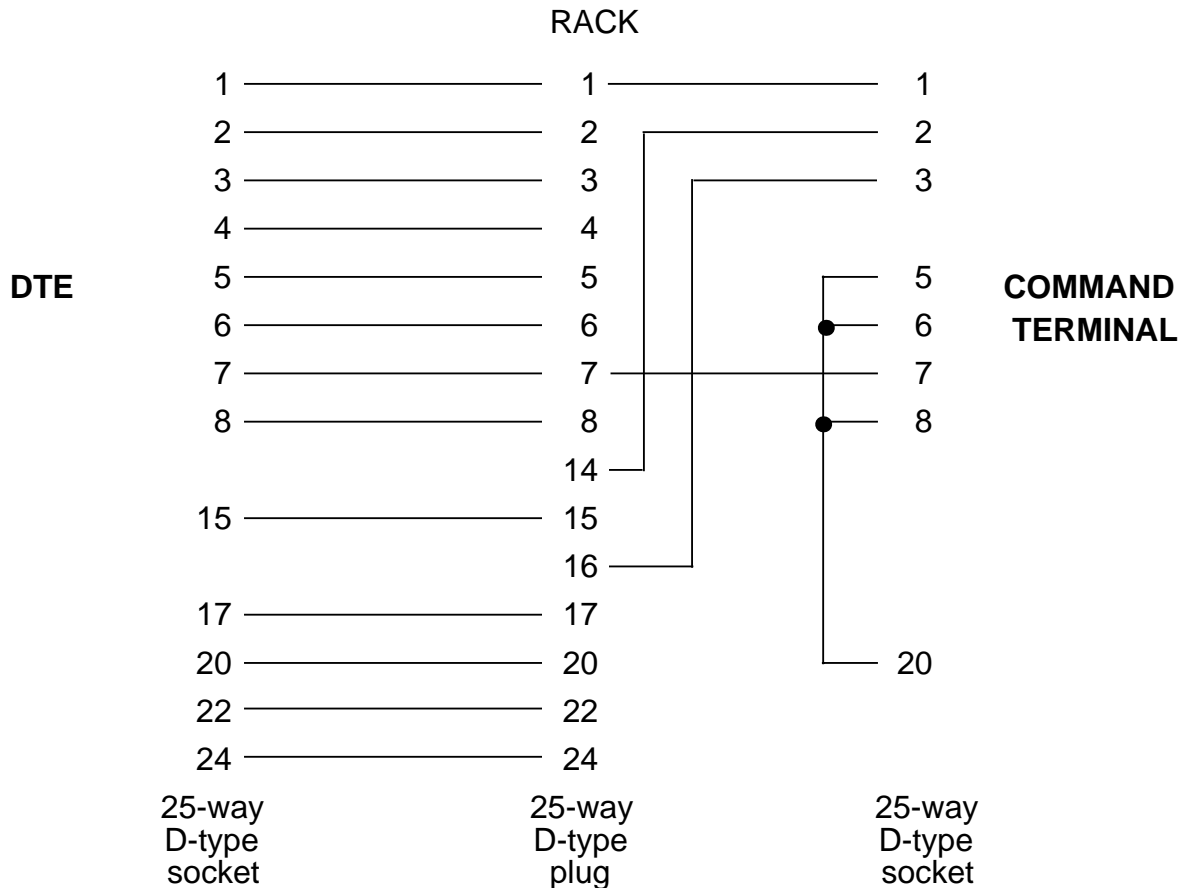
A command port adapter is provided with the modem, to enable a standard 25-way DTE plug to be connected to the command port:



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. If you are using a 'Y' cable, links 9 and 4 should be in positions 2 and 1 respectively (see Appendix entitled Technical Guide).



This appendix gives information which is specific to using the modem in the Country for which it is approved, so as to comply with the approvals regulations. For convenience, this chapter is split into sections, as shown below.

| Section | | Page |
|----------------|---------------------------------------|-------------|
| C.1 | Statutory Instructions for UK | C-2 |
| C.2 | Statutory Instructions for Belgium | C-8 |
| C.3 | Statutory Instructions for Denmark | C-10 |
| C.4 | Statutory Instructions for Finland | C-12 |
| C.5 | Statutory Instructions for France | C-14 |
| C.6 | Statutory Instructions for Holland | C-16 |
| C.7 | Statutory Instructions for Ireland | C-18 |
| C.8 | Statutory Instructions for Italy | C-20 |
| C.9 | Statutory Instructions for Luxembourg | C-22 |
| C.10 | Statutory Instructions for Norway | C-24 |
| C.11 | Statutory Instructions for Portugal | C-26 |
| C.12 | Statutory Instructions for Spain | C-28 |
| C.13 | Statutory Instructions for Sweden | C-32 |

C.1 Statutory Instructions for UK

This modem is approved for connection to telecommunication systems specified in the instructions for use subject to the conditions set out in them.

The approval numbers are:

NS/1404/23/K/601153 (Standalone)

NS/1404/23/K/601151 (Rackmount)

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.

Transmit Level Settings

These levels are selected using the switch nearest the edge of the board.

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

For UK use the switches must be set to the positions shown above. For leased line use, the settings will automatically be changed to -13dBm.

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.

Connection to BT Networks

Before connecting your modem to the BT network you must obtain the consent of your Local Area Telephone Office. The postcard at the rear of this manual can be cut out for you to apply for this consent. It also allows you to request the provision of appropriate sockets if you need them. You must use one postcard for each modem.

Don't forget to address it fully and add a stamp.

Connection to PBX

The postcard is only required when it is desired to connect the apparatus to a PBX where extension wiring is owned by BT. (Note that it is not necessary to apply to British Telecom for installation of sockets where the wiring does not belong to British Telecom).

Note: Where apparatus is to be connected to PBX extension wiring by means of a plug, the user may plug it in and use it straight away. If appropriate extension wiring and/or sockets are not already installed they must be installed:

- 1) by BT; or
- 2) where the extension wiring is not owned by BT, by the Designated Maintainer of the PBX unless the Designated Maintainer has agreed that some other person may do it or the Designated Maintainer has not brought this wiring into service following 14 days written notice specifying the person who is to bring the wiring into service.

C.1.2 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 cable from the modem is terminated with a BS6312 plug for connection to a BT socket.

When a private circuit is used, it must be terminated on pins 1 and 6 of a BS6312 socket.

Mains Power Connection

The mains connector is a standard 13 amp plug, fitted with a 3 amp fuse.

The wires in the mains lead of this apparatus are coloured in accordance with the following code:

Green & Yellow: Earth Blue: Neutral Brown: Live

As these colours may not correspond with the coloured markings identifying the terminals in your plug, proceed as follows:

The wire which is coloured Green & Yellow must be connected to the terminal in the plug which is marked by the letter E or by the safety earth symbol \perp , or coloured green, or green & yellow.

The wire which is coloured Blue must be connected to the terminal in the plug which is marked with the letter N or coloured black.

The wire which is coloured Brown must be connected to the terminal in the plug which is marked with the letter L or coloured red.

If the moulded mains plug is removed from the lead of this equipment, the plug must be disposed of immediately.

Protective Earthing

The protection of the user of this product relies on the connection of a protective earth. If this has not been hard-wired to the connection earth point of the modem, users should ensure:

- (i) That the connection to the line is unplugged before the mains plug is removed.
- (ii) That the connection to the line is not hard-wired.

C.1.3 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 BABT/SITS/82/005S/D and BABT/SITS/82/01/C.

C.1.4 Restrictions on Use of S-Registers

S-registers 6, 7, 8 and 36 must always comply with the statutory requirements listed below. Settings which do not conform are overridden and the minimum or maximum setting is reverted to.

| S-REGISTER | MINIMUM VALUE | MAXIMUM VALUE |
|-------------------------------|----------------------|----------------------|
| S6 Wait for dialtone | 4 seconds | 8 seconds |
| S7 Wait for carrier | 0 seconds | 59 seconds |
| S8 Pause time for comma | 4 seconds | 8 seconds |
| S36 Max. No. of dial attempts | 1 attempt | 7 attempts |

The use of multiple commas in a dialling string does not override the 8-second statutory maximum in registers S6 and S8.

C.2 Statutory Instructions for Belgium

WARNING

AGREE pour connection au réseau public des télécommunications de la façon
specifiéé dans les conditions d'utilisation.

(BE93DA5191)

THIS EQUIPMENT SHOULD BE INSTALLED BY A QUALIFIED
ENGINEER ONLY.

Modem Approval Numbers

Standalone and

Rackmount : BE93DA5191

S-Register Settings

The following S-register settings and defaults apply to Belgium.

| Register | Settings | | | Description |
|----------|----------|------|------|------------------------------------|
| | Default | Min. | Max. | |
| S6 | 8 | 3 | 20 | Wait for dialtone |
| S7 | 40 | 0 | 80 | Wait for carrier |
| S36 | 4 | 1 | 4 | Blacklisting : Max # dial attempts |

Black List Setting

5 seconds delay before the first retry.

60 seconds delay between subsequent attempts.

After 4 attempts, a 60 minute delay before the number can be
reattempted.

These rules apply to both automatic and manual redialled attempts.

Transmit Level Settings

These levels are selected using the DIP switch located on the PCB.

| SW4 | SW3 | SW2 | SW1 |
|-------------------|------------|------------|------------|
| (-8dBm) | (-4dBm) | (-2dBm) | (-1dBm) |
| OFF | ON | ON | OFF |
| PSTN Level | -6dBm | | |
| Leased Line Level | -6dBm | | |

Belgium Part Numbers

To ensure you have the correct modem for use in Belgium please check that it is labelled with one of the following part numbers:

| | |
|---------------|------------|
| X450-12021114 | Standalone |
| X450-21661114 | Rackmount |

C.3 Statutory Instructions for Denmark

WARNING

THIS EQUIPMENT SHOULD BE INSTALLED BY A QUALIFIED ENGINEER ONLY.

Modem Approval Numbers

Standalone and Rackmount :

DK93021437 (PSTN and 2-wire Leased Line)

DK93010111 (4-wire Leased Line)

S-Register Settings

The following S-register settings and defaults apply to Denmark.

| Register | Settings | | | Description |
|----------|----------|------|------|------------------------------------|
| | Default | Min. | Max. | |
| S36 | 10 | 1 | 10 | Blacklisting : Max # dial attempts |

Black List Setting

10 seconds delay before the first retry.

2 minutes delay between subsequent attempts.

After 10 attempts, a manual restart is required. This is done by pressing the data button twice, or power cycling the modem.

These rules do not apply to manual redialled attempts.

Transmit Level Settings

These levels are selected using the DIP switch located on the PCB.

SW4
(-8dBm)

ON

SW3
(-4dBm)

OFF

SW2
(-2dBm)

OFF

SW1
(-1dBm)

ON

PSTN Level -9dBm

Leased Line Level -13dBm

Denmark Part Numbers

To ensure you have the correct modem for use in Denmark please check that it is labelled with one of the following part numbers:

| | |
|---------------|------------|
| X450-12021102 | Standalone |
| X450-21661102 | Rackmount |

C.4 Statutory Instructions for Finland

WARNING

THE TRANSMIT LEVEL SWITCHES MUST NOT BE ALTERED WHEN USING
THIS UNIT IN FINLAND
THIS EQUIPMENT SHOULD BE INSTALLED BY A QUALIFIED ENGINEER ONLY.

Modem Approval Numbers

F193615092 Syncro 1496 Standalone (SY1496)

F193615093 Syncro 1496 Rack Card (SY1496R)

S-Register Settings

The following S-register settings and defaults apply to Finland.

| Register | Settings | | | Description |
|----------|----------|------|------|------------------------------------|
| | Default | Min. | Max. | |
| S0 | | 2 | | Rings to Answer |
| S6 | | | 4 | Wait for dialtone |
| S7 | 60 | 60 | 60 | Wait for carrier |
| S36 | 4 | 4 | 4 | Blacklisting : Max # dial attempts |

Black List Setting

5 seconds delay before the first retry.

60 seconds delay between subsequent attempts.

After 4 attempts, a 60 minute delay before the number can be reattempted.

These rules do not apply to manual redialled attempts.

Transmit Level Settings

These levels are selected using the DIP switch located on the PCB.

| | | | |
|-----------------------------|------------------------------|-----------------------------|------------------------------|
| SW4 (-8dBm) ON | SW3 (-4dBm) OFF | SW2 (-2dBm) ON | SW1 (-1dBm) OFF |
| PSTN Level | -10dBm | | |
| Leased Line Level | -14dBm | | |

Cable Assemblies

| | Leased Line | PSTN |
|------------|--------------------------|--------------------------|
| Rackmount | X400-408611 | X400-409911 |
| Standalone | As supplied with product | As supplied with product |

EMC Approval Requirements

EMC WARNING

To comply with the EMC approval regulations the cable part number listed above must be used, or a cable of a similar specification.

Case Communications Ltd will not accept liability for use of non-compliant cables.

Finland Part Numbers

To ensure you have the correct modem for use in Finland please check that it is labelled with one of the following part numbers:

| | |
|---------------|------------|
| X450-12021103 | Standalone |
| X450-21661103 | Rackmount |

C.5 Statutory Instructions for France

WARNING

THIS EQUIPMENT SHOULD BE INSTALLED BY A QUALIFIED ENGINEER ONLY.

Modem Approval Numbers

Standalone and
Rackmount: 93248D Syncro 1496

S-Register Settings

The following S-register settings and defaults apply to France.

| Register | Settings | | | Description |
|----------|----------|------|------|------------------------------------|
| | Default | Min. | Max. | |
| S0 | 2 | | 2 | Rings to Answer |
| S6 | 8 | 6 | 12 | Wait for dialtone |
| S7 | 40 | 35 | 90 | Wait for carrier |
| S8 | | 1 | 12 | Pause time for comma |
| S9 | 8 | 6 | 9 | DCD detect time |
| S10 | | | 40 | Loss of DCD to hang-up |
| S25 | 1 | 1 | 9 | Delay to DTR timer |
| S36 | 5 | | 5 | Blacklisting : Max # dial attempts |

Black List Setting

60 seconds delay between all call attempts.
After 6 attempts, a 60 minute delay before the number can be reattempted.

These rules do not apply to manual redialled attempts.

Transmit Level Settings

These levels are selected using the DIP switch located on the PCB.

| | | | |
|-----------------------------|------------------------------|------------------------------|-----------------------------|
| SW4 (-8dBm) ON | SW3 (-4dBm) OFF | SW2 (-2dBm) OFF | SW1 (-1dBm) ON |
| PSTN Level | -10dBm | | |
| Leased Line Level | -10dBm | | |

Cable Assemblies

| | Leased Line | PSTN |
|------------|--------------------------|--------------------------|
| Rackmount | X400-410011 | X400-410111 |
| Standalone | As supplied with product | As supplied with product |

EMC Approval Requirements

EMC WARNING

To comply with the EMC approval regulations the cable part number listed above must be used, or a cable of a similar specification.

Case Communications Ltd will not accept liability for use of non-compliant cables.

France Part Numbers

To ensure you have the correct modem for use in France please check that it is labelled with one of the following part numbers:

| | |
|---------------|------------|
| X450-12021111 | Standalone |
| X450-21661111 | Rackmount |

C.6 Statutory Instructions for Holland

WARNING

THE TRANSMIT LEVEL SWITCHES MUST NOT BE ALTERED WHEN USING
THIS UNIT IN HOLLAND
THIS EQUIPMENT SHOULD BE INSTALLED BY A QUALIFIED ENGINEER ONLY.

Modem Approval Numbers

HDTP/KR/167/188233 Syncro 1496 Standalone (SY1496)

HDTP/KR/167/188231 Syncro 1496 Rack Card (SY1496R)

S-Register Settings

The following S-register settings and defaults apply to Holland.

| Register | Settings | | | Description |
|----------|----------|------|------|------------------------------------|
| | Default | Min. | Max. | |
| S6 | 8 | | 20 | Wait for dialtone |
| S7 | 40 | | 90 | Wait for carrier |
| S8 | 5 | 1 | 5 | Pause time for comma |
| S36 | 14 | | 14 | Blacklisting : Max # dial attempts |

Black List Setting

5 seconds delay before the first retry.

60 seconds delay between subsequent attempts.

After 15 attempts, a 60 minute delay before the number can be reattempted.

These rules do not apply to manual redialled attempts.

Transmit Level Settings

These levels are selected using the DIP switch located on the PCB.

| | | | |
|-----------------------------|------------------------------|------------------------------|-----------------------------|
| SW4 (-8dBm) ON | SW3 (-4dBm) OFF | SW2 (-2dBm) OFF | SW1 (-1dBm) ON |
| PSTN Level | -9dBm | | |
| Leased Line Level | -13dBm | | |

Cable Assemblies

| | Leased Line | PSTN |
|------------|--------------------------|--------------------------|
| Rackmount | X400-410611 | X400-410711 |
| Standalone | As supplied with product | As supplied with product |

EMC Approval Requirements

EMC WARNING

To comply with the EMC approval regulations the cable part number listed above must be used, or a cable of a similar specification.

Case Communications Ltd will not accept liability for use of non-compliant cables.

Holland Part Numbers

To ensure you have the correct modem for use in Holland please check that it is labelled with one of the following part numbers:

| | |
|---------------|------------|
| X450-12021106 | Standalone |
| X450-21661106 | Rackmount |

C.7 Statutory Instructions for Ireland

WARNING

THE TRANSMIT LEVEL SWITCHES MUST NOT BE ALTERED WHEN USING THIS UNIT IN IRELAND.

THIS EQUIPMENT SHOULD BE INSTALLED BY A QUALIFIED ENGINEER ONLY.

Modem Approval Numbers

DOC 139/93 Syncro 1496 Standalone (SY1496)

DOC 138/93 Syncro 1496 Rack Card (SY1496R)

S-Register Settings

The following S-register settings and defaults apply to Ireland.

| Register | Settings | | | Description |
|----------|----------|------|------|------------------------------------|
| | Default | Min. | Max. | |
| S6 | 8 | | 10 | Wait for dialtone |
| S7 | | | 40 | Wait for carrier |
| S8 | | 1 | 4 | Pause time for comma |
| S10 | 20 | | 20 | Loss of DCD to hang up |
| S36 | 3 | | 3 | Blacklisting : Max # dial attempts |

Black List Setting

5 seconds delay before the first retry.

60 seconds delay between subsequent attempts.

After 4 attempts, a 60 minute delay before the number can be reattempted.

These rules do not apply to manual redialled attempts.

Transmit Level Settings

These levels are selected using the DIP switch located on the PCB.

| SW4 (-8dBm) | SW3 (-4dBm) | SW2 (-2dBm) | SW1 (-1dBm) |
|-----------------------|-----------------------|-----------------------|-----------------------|
| ON | OFF | OFF | ON |
| PSTN Level | -10dBm | | |
| Leased Line Level | -14dBm | | |

Ireland Part Numbers

To ensure you have the correct modem for use in Ireland please check that it is labelled with one of the following part numbers:

| | |
|---------------|------------|
| X450-12021105 | Standalone |
| X450-21661105 | Rackmount |

C.8 Statutory Instructions for Italy

WARNING

THIS EQUIPMENT SHOULD BE INSTALLED BY A QUALIFIED ENGINEER ONLY.

Modem Approval Numbers

ISPT 4.2-2.1-93-049 Syncro 1496 Standalone (SY1496)

ISPT 4.2-2.1-93-050 Syncro 1496 Rack Card (SY1496R)

S-Register Settings

The following S-register settings and defaults apply to Italy.

| Register | Settings | | | Description |
|----------|----------|------|------|------------------------------------|
| | Default | Min. | Max. | |
| S36 | 3 | | 3 | Blacklisting : Max # dial attempts |

Black List Setting

5 seconds delay before the first retry.

60 seconds delay between subsequent attempts.

After 4 attempts, a 60 minute delay before the number can be reattempted.

These rules do not apply to manually redialled attempts.

Transmit Level Settings

These levels are selected using the DIP switch located on the PCB.

| | | | |
|------------|------------|------------|------------|
| SW4 | SW3 | SW2 | SW1 |
| (-8dBm) | (-4dBm) | (-2dBm) | (-1dBm) |
| ON | OFF | OFF | ON |

PSTN Level -9dBm

Leased Line Level -13dBm

Italy Part Numbers

To ensure you have the correct modem for use in Italy please check that it is labelled with one of the following part numbers:

| | |
|---------------|------------|
| X450-12021108 | Standalone |
| X450-21661108 | Rackmount |

C.9 Statutory Instructions for Luxembourg

WARNING

THE TRANSMIT LEVEL SWITCHES MUST NOT BE ALTERED WHEN USING
THIS UNIT IN LUXEMBOURG
THIS EQUIPMENT SHOULD BE INSTALLED BY A QUALIFIED ENGINEER ONLY.

Modem Approval Numbers

Standalone and
Rackmount: 2641/208/11 Syncro 1496

S-Register Settings

The following S-register settings and defaults apply to Luxembourg.

| Register | Settings | | | Description |
|----------|----------|------|------|------------------------------------|
| | Default | Min. | Max. | |
| S6 | 8 | | 20 | Wait for dialtone |
| S7 | 40 | | 90 | Wait for carrier |
| S8 | 5 | 1 | 5 | Pause time for comma |
| S36 | 14 | | 14 | Blacklisting : Max # dial attempts |

Black List Setting

5 seconds delay before the first retry.

60 seconds delay between subsequent attempts.

After 15 attempts, a 60 minute delay before the number can be reattempted.

These rules do not apply to manually redialled attempts.

Transmit Level Settings

These levels are selected using the DIP switch located on the PCB.

| SW4 | SW3 | SW2 | SW1 |
|-------------------|------------|------------|------------|
| (-8dBm) | (-4dBm) | (-2dBm) | (-1dBm) |
| ON | OFF | OFF | ON |
| PSTN Level | -9dBm | | |
| Leased Line Level | -13dBm | | |

Luxembourg Part Numbers

To ensure you have the correct modem for use in Luxembourg please check that it is labelled with one of the following part numbers:

| | |
|---------------|------------|
| X450-12021107 | Standalone |
| X450-21661107 | Rackmount |

C.10 Statutory Instructions for Norway

WARNING

THIS EQUIPMENT SHOULD BE INSTALLED BY A QUALIFIED ENGINEER ONLY.

Modem Approval Numbers

Standalone: NO9300530-D
Rackmount: NO9300531-D

S-Register Settings

The following S-register settings and defaults apply to Norway.

| Register | Settings | | | Description |
|----------|----------|------|------|------------------------|
| | Default | Min. | Max. | |
| S10 | 20 | | 20 | Loss of DCD to hang-up |

Black List Setting

5 seconds delay before the first retry.

60 seconds delay between subsequent attempts.

After 10 attempts, a 60 minute delay before the number can be reattempted.

These rules do not apply to manually redialled attempts.

Transmit Level Settings

These levels are selected using the DIP switch located on the PCB.

| | | | |
|------------|------------|------------|------------|
| SW4 | SW3 | SW2 | SW1 |
| (-8dBm) | (-4dBm) | (-2dBm) | (-1dBm) |
| ON | OFF | ON | OFF |

PSTN Level -10dBm

Leased Line Level -10dBm

Cable Assemblies

| | Leased Line | PSTN |
|------------|--------------------------|--------------------------|
| Rackmount | X400-410411 | X400-410411 |
| Standalone | As supplied with product | As supplied with product |

EMC Approval Requirements

EMC WARNING

To comply with the EMC approval regulations the cable part number listed above must be used, or a cable of a similar specification.

Case Communications Ltd will not accept liability for use of non-compliant cables.

Norway Part Numbers

To ensure you have the correct modem for use in Norway please check that it is labelled with one of the following part numbers:

X450-12021110 Standalone
X450-21661110 Rackmount

C.11 Statutory Instructions for Portugal

WARNING

THIS EQUIPMENT SHOULD BE INSTALLED BY A QUALIFIED ENGINEER ONLY.

Modem Approval Numbers

Standalone: ICP.93.152 Syncro 1496 Standalone (SY1496)
Rackmount: ICP.93.153 Syncro 1496 Rack Card (SY1496R)

S-Register Settings

The following S-register settings and defaults apply to Portugal.

| Register | Settings | | | Description |
|----------|----------|------|------|------------------------------------|
| | Default | Min. | Max. | |
| S6 | 20 | | 20 | Wait for dialtone |
| S7 | 60 | | 60 | Wait for carrier |
| S8 | 5 | | 5 | Pause time for comma |
| S10 | 20 | | 20 | Loss of DCD to hang up |
| S36 | 4 | | 4 | Blacklisting : Max # dial attempts |

Black List Setting

1 minute delay between all call attempts.

After 4 attempts, a manual restart is required. This is done by pressing the data button twice, or power cycling the modem.

These rules do not apply to manually redialled attempts.

Transmit Level Settings

These levels are selected using the DIP switch located on the PCB.

| SW4 | SW3 | SW2 | SW1 |
|-------------------|------------|------------|------------|
| (-8dBm) | (-4dBm) | (-2dBm) | (-1dBm) |
| ON | OFF | OFF | ON |
| PSTN Level | -9dBm | | |
| Leased Line Level | -9dBm | | |

Portugal Part Numbers

To ensure you have the correct modem for use in Portugal please check that it is labelled with one of the following part numbers:

| | |
|---------------|------------|
| X450-12021109 | Standalone |
| X450-21661109 | Rackmount |

C.12 Statutory Instructions for Spain

WARNING

LA MARCACION AUTOMATICA DE NUMEROS INTERNACIONALES CON ESTE EQUIPO PUEDE LLEGAR A SER INFRUCTUOSA
THIS EQUIPMENT SHOULD BE INSTALLED BY A QUALIFIED ENGINEER ONLY.

Modem Approval Numbers

Standalone: E 98 93 0694 Syncro 1496 Standalone
Rackmount: E 98 93 0763 Syncro 1496 Rack Card

S-Register Settings

The following S-register settings and defaults apply to Spain.

| Register | Settings | | | Description |
|----------|----------|------|------|------------------------------------|
| | Default | Min. | Max. | |
| S6 | 8 | | 20 | Wait for dialtone |
| S7 | 30 | | 60 | Wait for carrier |
| S8 | 8 | | 8 | Pause time for comma |
| S36 | 3 | | 3 | Blacklisting : Max # dial attempts |

Black List Setting

5 seconds delay before the first retry.

60 seconds delay between subsequent attempts.

After 4 attempts, a 60 minute delay before the number can be reattempted.

These rules do not apply to manually redialled attempts.

Transmit Level Settings

These levels are selected using the DIP switch located on the PCB.

| SW4 (-8dBm) | SW3 (-4dBm) | SW2 (-2dBm) | SW1 (-1dBm) |
|-----------------------|-----------------------|-----------------------|-----------------------|
| ON | OFF | ON | OFF |
| PSTN Level | -10dBm | | |
| Leased Line Level | -10dBm | | |

Spain Part Numbers

To ensure you have the correct modem for use in Spain please check that it is labelled with one of the following part numbers:

| | |
|---------------|------------|
| X450-12021112 | Standalone |
| X450-21661112 | Rackmount |

C.13 Statutory Instructions for Sweden

WARNING

MAKING A CALL

In Sweden the comma should be replaced with a 'W' to cause a delay before the modem continues dialling, for example :

ATD9W0123456789<CR>

THIS MODEM IS NOT APPROVED FOR AND DOES NOT SUPPORT
PULSE DIALLING IN SWEDEN

THIS EQUIPMENT SHOULD BE INSTALLED BY A QUALIFIED ENGINEER ONLY.

Modem Approval Numbers

930816 30 Syncro 1496 Standalone (SY1496)

930816 31 Syncro 1496 Rack Card (SY1496R)

S-Register Settings

The following S-register settings and defaults apply to Sweden.

| Register | Settings | | | Description |
|----------|----------|------|------|------------------------------------|
| | Default | Min. | Max. | |
| S6 | 20 | | 20 | Wait for dialtone |
| S7 | | | 90 | Wait for carrier |
| S8 | | 1 | 4 | Pause time for comma (see above) |
| S36 | 10 | | 10 | Blacklisting : Max # dial attempts |

Black List Setting

5 seconds delay before the first retry.

60 seconds delay between subsequent attempts.

After 10 attempts, a manual restart is required. This is done by pressing the data button twice, or power cycling the modem.

These rules do not apply to manual redialled attempts.

Transmit Level Settings

These levels are selected using the DIP switch located on the PCB.

| | | | |
|-----------------------------|------------------------------|------------------------------|-----------------------------|
| SW4 (-8dBm) ON | SW3 (-4dBm) OFF | SW2 (-2dBm) OFF | SW1 (-1dBm) ON |
| PSTN Level | -9dBm | | |
| Leased Line Level | -13dBm | | |

Cable Assemblies

| | Leased Line | PSTN |
|------------|--------------------------|--------------------------|
| Rackmount | X400-411511 | X400-411511 |
| Standalone | As supplied with product | As supplied with product |

EMC Approval Requirements

EMC WARNING

To comply with the EMC approval regulations the cable part number listed above must be used, or a cable of a similar specification.

Case Communications Ltd will not accept liability for use of non-compliant cables.

Sweden Part Numbers

To ensure you have the correct modem for use in Sweden please check that it is labelled with one of the following part numbers:

| | |
|---------------|------------|
| X450-12021101 | Standalone |
| X450-21661101 | Rackmount |

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 may be necessary to re-test the modem to ensure it meets the requirements of the relevant approved authority following any modifications. See the appendix entitled Country-Specific Information for further details.

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.

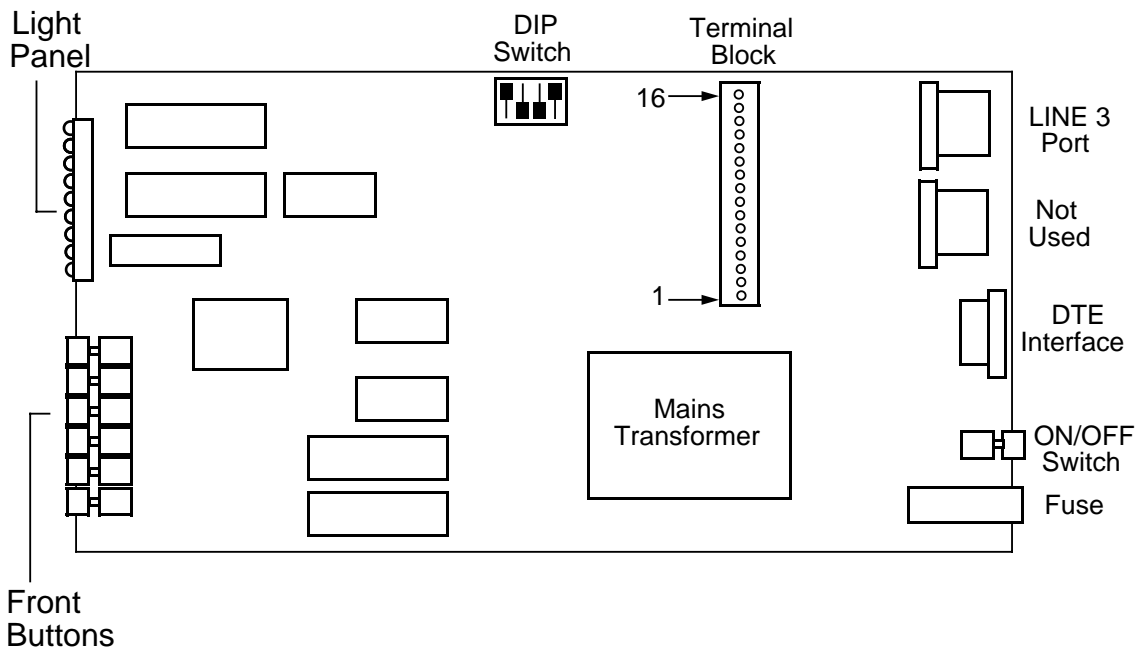


Figure D-1 Standalone Card Layout

PSTN Line 3 is for line connection to the modem.

D.2.2 Terminal Block Wiring

The numbering of your modem's terminal block and its wiring configuration is shown in Figure D-2.

Terminal Block Wiring

| | | | | | | | | | | | | | | | |
|-----------------------|-----------|-----------|-----------|------------|------------|-----------|----------|----------|----------|----------|----------|--------------------|----------|-----------|----------|
| G | B | W | R | Tel | Tel | | | | | | | W | R | B1 | O |
| 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| PSTN Line 3 | | | | | | Not Used | | | | | | Leased Line | | | |
| Wired to fixed socket | | | | | | | | | | | | Receive | | Transmit | |
| Available | | | | | | | | | | | | | | | |

Colour index:

G - Green, B - Blue, W - White, R - Red, O - Orange, B1 - Black

Figure D-2 Terminal Block Connections

D.2.3 Transmit Level Settings

These levels are selected using the switch nearest the edge of the board.

| | | | |
|------------|------------|------------|------------|
| SW4 | SW3 | SW2 | SW1 |
| (-8 dBm) | (-4 dBm) | (-2 dBm) | (-1 dBm) |

| | | | | |
|---------|----|-----|-----|----|
| Example | ON | OFF | OFF | ON |
|---------|----|-----|-----|----|

Sets the modem for -9dBm for PSTN operation. For leased line use, the transmit level will automatically be reduced by 4 dBm to -13dBm in this example.

D.2.4 Link Options

PCB links enable you to make the appropriate connections for your operating mode. See Figure D-3.

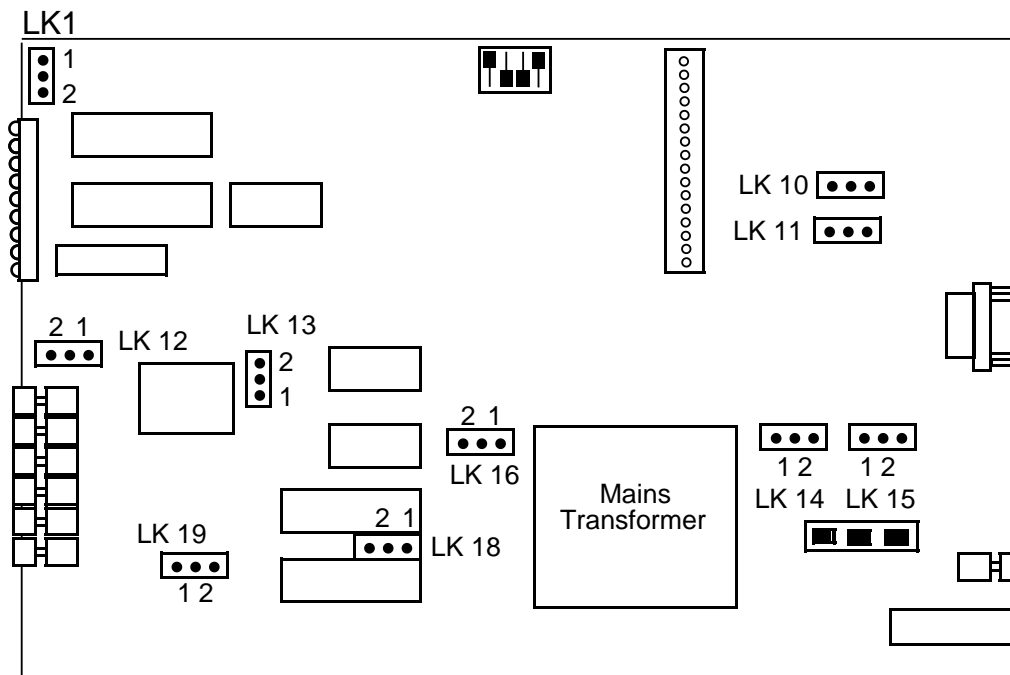
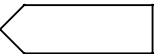
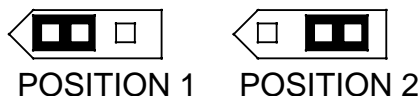


Figure D-3 Standalone Modem Link Locations

Link boxes are drawn on the PCB as  but the positions are not marked. The link positions are:



Links 1, 2, 3, 4, 5, 7, 9, 12, 13, 17, 18 and 19 are for factory use only and must not be changed.

Link 16: position 1 = AL on pin 18, test indicate on pin 25.
 position 2 = Busy on pin 25. Factory default is link fitted to one pin only giving test indicate on pin 25.

Link 14: position 1 = Speed indicate on pin 23.
 position 2 = Speed select on pin 23. Factory default is link fitted in position 1.

Link 15: position 1 = RDL on pin 21. Factory default is link fitted to one pin only.

Links 10 & 11: position 1 = Control through command port and on pins 14 and 16 of the DTE interface.

position 2 = Control through command port.

A number of the links have a permanent connection, provided by PCB tracks.

D.2.5 Connecting the 24 to 48 VDC Version

The 24 to 48 volt DC powered version of the standalone modem is designed to operate on an exchange/PABX battery. The supply requirements are 24-48 VDC, 0.5A max. DC source must be SELV.

The modem power connection is via a 2 metre cable, stripped and tinned ready for connection to a terminal block.

Connect the red wire to the ground terminal and the black wire to the -24 to -48 volts DC supply. Double check the connections before turning the modem on. If the connections are reversed, or the supply voltage is too high, the fuse will blow. Use a 500mA(T) 250V fuse.

D.3 Rackmount Modem

D.3.1 The Modem Card

Before inserting the modem into the Network 16 rack, the switches and links should be in the correct positions for the application. The rackmount card layout is as shown below.

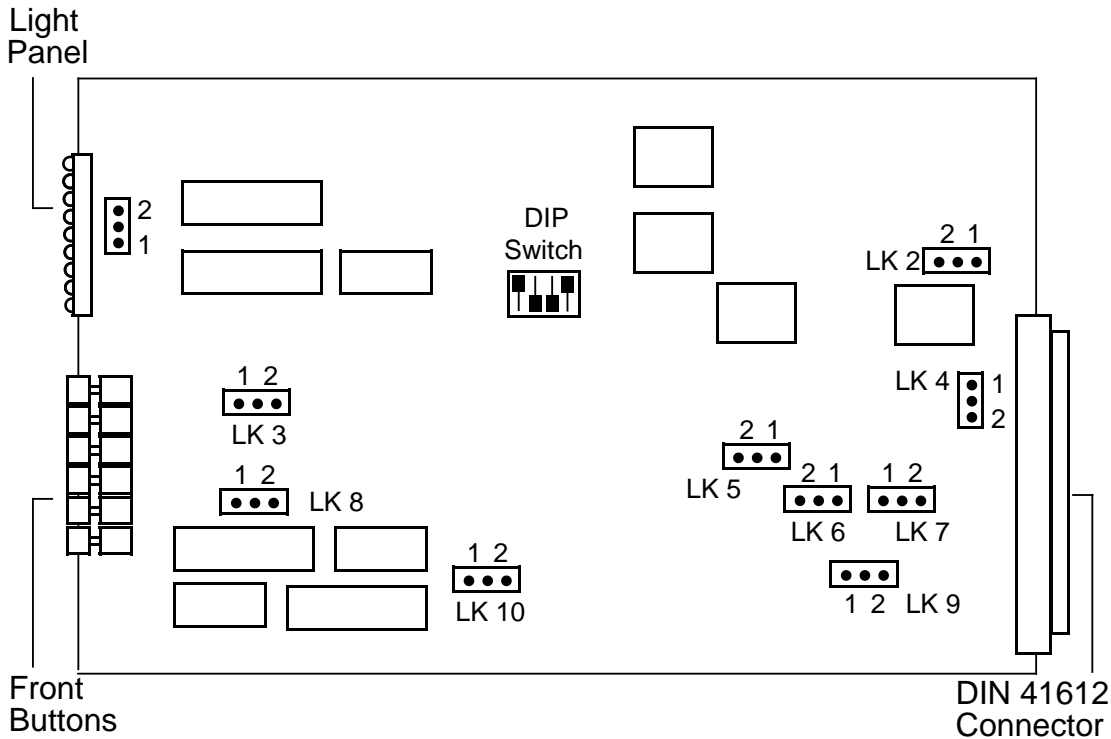


Figure D-4 Rackmount Card Layout

D.3.2 Transmit Level Settings

These levels are selected using the DIP switch.

| SW4 | SW3 | SW2 | SW1 |
|----------|----------|----------|----------|
| (-8 dBm) | (-4 dBm) | (-2 dBm) | (-1 dBm) |

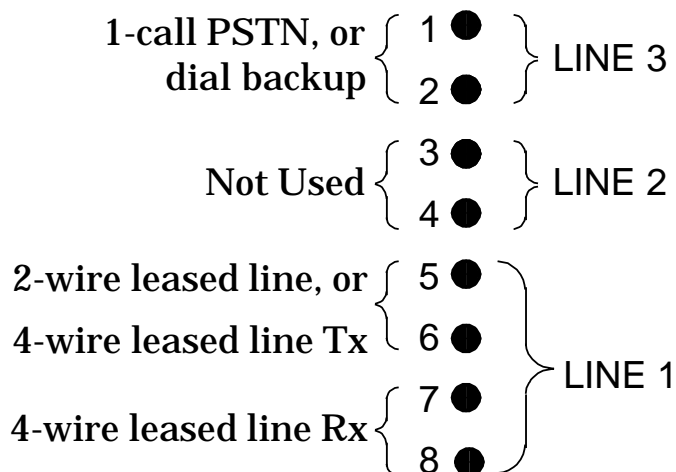
Example ON OFF OFF ON

Sets the modem for -9dBm for PSTN operation. For leased line use, the transmit level will automatically be reduced by 4 dBm to -13dBm, in this example.

D.3.4 Line Connection

Line termination is made through the terminal block on the backplane of Network 16, details of which are in your Network 16 manual.

The Network 16 terminal block is shown below:



Typical wiring configurations are:

4-wire leased line:

Tx pair to terminals 5 and 6
Rx pair to terminals 7 and 8

One call PSTN:

Connect to terminals 1 and 2

To connect the telephone line to the terminal block:

1. Remove the two screws retaining the cover of the line termination blocks on the rear panel of the Network 16. Lift and tilt the cover to remove it.
2. While connecting the telephone line cable to the relevant Network 16 line termination block, the cable must not be connected to the telephone network.

Only connect to the network after all line terminations have been connected to the terminal block.

3. Replace the cover over the line termination blocks. As long as the modem is operational this cover must be in place at all times.

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