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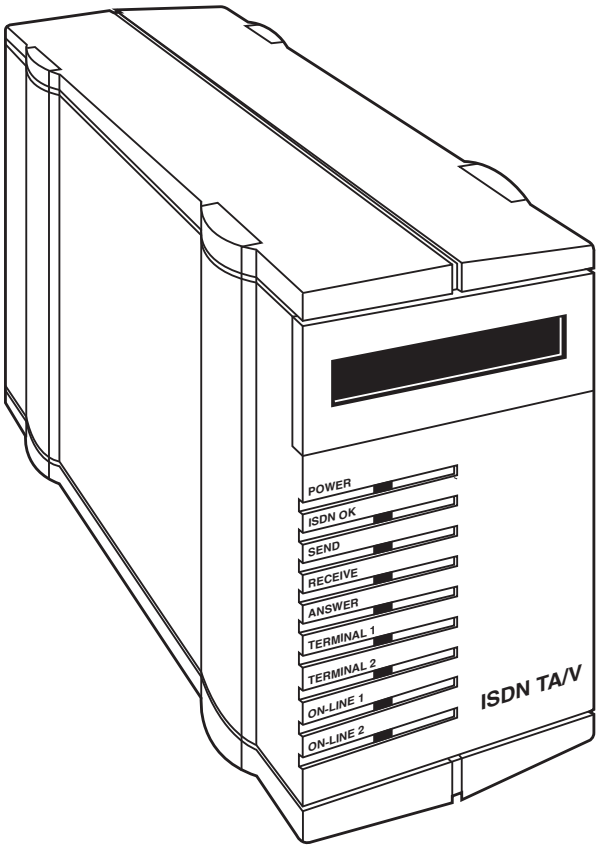
NETWORK SERVICES

JANUARY 1995
IS300AE

ISDN TA/V



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Part I

Getting Started

1. Specifications

ISDN Compliance — Basic Rate ISDN (2B + D) using both channels simultaneously with automatic channel aggregation, Q.931, Q.921. V.110 rate adaption. Compatible with NISDN-1, Euro ISDN, and other national variants

Synchronisation — Variable RTS/CTS delay

Error Correction — V.42 LAPM

Data Compression — V.42 bis

Speed — X.21 (V.11): synchronous: up to 64000 bps; asynchronous: up to 115200 bps (with V.42 bis);

V.24/V.28: Up to 19200 bps;

V.36: Up to 48000 bps

Connectors — (1) RJ-45 female for the ISDN S-bus

(1) Modular phone socket (connector type will vary depending on which ISDN TA/V you purchase)

(1) DB25 female for your DTE

(1) RJ-11 female CONTROL port, for entering asynchronous AT commands

Power — 190 to 265 VAC, 47-63 Hz, 0.1A max, 11 watts

Size — 15H x 9W x 27D cm

Weight — 1.3 kg

2. Introduction

2.1 Introducing Your New ISDN Terminal Adaptor

Your new ISDN TA/V provides a standalone interface to ISDN for your non-ISDN equipment. It provides one S-Bus ISDN Basic Rate connection to a single serial port, capable of handling both synchronous and asynchronous data. A separate analogue port is also provided which can support a connection to any standard analogue telephone network compatible equipment, working in DTMF (dial tones not pulses) mode.

There are 10 separate models of the ISDN TA/V, with different power and ISDN line specifications to accommodate the various requirements of countries throughout the world. These differences have no effect on the overall performance of any one model, however, so this manual is applicable to all of them.

2.2 Before You Get Started

2.2.1 About the Manual

"Do I have to read all the documentation?" You'll be glad to know the answer is *no*. The ISDN TA/V is designed for use by experienced *and* novice users, and the manual is written with both in mind. It's divided into two parts: Part I, Getting Started; and Part II, Reference. In fact, there are several ways you can use the manual to learn about your new ISDN TA/V:

Required Reading:
Your ISDN TA/V has been approved by BABT (the British Approvals Board for Telecommunications) for connection to British Telecom's ISDN service under the approval number of NS/3940/5/P/604019, and it is important that you make yourself familiar with the conditions of use as described in **Chapter 9** of this manual.

Installing ISDN TA/V Using the Intro Software (Chapter 3.0):
Intro is a DOS-based, full-featured program for installing and configuring your ISDN TA/V. For most applications, it can be used as a substitute for much of this manual. Read **Chapter 3** to learn how to install and use **Intro.** Then skip to **Chapters 6 and 7** for information about making and receiving ISDN calls.

Installing ISDN TA/V Without the Intro Software (Chapters 4-7):
These chapters provide a brief introduction for people who don't use the **Intro** software. You'll learn how to install the unit, what additional equipment you'll need to establish a connection to a remote device, and finally, how to configure your communication software (not included) so you can instruct the ISDN TA/V to initiate and receive calls.

In most cases, the ISDN TA/V's factory-default settings will be sufficient for your application. And once you read through **Chapters 4-7**, you'll be able to use the Terminal Adaptor to connect to a remote computer via an ISDN network, and carry out file transfers to and from it.

Part II: The Reference Section:
Part I, Getting Started does not cover any of the ISDN TA/V's more sophisticated features, or details about the command language you can use to alter and customise your ISDN TA/V's operation. You'll find that information in the Reference section of this manual.

Apple Macintosh Users:
Section 5.4 details special cable requirements you'll need to know.

2.2.2 Conventions Used in This Manual

Keyed commands that you send to the ISDN TA/V, LCD messages, and product features such as LED and port names, software titles, and menu titles all appear in boldface letters, to help you distinguish them from the descriptive text of this manual.

2.2.3 Unpacking

Before you install your ISDN TA/V, it is important that you compare the contents of the shipping package against the packing list. If any of items listed are damaged or missing, call your supplier to resolve the matter immediately. You ISDN TA/V should include:

- (1) ISDN TA/V
- (1) Mains power cord
- (1) 3-metre line cord for connecting to the ISDN2 service
- (1) 2-metre DB9-female-to-DB25-male V.24 DTE cable
- This User's Manual
- (1) 3.5-inch diskette, containing the **Intro** software

Save the box and protective packing material in case you need to store or ship the terminal Adaptor in the future.

2.2.4 Calling Your Supplier

If you determine that your ISDN TA/V is malfunctioning, *do not attempt to alter or repair the unit*. It contains no user-serviceable parts. Contact your supplier. Before you do, make a record of the history of the problem. Your supplier will be able to provide more efficient and accurate assistance if you have a complete description, including:

- The nature and duration of the problem.
- When the problem occurs.
- The components involved in the problem.
- Any particular application that, when used, appears to create the problem or make it worse.

2.3 Some Background Information About ISDN

ISDN (Integrated Services Digital Network) is a public switched digital network which enables voice, data communications, video and many other services, to be transmitted simultaneously over a single pipe consisting of two 64000-bps streams and a 16000-bps control channel.

The two 64000-bps streams are known as the bearer channels (B channels for short; B1 and B2), with the control channel being referred to as the D channel.

Your ISDN TA/V is approved for connection to an approved ISDN-2 service, operating at data rates of 64000 bps, 56000 bps, 48000 bps, 38400 bps, 19200 bps, 14400 bps, 12000 bps, 9600 bps, 7200 bps and 2400 bps. Each of the two B channels supported on a single ISDN line can be associated with either the DTE interface or the telephone socket within your ISDN TA/V, and as such provides you with simultaneously active data and voice channels.

B channel selection is handled automatically by the ISDN TA/V, and is totally transparent to the user.

2.4 A Brief Overview

You connect the ISDN TA/V to your ISDN service line via a rear-mounted RJ-45 connector, which is fully compliant with ITU standards for the ISDN S interface. Depending on the nature of the active traffic (data or voice), this ISDN interface is automatically connected to either the rear panel mounted 25-pin digital DTE interface, or via the unit's analogue circuitry to the telephone handset socket.

The 25-pin female DTE connector is by default configured to conform to the electrical characteristics of ITU recommendation V.24/V.28 running in asynchronous data mode, supporting a throughput rate of up to 19200 bps. Using the AT command language to alter the active configuration, this port can be configured to operate synchronously conforming to V.24/V.28; synchronously conforming to ITU X.21 (V.11) at speeds up to 64000 bps (aggregated channels); asynchronous conforming to ITU X.21 (V.11) at speeds up to 115200 bps using V.42bis data compression; or asynchronously/synchronously conforming to ITU V.36 at speeds up to 4800 bps.

A separate **CONTROL** port is provided for optionally entering AT commands from an attached asynchronous terminal, and for accessing the management interface of the ISDN TA/V. When the DTE interface is configured to operate asynchronously (default configuration setting) the **CONTROL** port would not normally be used since all commands can be entered via the DTE. However, AT commands can only be entered asynchronously and a separate command port is therefore required when the DTE has been configured to operate synchronously. The CONTROL port operates at 9600 bps.

Industry standard communication software packages can be used to give error-free data transfer and control. When installed in your PC, the communication software is used to command the ISDN TA/V to dial and accept calls etc. There is a wide variety of these software packages available from computer dealers and computer user groups, the majority of which are fully compatible with your ISDN TA/V.

A large number of specialised features such as error correction, data compression, and rate adaption are supported by your ISDN TA/V. For details of how and where such facilities should be used, and the configuration requirements of the ISDN TA/V to enact them, refer to Part II, the reference section of this manual.

2.5 Features of the ISDN TA/V

Your ISDN TA/V is a fully featured, high-speed digital dial-up device which provides reliable asynchronous and synchronous operation over the ISDN. As a complement to the high speed data transfer of up to 64000 bps, ITU V.42bis data compression and ITU V.42 error correction are supported. The data transfer speed between the DTE interface and your attached computer can be configured to be as high as 115200 bps.

The ISDN TA/V's compatibility with a number of dialing methods and protocols, such as asynchronous AT commands and ITU V.25bis dialing, allows you to use the unit in a variety of applications and environments, and to control the ISDN TA/V's configuration, dialing characteristics and diagnostic features.

Four factory set configurations, containing the most commonly-used DTE interface settings, are permanently stored in the Terminal Adaptor's memory, providing you with a quick and easy method of configuring the unit to be compatible with asynchronous and synchronous data environments, conforming to ITU V.24/V.28, X.21 (V.11) or V.36.

The principal features are:

- Support for digital to digital communication at speeds up to 64000 bps.
- V42bis data compression and V42 error correction via the ISDN sevice.
- V.110 rate adaption techniques.
- Rear-panel phone socket for connecting a PSTN telephone handset (or other analogue equipment) to the ISDN service.
- Simultaneous support for ISDN-to-ISDN voice and data calls.
- All available DTE and analogue ports have access to either or both ISDN B channels.
- Asynchronous dial DTE data rates from 300 to 115200 bps.
- Asynchronous AT commands entered via the DTE interface or the dedicated **CONTROL** port.
- ISDN TA/V configuration changes via AT commands and the **Intro** software program.

- Compatibility with the industry-standard AT command set.
- Storage of up to 20 ISDN numbers in directory locations.
- Dialing via AT commands, V.25bis, or via PC by raising DTR on the PC-to-DTE interface.
- High-speed transmission using asynchronous, synchronous, or UNIX® devices over the ISDN.
- Self-testing facility.
- Four factory-set configurations and two user-definable configuration locations.
- Front-panel LCD and LED displays to inform you of the current status.

3. Installing ISDN TA/V Using the *Intro* Program

3.1 Overview

Intro is a DOS-based software program that you load and run from your PC. It's designed to help you install and use all of the ISDN TA/V's features and facilities. To use **Intro**, your computer must be IBM® compatible, with a 3.5-inch floppy drive, and a graphics card of at least EGA standard.

A DOS mouse driver is not a prerequisite, but it is recommended, since **Intro** is easier to use under mouse control than keyboard control.

3.1.1 Quick Install

Insert the **Intro** diskette into your PC and type:

SETUP<CR>

from the appropriate drive prompt. Follow the on-screen prompts to install the program files onto your hard disk. Select **INSTALLATION** from the program's main menu options. Instructions for installing and using your ISDN TA/V will be clearly explained on-screen.

Installation is now complete, with each physical connection having been tested for you. Using **Intro** you will now be able to make ISDN TA/V configuration changes etc.

3.2 About the Intro Program

Initially, **Intro** familiarizes you with the ISDN TA/V and explains how it should be connected to a DTE, the ISDN line, and a telephone handset. Each connection that you make is automatically tested by **Intro**.

Subsequently the **Intro** software can be used to alter the ISDN TA/V's operating configuration either by you selecting an application, by selecting specific features, or interactively (as though you had a dumb terminal connected to the **CONTROL** port). However, it is important to note that if you alter the definition of the DTE interface (from its default setting of V.24/V.28 asynchronous command), **Intro** will no longer be able to communicate with the ISDN TA/V.

3.3 Installing Intro Program Files on Your Hard Disk

To install the **Intro** files on your hard disk:

1) Insert the program diskette into the floppy drive of your PC, and type the letter which identifies the floppy drive, followed by a colon and then press return as shown below:

   A:<CR> or **B:<CR>**

   When the DOS prompt alters to indicate that this drive is active, type:

   SETUP<CR>

   An error message will be displayed if the PC's graphics card is not able to support the **Intro** software, and the installation will be aborted. If this occurs, move on to **Chapter 4** and follow the remainder of this manual.

2) Follow the instructions given on-screen to install the files within the required directory.

3.4 Connecting Your ISDN TA/V

Once the **Intro** files are installed on your hard disk, answer `YES` when the final screen prompts you with:

Your software is installed. Are you ready to install the ISDN TA/V now?

This automatically initiates the **Intro** program and displays its base screen options.

If you answer `NO` to this screen, refer to **Section 3.6** for details of how to initiate **Intro** from DOS.

Select **INSTALLATION** from the base screen and follow the instructions given. When the ISDN TA/V-to-computer (DTE) connection and the ISDN TA/V-to-ISDN line connection have been established, they will automatically be tested by **Intro** and any errors will be reported to you.

3.5 Navigating Through the Intro Screens

When using a mouse to select the appropriate action button, position the mouse cursor directly over the required action and press the left-hand mouse button once to select it.

When navigating around the screen using keyboard commands, use the arrow keys, tab key and shift tab keys to highlight the required option, and the carriage-return key to action it. Note that the escape key can be used to action an **EXIT** button.

3.6 Running Intro from DOS

To run the **Intro** software from DOS from the root directory of your hard disk select the sub-directory into which you copied **Intro**, and type:

INTRO<CR>

3.7 Using Intro to Configure the ISDN TA/V

A powerful function of the **Intro** software is that it enables you to alter the ISDN TA/V's factory-default configuration settings, using simple menu selections. However, as previously mentioned, the factory-default configuration will normally be sufficient for most ISDN TA/V users, and may never need to be altered.

We therefore recommended that this function of the **Intro** software only be used by experienced communications device operators, and then only in conjunction with the reference instructions in Part II of this manual.

If you alter the definition of the DTE interface (from its default setting of V.24/V.28 asynchronous data), **Intro** will immediately lose contact with, and no longer be able to communicate with, the ISDN TA/V. Using the management interface of the **CONTROL** port then becomes the easiest way of commanding the ISDN TA/V. (The Reference section includes instructions for using this management interface).

4. ISDN TA/V Introduction for Non Intro Users

4.1 Preparing for Installation

In order to install and use your ISDN TA/V, you'll have to make sure you have all the proper equipment, cables, and connectors. These requirements may vary depending on your particular application

4.2 Connecting a Computer

An ISDN TA/V can only receive data from your computer via a serial port connection. On most IBM or compatible PCs , this would be a D-shell male connector, V.24 RS-232 serial port, with 9 pins (DB9). Connecting an Apple® Macintosh® computer requires an available 9-pin serial port. Most PCs have only one serial port, which is likely to be labeled **COM1**.

Many devices other than an ISDN TA/V can be connected to a serial port, for example a serial printer, mouse or graphics plotter. If your PC has only one serial port, and this is already supporting an external device, you can swap between the ISDN TA/V and the other device as required. However, if you prefer to use both devices without the interruption of plugging and unplugging cables, ask your PC supplier to install a second serial port.

4.3 Connecting an Alternate DTE Device

This must be equipped with either a V.24/V.28, X.21 (V.11) or V.36 serial port, for connecting to the DTE interface of the ISDN TA/V.

4.4 The CONTROL Port Connection

Optionally, an asynchronous terminal can be connected to the **CONTROL** port of the ISDN TA/V to enable you to pass AT commands to the ISDN TA/V when using a synchronous transmission format over the DTE interface link, or to gain access to the unit's management interface facilities.

The communications format of any device connected to the **CONTROL** port must be set to 8N1 (8 data bits, no parity, 1 stop bit), running at 9600 bps.

4.5 Communication Software

When installed in your PC, this is used to command the ISDN TA/V to dial and accept calls etc. There is a wide variety of these software packages available from computer dealers and computer user groups, the majority of which are fully compatible with your ISDN TA/V. For example, a package such as 'Terminal' (a program within the Microsoft® Windows™ 3.0 graphical environment for PCs) is adequate.

4.6 Connecting Cable

For maximum performance the cable which connects your computer to the ISDN TA/V DTE interface must support RTS/CTS hardware handshaking for use with data compression and error correction.

One such cable conforming to the electrical characteristics of the V.24/V.28 interface will have been supplied in your ISDN TA/V package. If for any reason you have to make up a cable yourself, refer to the cable specifications in the Appendix. As a general rule: the shorter the cable, the better it is.

Apple Macintosh users should refer to **Section 5.4** for details on the connecting cables they'll need.

4.7 ISDN Service Connection

You will need a standard ISDN line wall socket to plug your ISDN TA/V's line cable into. If one is not available close enough to where you are going to site your ISDN TA/V, contact your line supplier for assistance.

All connections to the Integrated Services Digital Network are subject to the rules and regulations of the governing body of the country in which the connection is made. **Chapter 9** of this manual details the statutory requirements of these governing bodies. It is important that you read these requirements carefully and ensure your compliance with them.

4.8 Service Number of the Remote Device

In order to connect to a remote device you will obviously need to know the telephone number of the remote ISDN TA/V.

4.9 Communication Settings

To communicate efficiently you will have to configure your communication software to use the correct word length, parity, and number of stop bits according to the requirements of the DTE interface or **CONTROL** port.

Details about how your data is broken into short strings and transmitted according to the settings of the data format are fully explained in the Reference section. It's not important, at this stage, to understand the significance of the format.

The most popular setting for data format of a service which is connected to the PSTN is 8 data bits, no parity, 1 stop bit (described as 8N1); although many public data services use 7 data bits, even parity, 1 stop bit (7E1). You will normally be advised of the format used by the remote computer or service on payment of a subscription, or on request if no subscription fee is required.

Setting the communications data format is normally a menu option within your communication software. Refer to **Chapter 6** of this manual for more information, and your communication software manual for detailed guidance.

5. Installing the ISDN TA/V Without Using the Intro Program

This chapter should only be followed if you are unable to load and use the **Intro** software as described in **Chapter 3** It explains how to install your ISDN TA/V, describes the function of the front panel LEDs, and also details the special cable requirement for Macintosh computer users.

5.1 Connecting Your ISDN TA/V

Use Figure 5.1 and the following steps to connect the ISDN TA/V between your computer and the ISDN line:

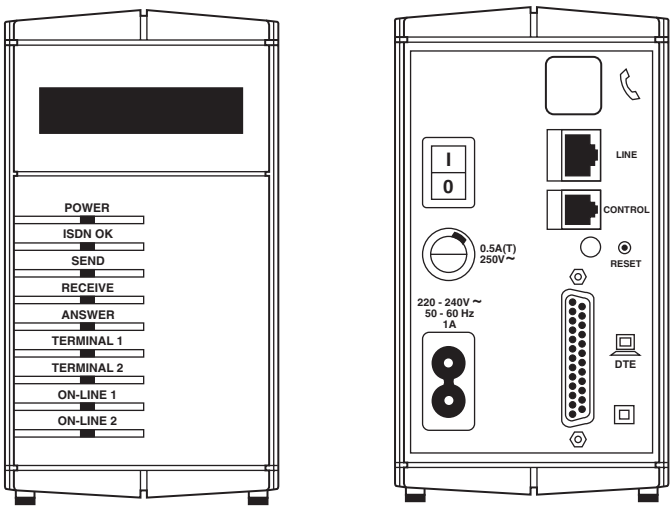

Figure 5.1 Front and Back Views of the ISDN TA/V

1) Ensure that both your computer and the ISDN TA/V are powered off (The half of the back-panel **ON**/**OFF** switch with a circle is depressed).

2) Connect the supplied power lead into the socket marked with the proper voltage indication on the ISDN TA/V.

3) Plug the other end of the mains lead into a mains socket.

4) Insert the male end of the supplied V.24/V.28 DTE connecting cable into the connector marked **DTE** on back of the ISDN TA/V, and tighten the locator screws to secure the cable to Terminal Adaptor.

   The cable requirement of the DTE interface when it is configured to conform to the electrical characteristics of X.21 (V.11) or V.36 are given in **Appendix A**. If the interface is going to be configured to conform to one of these ITU recommendations, a suitable cable should be used in place of the supplied V.24/V.28 DTE cable. The ISDN TA/V will then autosense the interface standard if the connecting cable is wired as shown in **Appendix A**.

5) Plug the other end of the connecting cable into the serial port on the back of your computer or other DTE, and tighten the locator screws.

6) Using the ISDN service cable supplied, plug the jack end into the socket marked LINE on the back of the ISDN TA/V. Note that any ISDN TA/V can be damaged by lightning. When the possibility of lightning is high, unplug this connection to the telephone line.

Warning

Interconnection directly or by way of other apparatus, of ports marked "SAFETY WARNING see instructions for use" with ports marked or not so marked, may produce hazardous conditions on the network. Advice should be obtained from a competent engineer before such a connection is made.

7) Optionally connect an asynchronous VT100™ terminal to the **CONTROL** port of the ISDN TA/V. This terminal can then be used to send AT configuration and dialing commands to the ISDN TA/V, and also to access the internal management interface.

   Note that this terminal connection need not be used if the DTE interface is configured to accept asynchronous AT commands (default configuration setting). A PC or terminal connected to the **CONTROL** port must be configured to use 8 data bits no parity and 1 stop bit as the communications format, running at 9600 bps.

8) Optionally connect a PSTN telephone handset, or any other compatible analogue equipment, operating in DTMF (tone not pulse) mode to your ISDN TA/V by connecting the phone's telephone-line plug into the socket marked with a handset symbol on the back of the ISDN TA/V. This port is in effect an analogue to digital converter which allows you to use your conventional PSTN telephone on an ISDN line.

   It is capable of supporting ringing current and call-progress tones, and will support analogue devices to a maximum of REN=1. Providing one of the two 64000-bps ISDN channels is not being used by the DTE interface, it is available for you to make voice calls over the ISDN via this analogue port.

   Incoming ISDN traffic carries a voice/data identifier which enables the ISDN TA/V to automatically direct incoming voice calls to the handset port, and incoming data calls to the DTE interface.

9) Plug the unattached end of the supplied line cable into the ISDN wall socket.

5.2 Powering ON the ISDN TA/V

Having carefully followed the instructions for connecting your ISDN TA/V, swith on power to the unit by pressing the half of the back-panel **ON/OFF** switch marked with a line. Then switch on power to your computer.

Nine LED indicators on the ISDN TA/V's front panel are used in conjunction with the LCD display to report the unit's current status.

When the ISDN TA/V is initially powered-on it initiates a self-test, which is shown by the LCD reporting

Self Test

followed shortly afterwards by

Passed or **Failed**

If a self-test failure is reported, or the **POWER** LED fails to light, refer to **Chapter 8, Troubleshooting,** for help.

5.3 The Front-Panel LCD and LEDs

LCD — The Liquid Crystal Display is a two-line sixteen character display used as a progress indicator and to report system messages.

POWER — Should be lit whenever the ISDN TA/V is powered on, indicating that it is capable of operating. During the power-on test sequence, and all other tests, this indicator will flash every half second.

ISDN OK — Is an indicator of the state of the ISDN line. This LED should be lit whenever the ISDN TA/V is powered on while connected to a working ISDN service.

SEND — Flashes on and off to indicate that the ISDN TA/V is receiving data from the terminal or computer attached to the DTE interface.

RECEIVE — Flashes on and off to indicate that the unit is passing data received over the ISDN to the DTE interface.

ANSWER — Lights to indicate that the ISDN TA/V has been configured to automatically answer an incoming data call. When an incoming data call is detected, this indicator will flash.

TERMINAL 1 — This is an indicator of a signal provided by the computer or terminal attached to the ISDN TA/V's DTE interface. It is normally used to signal the ISDN TA/V that a call can be made, or an incoming call answered. The ISDN TA/V may be configured to act in different ways on receipt of this signal (according to the **AT&D** and **AT&M** commands). Refer to Part II of this manual, the Reference section, for further details.

TERMINAL 2 — Is not used on this version of the ISDN TA/V.

ON-LINE 1 — Lights to indicate that the unit has seized either channel of the ISDN line, and is forwarding data traffic on the ISDN line to the rear- panel connector marked **DTE**.

ON-LINE 2 — Is not used on this version of the ISDN TA/V.

5.4 Macintosh Computer Compatibility Requirements

When using the ISDN TA/V in conjunction with a Macintosh computer, all that is required to establish a successful installation is the appropriate connecting cable, and then, depending on the type of handshaking being used, a small change may have to be made to the ISDN TA/V's operating configuration.

Although a Macintosh cable is not supplied with the unit, these are readily available from your computer dealer. Alternatively you may choose to build one yourself by following the appropriate pin-out diagrams shown in Figures 5.2 and 5.3

5.4.1 Using Cable That's Compatible with Your Communication Software

Before you can select the appropriate cable for connecting the DTE interface to your Macintosh computer, it is important that you first ascertain whether the communication software that you are going to use to command the ISDN TA/V supports hardware or software handshaking as the means of flow control. Having done this, you must use a compatible cable to connect to the ISDN TA/V.

5.4.2 Hardware Handshaking Cable

Figure 5.2 shows the cable used to connect the DTE interface to a Mac® using communication software which accepts hardware handshaking:

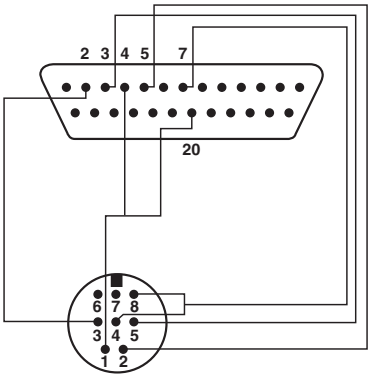

Figure 5.2 Pinning of Hardware Handshake Cable for Macintosh

Using this cable requires no change to the ISDN TA/V's factory-default configuration.

5.4.3 Software Handshaking Cable and Setup Command

The cable used to connect the DTE interface to a Macintosh using communication software which requires software handshaking is shown in Figure 5.3:

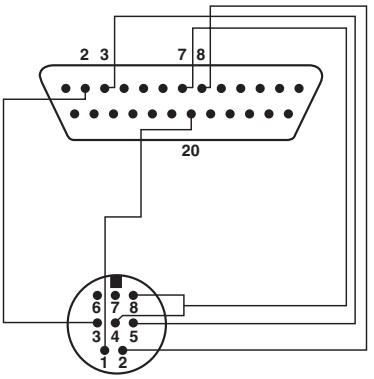

Figure 5.3 Pinning for Software Handshake Cable for Macintosh

When using this cable, a small change will have to be made to the ISDN TA/V's operating configuration before a communications link can be established. Having connected the DTE interface to the Macintosh, switch on power to the ISDN TA/V. Following the instructions given in your communication software manual, use the software to change the ISDN TA/V's operating configuration by typing the following command:

AT\Q1&D2&W<CR>

Within this command string, the characters **&W** indicate that the command is to be stored in memory, and loaded automatically each time the ISDN TA/V is powered on. (See the Reference section for more details about this and other command lines.)

6. Installing and Configuring Communication Software in Your Computer

Generally when using the ISDN TA/V you need to know very little about the unit itself, since its control is governed by the communication software installed in your computer. This software is not included with the purchase of the ISDN TA/V, therefore for details of how to install and use these programs you must refer to their dedicated user guides. There are, however, a limited number of settings which reflect the requirements of your ISDN TA/V that have to be configured into the communication software. These are outlined in this chapter.

6.1 Selecting the Flow-Control Type

Flow control is the system by which the computer or ISDN TA/V is instructed to stop sending data if the processing buffers of the connected device are full, and to recommence sending once the buffers reach a low level. In all applications of computer-to-ISDN TA/V communications, the flow-control system used should be of the type RTS/CTS (otherwise known as hardware flow control) which should be specified within the communication software configuration.

Hardware flow control is recommended over software flow control because it allows fully transparent passage of data through the ISDN TA/V, in that the TA/V's flow control does not interfere with any data or protocols used by the attached computer equipment.

6.2 Setting the Data Rate (Data Transfer Speed)

The ISDN interface is transparent to whatever data rate is configured into the communication software. However, the unit offers the best throughput of data between its DTE interface and the attached computer when it is running at the highest available speed. For this reason your computer's serial port should be set to operate at its fastest speed, but not exceeding 115,200 bps which is the highest acceptable speed of your ISDN TA/V's DTE interface. Note: A lower data rate can be used, and this will be recognised by your ISDN TA/V.

6.3 Specifying the Communications Format to be Used

The communications format used between your PC and the ISDN TA/V's DTE interface is configured in the communication-software program's setup options, and should initially be set to 8 data bits, no parity with 1 stop bit, often referred to as 8N1. Note that a PC or terminal connected to the **CONTROL** port must be configured to use 8N1 as the communications format, running at 9600 bps.

6.4 Specifying the Terminal Emulation to be Used

Terminal emulation is the term given when a computer emulates the terminal type required by the remote computer with which it is exchanging data. Providing that you have been notified of the terminal type that the remote computer expects to be connected to, this can be specified in the set-up options of your communication-software package.

6.5 Specifying the Command Language of Your ISDN TA/V

The command language used to issue instructions to your ISDN TA/V (such as dial a number, or answer a call) is compatible with the industry-standard AT commands, and can be typed directly at your computer's keyboard (in asynchronous mode), or indirectly via the menu structure of your communication-software package.

Unfortunately we have to generalise at this point because you could be using one of a great many communication-software packages to interact with your ISDN TA/V. However, in order for your software to be able to instruct the unit to dial, etc, it will need to be informed of the type of command language used by the ISDN TA/V.

By selecting from the menu options available (refer to your communication-software guide for details):

- Specify that the command language to be used is **AT** or **HAYES** compatible.
- Specify that the command required to initiate dialling is **ATD**.
- Specify that the command to answer an incoming call is **ATA**.
- Specify that the command used to hang-up a call is **+++** (three plus signs) followed by **ATH**.

6.6 Configuring the ISDN TA/V DTE Interface and Line Interface

It would be logical to assume that because the serial port of your computer needs to be configured (with respect to the data rate, flow-control method and data format), the ISDN TA/V's **DTE** and **LINE** ports would require the same. However, one of the many features of your ISDN TA/V is its ability to automatically sense the serial port settings of the PC (when it receives a command line originated from the PC), and the ISDN line rate. Your ISDN TA/V will adjust its operating characteristics accordingly, thus ensuring compatibility with the attached device.

Note that for efficient and uninterrupted data transfer, it is important that the data rate of the ISDN line is slower than the data rate of the DTE interface. If this situation is reversed, data arriving on the line will overflow the ISDN TA/V's buffers while waiting to be sent from the DTE interface to your computer. A data overflow means lost data.

Under normal operating circumstances, the ISDN TA/V attached to the remote computer will also be able to auto-sense the line, and lower, or raise, its transmission speed to suit your ISDN TA/V. For this reason, there is no need for any configuration changes to your ISDN TA/V's default settings unless you detect an incompatibility with the remote computer.

7. Using the ISDN TA/V

Now that you've configured the serial port of your PC to match the requirements of the Terminal Adaptor; and the physical connections between your PC, the DTE interface, and the ISDN network are correctly made, you're ready to complete your first call via the ISDN TA/V.

7.1 Dialing via the Communication Software Menu Structure

While running your communication software, select the **DIAL** menu option (refer to your software's manual for instructions on dialing a call) and enter the number of the remote computer service to be dialed.

7.2 Monitoring the Call

The current status of your ISDN TA/V is displayed on its front-panel LCD. During a dialing sequence the display will read:

DIALING xxxxxxxxx

followed by

REMOTE RING or **CALL FAILED**

depending on the state of the line.

When making a call, the ISDN TA/V behaves much the same way as a human telephone user. It connects to the line, dials the number, and then listens for a response. If the unit hears an engaged tone, or doesn't get an answer within a configurable time period, it hangs up.

When a call is answered, the connecting line is evaluated for protocols such as V.110 rate adaption, error correction, data compression, etc. Once this evaluation is completed, the outcome is reported back to the computer in the form of a coded message. The front-panel LCD reports the line speed, accompanied by a statement of the error correction type in use.

For example:

CONNECTED 64Kbps V.42

indicates a line speed of 64000 bps using V.42 error correction. This LCD message is also echoed to your computer screen.

7.3 During the Call

Your computer is now in direct communication with the remote computer, and whatever is entered at your keyboard will be relayed to the remote computer.

7.4 Logging On to the Remote Computer

When you initiate a connection with a remote computer, you will normally be required to log-on by entering a password or identification code. For details of the log on procedure required by the remote device, refer to the manuals supplied by the service, or contact the remote computer's operator. You can browse through the remote computer's directories, read and send mail, etc.

7.5 Initiating a File Transfer

Having established a call to the remote computer, you now have direct access from your local keyboard. The method used to initiate a file transfer will depend on the communication-software package that you are using (refer to your communication-software manual for details).

7.6 Logging Off and Clearing the Call

Disconnecting the call can be done in a number of ways. A controlled disconnection is one where you select the disconnect option from the menu of the remote computer service (termed as logging off). This causes the remote ISDN TA/V to disconnect first. Your own ISDN TA/V will sense the loss of signal, report:

```
NO CARRIER
```

on both its front-panel LCD and your computer screen, and then hang up.

Alternatively, you can initiate a disconnection by typing an ISDN TA/V command sequence (detailed in the Reference section), or by selecting the disconnect option from the menu of your local communication software. Refer to your communication software manual for details of how to disconnect a call in this way.

Caution

Remember that if you have dialed the call you will normally be billed for it. Always ensure that your own ISDN TA/V has disconnected properly.

7.7 Receiving Incoming Calls

As a default, your ISDN TA/V has been configured to answer incoming data calls automatically, as long as DTR has been raised on the DTE interface (your communication software program is running on the PC). This can be altered using AT commands, detailed in the Reference section.

On receipt of an incoming data call, your ISDN TA/V's front-panel LCD displays

```
INCOMING RING
```

The word RING, will be echoed to your computer screen (providing your computer is running a communication-software program, and is in communication with the TA/V).

This call can be answered by selecting the appropriate menu option within your communication software. Refer to your communication-software manual for details of how to do this.

When your ISDN TA/V is instructed to answer the call, it sends an answer tone to the remote unit, and displays

```
ANSWERING
```

on the front-panel LCD. Rate adaption, error correction and data-compression negotiations take place between the two units, the results of which are reported back to your computer screen (and on the unit's LCD). For example

```
CONNECT 64000/LAPM
```

indicates a line speed of 64000 bps using LAPM (V.42) error correction.

7.7.1 Automatic Answering of Incoming Calls

When the ISDN TA/V is configured with auto-answer enabled on DTR (as it is in the factory-default configuration), as long as DTR is present on the DTE interface (the ISDN TA/V's **TERMINAL 1** LED is lit) the unit will answer any call that is incoming on the line irrespective of whether it is carrying voice or data traffic. All voice calls will automatically be directed to the telephone handset socket, and all data calls will be sent to the DTE interface.

7.8 Where to Go From Here

Now that you know the basics of how to use your ISDN TA/V, you are unlikely to need to know much more to get maximum performance from it. This is because your communication software performs most of the tasks for you. To answer any questions that you may have, and to help you with any problems relating to the unit's configuration, the ISDN TA/V's Reference section contains all of the detailed information relating to its operating characteristics.

8. Troubleshooting

Your ISDN TA/V has been designed to give you reliable, trouble-free use. However, if you encounter any problems, this chapter will assist you in diagnosing and overcoming the difficulty.

• Positioning Your ISDN TA/V

Where you position your ISDN TA/V can affect its operation, and therefore the following site-selection guidelines should be followed to enhance its performance:

- The ISDN TA/V should be installed in a clean area that is free from dust and extreme temperatures.
- Do not place anything on top of, or within 15 centimetres of the back of your ISDN TA/V.
- Locate the unit as close to your computer as is practical, and within 1.83 metres of a grounded AC power outlet.
- To ensure adequate cooling, make sure that there is at least a 3-centimetre gap between the sides of your ISDN TA/V and any other object.
- Do not place your ISDN TA/V on its side.

• If You Cannot Connect the ISDN TA/V to the Computer

First verify that your computer is equipped with an available serial port, otherwise contact your computer supplier. If the ISDN TA/V-to-computer cable will not connect to the computer's port, contact your equipment supplier and verify that you are using the correct cable.

• If the POWER LED Does Not Light

Verify the connection of the power lead to the ISDN TA/V and the mains supply. Verify that the unit's on/off switch is turned on, and if the power-supply point has a similar switch make sure this is also turned on. You can also check your power-supply socket by plugging the ISDN TA/V into an alternate socket to see if it works there. Finally check that the fuse within the plug has not blown, and that it is in good working order.

• The ISDN OK LED Does Not Light

Ensure that the ISDN TA/V is powered on with its **POWER** LED alight. Verify the connection of the line cord to the ISDN TA/V's socket marked **LINE**, and the ISDN service outlet. If the LED still fails to light, check your ISDN service by plugging the ISDN TA/V into an alternate ISDN service outlet to see if it works there. Try using an alternate line cord to connect the ISDN TA/V to the service outlet. If all of these options fail contact your ISDN service provider.

• Other LEDs Do Not Light During Operation

If the **TERMINAL 1** LED does not light when the communication software in DTE interface connected computer is started (**TERMINAL 2** LED is not used and should never light), check that the software program is correctly configured to address the port to which the ISDN TA/V is connected.

The ISDN TA/V's other LEDs should light and extinguish depending on the action being taken during normal operation: if they do not light in accordance with their function (see **Section 5.3**) contact your equipment supplier.

• The ISDN TA/V Doesn't Attempt to Dial

If the **TERMINAL 1** LED is lit, but the unit does not dial when instructed to do so by your communication software, check that the dialing command being issued by the software is set to **ATD**.

• Will Not Connect to the Remote Device

Check the connections between your ISDN TA/V, the computer and the ISDN line. Verify that the line is working by using a telephone handset attached to the ISDN TA/V's phone socket to make a call. Check that the number which you are dialing is connected to a remote device, and that the remote device is configured to be able to answer calls.

It is possible that the remote device is not fully compatible with your ISDN TA/V. Verify that the user of the remote device has correctly installed it, has configured it appropriately, and is using suitable communication software.

• Will Not Answer Incoming Calls

Using the factory-default configuration, the auto-answer facility will be enabled on DTR, and you should check that this has not been altered (refer to the Reference section for details). Other possibilities are that the ISDN line or socket may be faulty, or the ISDN TA/V may not be connected to the ISDN socket at all.

Note that the front-panel LCD identifies an incoming call by displaying:

```
INCOMING RING
```

If this is not displayed when the remote device calls your TA/V, it indicates that the call is not reaching your incoming line.

• The ISDN TA/V Connects with the Remote Device but Locks Up

Ensure that the ISDN TA/V-to-computer flow-control method being used is correctly configured into the communication-software program's operating parameters. By default your ISDN TA/V uses hardware flow control (RTS/CTS). If this is incorrectly set, data may be interpreted as a flow- control character, stopping the flow of data.

• The ISDN TA/V Disconnects While it's On-line

Check for any loose connections between your computer, the ISDN TA/V, and the ISDN line wall socket. Excessive line noise or interference may also cause an interruption to the ISDN TA/V signals, in which case you should try dialing the connection again. If this problem persists, contact your ISDN TA/V supplier for help.

9. Regulatory Information

Your ISDN TA/V has been approved by BABT (the British Board of Telecommunications) for connection to British Telecom's ISDN service under the approval number of NS/3940/5/P/604019.

WARNING

Interconnection directly, or by way of other apparatus of ports marked "SAFETY WARNING: see instructions for use", with ports marked or not so marked may produce hazardous conditions on the network, and advice must be obtained from a competent engineer before such a connection is made.

Interconnection directly, or by way of other apparatus, of ports complying with SELV requirements may produce hazardous conditions on the telephone network. Advice should be sought from a competent engineer before such a connection is made.

The safety status of the interconnection ports on the back panel of the unit are as follows: Ports identified by **LINE** and the handset symbol = **TNV**; Ports identified by **DTE** symbol and **CONTROL = SELV**.

TNV — Is a circuit which under normal operating conditions carries telecommunications signals.

SELV — Is a secondary circuit which is so designed and protected so that under normal and single-fault conditions, the voltage between any two accessible parts does not exceed a safe value (42.2V peak or 60 VDC).

Only connect apparatus complying with the relevant interface requirements to the ports on the back panel of the unit.

A single mains cable, 2 metres in length, is supplied with the unit. This should be connected to a suitable mains supply. The mains plug is the primary disconnect device for the unit and you must ensure that the unit is installed near a socket outlet and that the outlet is easily accessible.

The mains cable supplied with the unit is fitted with a moulded plug, for connection to the standard socket outlet. Should the plug not be of the correct type for the outlet that it is to be connected to, the plug should be removed and the cable re-wired to the correct type of plug. The use of adaptors is not recommended and may invalidate the product's approval. The wires in the supply cord are coloured in accordance with the following code:

Blue = Neutral (N)

Brown = Live (L)

Ensure that neither the brown or blue wires are connected to the earth pin. When replacing the unit's fuse (accessed via the back panel) ensure that you replace it with one of the same amp and voltage rating.

Interference and Safety Requirements
Radio frequency interference may be caused by incorrect operation or inadequate maintenance of this equipment. This unit is intended for use with screened digital cables.

Caution: There is danger of explosion if the battery is incorrectly replaced. Replace only with the same or equivalent type of battery as specified by the manufacturer. A used battery must be disposed of in accordance with the manufacturer's instructions.

Introduction to the Reference Section

Overview

Before reading this part of the manual you should be familiar with Part I — Getting Started, and already have installed your ISDN TA/V according to the instructions given there.

The Reference section is, as its name suggests, a reference document which details the functionality of each command that can be sent to your ISDN TA/V in order to customise its use. It is designed to be used by more experienced communications device users who have a specific operating requirement and want to alter the unit's operating characteristics accordingly.

It is not required reading for the majority of users, however, as you become more experienced using the ISDN TA/V, you'll want to learn certain aspects of the AT compatible command language used by the ISDN TA/V, enabling you to make use of its advanced facilities and features.

Using this Reference Section in Support of the Intro Software

If your ISDN TA/V is connected to a DOS-based IBM compatible PC with a hard disk and a 3.5-inch floppy drive, you will no doubt have used the supplied **Intro** software to help you install the unit and make your first call. When using **Intro**, you will also have noticed that one of its main menu options enables you to **CONFIGURE** the ISDN TA/V by application, by feature, or interactively. This menu lets you create customised configurations to get the most functionality out of your ISDN TA/V.

Intro is in fact a user-friendly front end to the ISDN TA/V's command language. Whenever you make a selection for a parameter value within **Intro**, the software builds the required AT command for you and then sends it to the ISDN TA/V when you click OK in response to the prompt:

```
Confirm Update Configuration
```

As a result, it is no longer necessary for you to know a large chunk of the command language. You simply select your required settings from the descriptive options and **Intro** does the rest for you.

Not all of **Intro's** features can be accessed in this way, and indeed **Intro** can not be used at all when the ISDN TA/V's operating configuration doesn't allow AT commands on the DTE interface. In these circumstances you will therefore have to familiarise yourself with aspects of the AT command language or management interface menu structure, since you are likely to have to command the modem using a VT100 terminal connected to the **CONTROL** port.

Even in circumstances where you can use **Intro** to command the ISDN TA/V (the DTE interface is operating asynchronously), you may need to complement the explanation given within **Intro** of any feature's options, by reading about the particular feature in this Reference section, and then going back to **Intro** to make the appropriate selection.

10. Principles of Data Communication

An ISDN TA/V provides an interface between the digital world of an attached computer, and that of the ISDN service, and also between the analogue world of a telephone handset and the ISDN service. In this chapter we take a moment to explain why its use is necessary to enable a communication to take place, and explain some of the terminology that you'll find in later chapters. We also outline how the ISDN TA/V's command language is used to initiate and accept calls to/from other devices over the ISDN service.

10.1 How the ISDN TA/V Works

The digital signals received on the DTE interface are passed over the ISDN line using the first available B channel. An incoming data call on the ISDN is identified as being a data call, and is automatically passed to the DTE interface. An incoming voice call on the ISDN is identified as such and is automatically passed to the telephone-handset circuitry, converted from its digital format into an analogue format, and output via the handset interface. Vice versa an outgoing analogue voice call is converted into digital format by the ISDN TA/V before being passed over the ISDN service.

10.1.1 Controling the ISDN TA/V

Your ISDN TA/V, like most ISDN terminal adaptors and modems available today, uses a deviant of the industry standard set of commands known as AT codes to control all aspects of its operation. Control over the ISDN TA/V can then be initiated directly using the commands, via a communications-software program, or via the **Intro** software program installed in the DTE interface attached PC, (providing that the DTE interface is configured to accept asynchronous command).

Direct command to the ISDN TA/V is possible either by using your DTE interface attached computer in terminal-emulation mode (providing that the DTE interface is configured to accept asynchronous commands), or from a dedicated terminal/PC attached to the **CONTROL** interface—in either case you can control the ISDN TA/V by entering the relevant AT command at your keyboard. Although this method of operation requires a greater understanding than when using communications software or the **Intro** program, the terminal mode offers the greatest flexibility of customisation and fine control over the ISDN TA/V's parameters.
When using a communications-software program, or the supplied **Intro** software, in the DTE interface attached computer to control the ISDN TA/V, providing that the DTE interface is configured to accept asynchronouus commands, a friendlier interface containing menu selections is presented to the user. ISDN TA/V command is then executed by selecting options from the menu structure, then the software automatically builds the appropriate

AT command string, and sends this to the unit. As a result you, the operator, do not need to have a great understanding of the particular command structure, since all you have to do is select the parameter settings you want to use from the menu options.

When using a dedicated terminal or computer attached to the ISDN T/A's **CONTROL** port, AT commands can be entered into the unit at any time, irrespective of the configuration of the DTE interface or LINE interface, by entering the relevant command on the attached keyboard.

10.1.2 Error Correction

The method of error detection supported by your ISDN TA/V is ITU V.42 error correction based on the LAPM (Link Access Procedure) protocol. This protocol does not use start and stop bits to group data bytes; instead, your ISDN TA/V and the remote TA each break down a transmission into blocks of data (frames) and calculate a checksum for the block—the sum of the data bytes in the block. The block and its checksum are then transmitted. The receiving ISDN TA/V then calculates a checksum on the received data block and compares this with the received checksum. If these numbers differ the receiving ISDN TA/V requests a resend of that data block from the transmitting ISDN TA/V.

V.42 error correction is an important feature of your ISDN TA/V in that it automatically compensates for data corruption that has been caused by intermittent line quality. However, since the method of correction is to request a resend it cannot, of course, compensate for a line that is constantly corrupting data. If you are receiving a lot of errors on a particular line, we recommend that you contact your line supplier and have them check the quality of the line.

10.1.3 Data Compression

Data compression is a technique that is automatically negotiated by your ISDN TA/V, which significantly improves the throughput of a connection by reducing the time required to transmit and receive blocks of data.

Data compression is accomplished by the sending ISDN TA/V analysing the outgoing data for repeated patterns, and assigning a shorter data code to the pattern. Hence, the more often the same data codes occur in a transmission, the greater the overall compression will be.

The international data compression standard supported by your ISDN TA/V is ITU.42bis, which can provide compression capabilities of up to 4:1. This is especially suited to text file and graphic-file transmissions.

Files that have already been compressed using PC-based compression software such as ZIP or ARC® are not particularly suited to further compression, and will only receive a small percentage increase in throughput time when transmitted using the V.42bis standard.

To achieve the maximum gain in throughput offered by data compression, the data-transfer speed between your computer and the ISDN TA/V (data rate of the computer's serial port) should be faster than the transfer speed of the ISDN line traffic. It is recommended that the DTE connection is set to run as fast as possible, since the data has to be decompressed (back to its original size) before it is sent on to the computer.

10.1.4 Flow Control

The serial data rate (speed of transfer between your computer and the ISDN TA/V) and the line rate (speed of transfer down the ISDN line) normally differ in data communications, as outlined in **Section 10.1.3**. Because of this, a technique of data buffering to prevent data loss during transmission is required.

Flow control is the method by which your ISDN TA/V and computer tell each other when they have the capacity to receive more data, and when they have not—in which case the device which is attempting to pass on the data holds it within a memory buffer until the receiving device is ready.

Two types of flow control are supported by your ISDN TA/V. The default setting (hardware flow control) is appropriate when the ISDN TA/V, computer, and the cable between the ISDN TA/V and your computer support the RTS and CTS signals. Your ISDN TA/V can also be configured to support software flow control, where the ISDN TA/V and computer use special XON and XOFF characters to communicate. Refer to **Section 17.3** for details of the AT commands which determine the type of flow control used by the ISDN TA/V.

IMPORTANT — The type of flow control that you should use on a given communications link is normally dictated by the requirements of the service to which you are connecting, and whichever of the two methods your ISDN TA/V is configured to use must also be configured into the operational settings of your communication-software program.

10.1.5 Line Transmission Speeds

By default your ISDN TA/V will automatically negotiate the optimum transmission speed according to the capabilities of the line. A particular line speed to be used can however be specified as explained in **Section 16.1**.

10.1.6 V.110 Rate Adaption

Rate adaption is the technique which enables a synchronous or asynchronous DTE line speed of below 64000 bps to be connected to the ISDN line, while ensuring that line integrity is maintained. The V.110 standard of rate adaption supported by this Terminal Adaptor is regarded as the common standard among manufacturers of ISDN TA/Vs, thereby ensuring interoperability when communicating with other manufacturer's Terminal Adaptors.

10.2 File Transfer Protocols

Files are passed between communicating devices in blocks of data using transfer protocols such as XMODEM, YMODEM, ZMODEM, Kermit, etc. These protocols determine the block length, type of error detection used and whether or not filenames have to be stipulated or are automatically transmitted with the data.

The protocol that will best suit your file-transfer requirements will depend on the type of file, size of file, etc. However, as a guide, ZMODEM is generally recognised as the best general purpose protocol. It is a multiple- file transfer protocol and therefore most suitable for unattended operation.

In addition to using the above protocols, you can also send and receive straightforward, unchecked, ASCII files.

The type of file transfer protocol to be used must be specified within your communication software program's setup. Refer to the software's manual for further details.

10.3 Terminal Emulation

To enable trouble-free connections to a wide range of remote computer systems, communications-software programs offer several terminal emulation possibilities. These are mini-programs which, when running, make your computer appear to the remote computer as an acceptable terminal device.

By making your computer emulate a particular type of terminal, the software sets up the correct control codes which are passed to the remote computer during dial-up and answering, and informs your computer how to handle certain control characters that are sent from the remote device.

A large number of communications-software packages are available, and the majority of them have many terminal emulation options that you can choose from. In general, either ANSI or VT100 emulation is required for communicating with a remote Bulletin Board Service (BBS).

11. Commanding the ISDN TA/V

Before your ISDN TA/V can effect a communications link you have to issue a number of instructions to it to tell it what number, when, and how to dial or answer a call. You may also want to instruct the ISDN TA/V to perform a test of one or another part of the circuit.

If you need to alter the ISDN TA/V's configuration from its default settings so that its operating characteristics are compatible with the remote ISDN TA/V, the line, and the connection to your computer, these changes will also have to be made by sending one or more instructions to the ISDN TA/V.

The command language used to communicate with the ISDN TA/V is compatible with the industry-standard AT command set, and in this chapter we outline the different ways in which you can issue commands to the ISDN TA/V, explain the rules that apply to the AT language, and show you how they are applied.

11.1 Via Communication Software Command

In Part I of this manual, Getting Started, we explained how to command (drive) your ISDN TA/V using a resident communications-software program in the computer which is connected to the DTE interface. What you were in effect doing was sending a limited range of AT commands to your ISDN TA/V, which had a direct effect on its operation.

Remember how, when configuring the communications software, you were asked to identify the ISDN TA/V command language and you specified it to be AT compatible. By doing this you were in fact instructing the software to build an AT command string for you each time an option was selected from a menu. For example, when you selected the menu option

```
DIAL
```

the communications software would have constructed the command string ATD (plus the specified ISDN number) for you, and sent it to the ISDN TA/V.

Under normal operating conditions, and providing that the DTE interface is configured to accept asynchronous commands, this method of ISDN TA/V control will prove to be adequate. However, using the communications software to build command strings for you does limit the number of features to which you have access. When you need to access additional features and facilities you will have to force the communications software into terminal mode (usually done by selecting

```
TERMINAL
```

from within the software's menu structure), and address the ISDN TA/V directly by typing commands from the AT command language. Alternatively, you can use the supplied **Intro** software to command and configure the ISDN TA/V, as outlined in **Section 11.2**

11.2 Via Intro Software Menu Selections

Intro is a DOS-based software program designed to help you command the ISDN TA/V and alter its operating configuration using a simple menu structure. It is by far the easiest way to command your ISDN TA/V, and we therefore strongly recommend that you use it. However, similarly to the command option described in **Section 11.1**, **Intro** must be installed in the computer which is connected to the unit's DTE interface, and can therefore only address the ISDN TA/V if the DTE interface is configured to accept asynchronous commands (default configuration). Of course, if your system is not compatible with the program's requirements as detailed in Part I, the Getting Started section of this manual, you will not be able to use it, and you will have to use one of the other methods to command the ISDN TA/V.

Each of your ISDN TA/V's features and functions which can be altered using **Intro** are described within the program's on-screen menus, and when one of these features or functions is selected a help box is displayed giving details of the effect it will have on the ISDN TA/V's operating characteristics. When you confirm your selection, the software then builds the correct AT command for you and sends it to the ISDN TA/V to be actioned.

Because of the simplicity of this system, and the number of your ISDN TA/V's features and facilities that it encompasses, you may find that you will never have to instruct the ISDN TA/V by issuing an AT command directly from your keyboard. However, it should be noted that **Intro** menus do not cover the entire range of AT commands available to you. Those that are not covered can be actioned by selecting **CONFIGURE** from the main menu and **INTERACTIVE** from the sub-menu. In effect, this provides you with a terminal connection to the ISDN TA/V from which the entire range of AT commands can be issued.

If you want to complement a description given by **Intro** which relates to a feature/function or application, you should refer to the relevant section within this Reference section of the manual for further clarification.

11.3 Using AT Commands

Entering AT command sequences, via the DTE interface or CONTROL port, from any asynchronous computer or terminal keyboard provides greatest flexibility when commanding the ISDN TA/V. This method of control also requires the greatest level of knowledge in that it is like using any language—if you only think that you know how to say whatever you want to say, you are likely to get it wrong and will be misunderstood.

The remaining sections of this chapter outline the do's and don'ts of the AT command language, and should give you the confidence to go on and use the command language to optimise the performance of your TA/V.

11.4 AT Command Rules

AT commands can be entered from any asynchronous computer or terminal attached to the ISDN TA/V's DTE interface, providing it is communicating with the DTE interface, is in terminal mode, and the DTE interface is configured to accept asynchronous commands. Alternatively, AT commands can be entered from any asynchronous computer or VT100 terminal attached to the ISDN TA/V's **CONTROL** port.

In practice, if you have followed the installation instructions detailed in Part I of this manual, your computer will be connected to the ISDN TA/V's DTE interface, and running a communications-software package. All programs of this type offer terminal mode as a menu option, and therefore enable AT command access to your ISDN TA/V.

In order to use the AT command language successfully you must follow certain rules, as outlined here:

11.4.1 Formatting Command Lines

With the exception of two commands, all command lines must begin with the letters **AT**.

This can be typed in either upper or lower case, but not in a mixture of upper and lower case. The two commands that prove an exception to this rule are detailed later in this section.

AT is a command by itself in that it is used to bring the ISDN TA/V to ATtention. However, for the purpose of understanding the AT command language and how it is used, you should think of the letters **AT** as a prefix rather than a command.

The ISDN TA/V configuration or dialing command follows the AT prefix. Spaces can be inserted but they will be ignored by your ISDN TA/V. Each character in a string is then stored in your ISDN TA/V's memory until a "terminator character" is entered, marking the end of a command line. Once the terminator character reaches the ISDN TA/V, the command buffer is emptied and the command is executed.

A command line must end with a terminator character, the default character for this being a carriage return **<CR>**. This character option can be altered if necessary by changing the appropriate ISDN TA/V S-register setting (ISDN TA/V S-registers, their function and possible settings are explained later in this manual).

Many commands have two or more possible options, the setting of which determines the operating characteristics of that particular function of your ISDN TA/V. Each and every command has a factory setting which varies according to the ISDN TA/V configuration being used. The command's numeric parameter indicates which option is selected. For example, with the **Q** command set to **Q0** the ISDN TA/V will respond to commands by reporting result codes back to screen, and when this is set to **Q1** the ISDN TA/V will not report these result codes.

If you issue a command without specifying a numeric parameter, the ISDN TA/V will assume that the 0 option is to be used. For example, if you issue the command **ATQ<CR>** this will be interpreted by the ISDN TA/V as **ATQR0<CR>**.

The **Sn=r** command (used to control special memory locations within the ISDN TA/V called S-Registers), the **&Zn=x** command (for storing numbers in the ISDN TA/V's memory) and the **DS=n** command (for dialing stored ISDN numbers) have a slightly different format from all other commands. Here, instead of specifying the option directly after the command, an equal sign (=) and a number provide the value. Refer to the appropriate sections in this manual for detailed descriptions of these commands and their use.

11.4.2 Combining Commands

A command line can contain a maximum of 40 characters in it, and may be constructed of a combination of commands. You can use spaces as fillers to make the commands easier to read; the ISDN TA/V ignores these fillers and they are not counted among the characters which make up the command string.

Because the commands are always enacted in the order that they were entered, not all commands can form part of the same command line. For example, there are a number of commands within the AT language that have to be placed at the end of a command string (such as a dial command) and can therefore not form part of a string in which there is a similar command.

11.4.3 Waiting for a Response

The speed, or slowness with which you type a command line is of no significance. However, you must wait for a response from the ISDN TA/V between typing the terminator character (normally a **<CR>**) and starting to type a new command line. Commands which take a long time to action, such as a dialing string or an answer command, will be abandoned if a character is sent from the computer to the ISDN TA/V before the command has been completed.

The type of ISDN TA/V response is dependent on the command issued, and is displayed on your computer screen below the command line to which it refers. Most command lines get an immediate response which may simply be **OK** when all the commands on a command line have been executed. Sometimes responses are delayed, and there may be a number of responses to a single command.

If a command is not recognised by your ISDN TA/V (if its numerical value is out of the permitted range), or if actioning a command would cause a malfunction of some sort, the ISDN TA/V will respond with **ERROR** and abandon the command line. **ERROR** is an example of a response that is also displayed on your ISDN TA/V's front-panel LCD.

11.4.4 Editing a Command Line

If you make a mistake when compiling a long ISDN TA/V command line, the backspace key or **<Ctrl>H** (default setting as held in S-register S5) can be used to reposition the cursor and correct the mistake. The keyboard's delete key does not have the same effect.

11.4.5 Repeating a Command Line

One of only two exceptions to the prefix and terminator character requirement rule is the command A/ (A followed by a forwardslash). Issue this command and the ISDN TA/V will repeat the last command line that it executed.

11.5 Interrupting Data Traffic to Issue AT Commands

Providing that your ISDN TA/V is off-line (you have not issued a dial command or answered an incoming call), and is therefore not in communication with a remote ISDN TA/V, AT commands can be entered via the **CONTROL** port any time, or via the DTE interface at any time that your communications software is in terminal mode and the interface is configured to accept asynchronous command.

If the ISDN TA/V is on-line (passing data between your computer and a remote computer), the passage of data has to be interrupted if you wish to issue any commands to your ISDN TA/V: for example if you wish to hang-up the call. Note that this interrupting action does not break the connection to the remote ISDN TA/V.

To interrupt the data flow, a special command is used which does not require either the AT prefix or the terminator character.

At your keyboard type +++ to interrupt the data flow, and put the ISDN TA/V into command mode. Any characters subsequently sent to the ISDN TA/V are seen as an AT command sequence. If a pause occurs between the third escape character and the first subsequent character, that is longer than the time period defined within S-Register S12 (see **Section 15.1.3**), the ISDN TA/V will return the **OK** result code (**OK** will be displayed on-screen), confirming that it is in command mode.

If no pause occurs between the third escape character and the first subsequent character, or the pause is shorter than that defined in S12, the ISDN TA/V will still respond to a valid AT command string in the normal manner. However, if the characters received do not form a valid AT command string, the ISDN TA/V will immediately revert to data-transmission mode.

11.5.1 Returning to an On-line State After Interrupting Data Flow

The **O** command is used to return the ISDN TA/V from a command state to an on-line state when a connection has been interrupted using the **+++** command. If you have placed the ISDN TA/V in command mode and are still connected to the remote system, type **ATO<CR>** at your keyboard to go back on-line. Anything that you type from the keyboard will then be transmitted to the remote modem or ISDN TA/V. If the connection was broken for any reason while you were in command mode, to go back on-line you will have to instruct the ISDN TA/V to re-dial the remote device's line number.

12. ISDN TA/V Configurations

An ISDN TA/V's configuration determines its operating characteristics with regard to how it connects to and communicates with the local DTE, and how it communicates over the ISDN line. To this end, your ISDN TA/V is equipped with four factory-set configurations (Factory 0 - 3), covering the most common connectivity requirements of the attached DTE. These are held within the ISDN TA/V's memory and cannot be altered.

A further three memory locations are used to store editable configurations—those containing your preferred power-up configurations (automatically loaded each time the ISDN TA/V is powered on), with the other two containing user defined configurations (User 1 - 2).

One of the ISDN TA/V's memory areas which is not saved when the ISDN TA/V is powered off, is used to temporarily hold the configuration which is actually being used. This memory area is of course fully editable and supports configuration changes which are made while the ISDN TA/V is powered on. The configuration within this memory location is termed the active configuration.

This chapter explains the significance and use of each of these configurations; how to build and store configurations within the user-definable locations, and how to examine the active configuration.

12.1 Factory Configurations

The four factory set configurations which are permanently stored within your ISDN TA/V's memory have been designed to cater for the most common applications of the ISDN TA/V. **Chapters 14-17** contain a detailed listing of the parameter settings which together form a configuration; and **Section 12.3** explains how you can examine the settings of a particular configuration.

- **Factory 0 —** V.24/V.28 DTE interface operating asynchronously. Dialing is initiated using the AT command language, and automatic answering and sensing of the required DTE interface rate are enabled, as is the type of rate adaption, error correction, data compression, etc. This is the most common application of an ISDN TA/V and Factory 0 should be used for most PC-to-PC, and PC-to-host ISDN communication.

- **Factory 1 —** V.24/V.28 DTE interface operating synchronously at 19200 bps. Dialing is initiated using V.25bis HDLC commands, and automatic answering is enabled. V.110 rate adaption is employed. This configuration is designed for use in specialist applications of the ISDN TA/V, where a synchronous V.24 data link exists between the ISDN TA/V and the local DTE.

- **Factory 2 —** V.24/V.28 DTE interface operating asynchronously at 19200 bps for a UNIX host connection, similar to Factory 0 with V.110 rate adaption employed. This configuration is designed for use where the ISDN TA/V is connected to a UNIX host, and is primarily being used to answer calls originating from a remote device.

- **Factory 3 —** V.24/V.28 DTE interface operating strict V.110 rate adaption without automoding. For outgoing calls this means that the ISDN line rate is adapted to match the DTE rate. On incoming ISDN calls the V.110 information attached to the call is used to determine the rate of the local DTE.

12.2 Selecting Which Configuration is Active

The active configuration is, as its name suggests, the configuration which the ISDN TA/V is actually using to operate at any particular time. When the ISDN TA/V is powered on, the .power-up configuration is automatically loaded into the memory location reserved for the active configuration, and then any one or more of the configuration parameters can be altered to suit a particular operating requirement.

It should be noted that the ISDN TA/V's parameter settings which are held within this active configuration are not stored to memory if the unit is powered off. If you want to save them so that an altered factory configuration can be used again and again, the active configuration must be stored into one of the user configuration locations, or the power-up configuration location as explained in **Sections 12.4 and 12.5**.

12.2.1 Four Ways to Select Which Configuration is Active

1) When you switch on power to the ISDN TA/V using the rear-panel ON/OFF switch, the configuration held in the power-up memory location is automatically loaded as the active configuration. Because Factory 0 is the most common ISDN TA/V application, the parameter settings of the power-up configuration will default to match Factory 0. Subsequently, an altered configuration can be saved as the power-up configuration. This will be loaded every time the unit is powered on.

2) When powering on the ISDN TA/V using the rear-panel ON/OFF switch, while holding in the rear panel-mounted **RESET** button, the unit's LCD will toggle at three-second intervals through the stored configurations (Factory and User), naming each configuration location. By releasing the **RESET** button when the configuration that you want to load is displayed in the LCD, that configuration's parameter settings will be loaded automatically as the active configuration.

   Having selected which configuration's parameter setting are to be loaded as the active configuration, the LCD will ask if you want to store this configuration to the power-up configuration location, thereby ensuring that it is loaded each time the ISDN TA/V is powered ON as described in option 1. To confirm the request press the **RESET** button once more. To ignore it simply wait until the prompt disappears before addressing the ISDN TA/V further.

3) If you are using the **Intro** software to command your ISDN TA/V, select the **CONFIGURE** option from the software's main menu, and select **BY APPLICATION** from the sub-menu to display a description of the function of each factory configuration. By highlighting the required application and confirming your selection, the corresponding factory-configuration setting will be loaded as the active configuration. Note that the power-up configuration, User 1 and User 2 cannot be loaded as the active configuration using this method.

4) The fourth method of loading a stored configuration is by issuing an AT command directly to the ISDN TA/V. Ensuring that your communications software is in **TERMINAL** mode, or that you are using the **INTERACTIVE** facility of the **Intro** software, the **&F** command is used to load a factory configuration, where:

AT&F0<CR>	Loads Factory 0 as the active configuration.
AT&F1<CR>	Loads Factory 1 as the active configuration.
AT&F2<CR>	Loads Factory 2 as the active configuration.
AT&F3<CR>	Loads Factory 3 as the active configuration.

The **Z** command is used to load the power-up configuration, or a user configuration, where:

ATZ0<CR>	Loads the power-up configuration as the active configuration.
ATZ1<CR>	Loads User 1 as the active configuration.
ATZ2<CR>	Loads User 2 as the active configuration.

12.3 Viewing Parameter Settings of the Active Configuration

The **&V** command is used to display the parameter settings of the active configuration on your computer/terminal screen. A brief summary of the configuration will be displayed, along with an index of the commands used to access more detailed information relating the configuration's parameters.

In the example given here, Factory 0 is being used as the active configuration. Type **AT&V<CR>** to display:

```
ISDN TA/V Configuration Summary

DTE Interface      ASYNC / AUTOBAUD
Commands           AT
Autoanswer         ENABLED WITH DTR
Protocol           AUTO SELECT
Flow Control       RTS/CTS

Configuration Index

AT&V1   All Screens           AT&V2   User Commands
AT&V3   User Commands         AT&V4   Dial/Answer/Clear
AT&V5   Dial Line Settings    AT&V7   Protocol/Buffer

OK
```

To examine the parameter setting within any of the configuration index groupings that are listed, simply enter the associated AT command.

12.4 Creating a User-Defined Configuration

Where the operating requirements of the remote ISDN TA/V, to which you want to establish a connection, differ from those provided by any of the factory-set configurations, you can create and store a user-defined configuration expressly for use when communicating with that remote Terminal Adator. Two such user configuration locations are provided for in your ISDN TA/V's memory, namely User 1 and User 2.

A user configuration is created by altering the parameter settings of the active configuration, and then saving this altered configuration into one of the two locations provided. The AT commands used to alter an ISDN TA/V's configuration are listed in **Appendix B**, how to use them and the significance of each value is explained in the remaining chapters of this manual.

12.4.1 Building a User-Defined Configuration

Having established a link between your computer and the ISDN TA/V, and using either your communications software program, the **Intro** software, or a terminal attached to the **CONTROL** port — load the factory configuration which most closely resembles your requirements as the active configuration (following the instructions given in **Section 12.2**). Then type the AT commands required to alter the configuration.

For example, if you want to use Factory 0 but want to turn the autoanswer facility of, load Factory 0, then type **ATS0=0<CR>**, where **S0=0** disables the autoanswer facility. All parameters and S-Register settings that have not been altered will match those of the original configuration (Factory 0).

Note that the active configuration will not be saved to the ISDN TA/V's memory unless you expressly do so as explained in **Section 12.5**.

12.4.2 Saving Altered Configurations to a User Location

To save the active configuration to one of the two user locations, use the **&W** command as shown below:

AT&W1<CR> Stores the active configuration in User 1.

AT&W2<CR> Stores the active configuration in User 2.

12.5 Saving a Configuration to the Power-Up Location

By default the configuration stored in the power-up configuration location exactly matches that of Factory 0. This has been done because the power-up configuration is automatically loaded as the active configuration when the ISDN TA/V is powered on, and the configuration settings within Factory 0 would normally be used by the majority of ISDN TA/V users.

However, if the configuration of Factory 0 does not reflect the requirements of the application that you will most commonly use, we strongly recommend that you save a more appropriate configuration to the power-up memory location, which will subsequently be loaded each time you power on the ISDN TA/V.

The active configuration is the only configuration that can be manipulated and saved to an alternate location, and this must therefore be configured to reflect the parameter settings that you want to store as your power-up configuration. To save the active configuration to the power-up location, use the **&W** command as shown below:

AT&W0<CR>

Note that to store a configuration which disables asynchronous AT command, or one which sets an asynchronous rate or format that is different from the rate and format at which you are entering commands, the **&W0** command must be the last command on the command line whcih contains the configuration changes.

13. Dialing, Answering, and Clearing Calls Using AT Commands

When using your ISDN TA/V, there are five ways that a call can be dialed, the first two of which you will already have used when working through Part I of this manual:

- A digital voice call can be manually dialed using a telephone attached to the ISDN TA/V.
- A data call can be dialed by selecting the appropriate option using communications-software program or **Intro** in the DTE interface attached computer, and typing the number to be called.
- A data call can be dialed from the DTE interface attached computer's keyboard, or the **CONTROL** port attached terminal, using the AT command language.
- A data call can be dialed from the DTE interface attached computer's keyboard using V.25bis dialing commands. See **Chapter 18** for further details about this option.
- A preset data call can be automatically dialed by the ISDN TA/V when the control signal DTR (Data Terminal Ready) is detected on the ISDN TA/V's DTE interface.

13.1 Using the D Command

The D command, followed by the number that you wish to dial, forms the AT command line that is used to instruct your ISDN TA/V to dial a number. Following the command language rules as specified earlier, issuing the command **ATD12345678<CR>** would instruct the ISDN TA/V to dial the number: 12345678.

The current status of your ISDN TA/V is displayed on its front-panel LCD. During a dialing sequence the display will read **Dialing xxxxxx**, followed by **Remote Ring** or **Call Failed** depending on the state of the line.

When it is making a call, your ISDN TA/V behaves in much the same way as a human telephone user in that it connects to the line, dials the required number, and then listens for a response. If the ISDN TA/V hears an engaged tone, or doesn't get an answer within a configurable time period, it hangs up.

If the call is answered by an ISDN TA/V, it begins to evaluate the type of ISDN TA/V to which it is connected, the transmission protocol to be used, and whether the remote ISDN TA/V will permit error correction, data compression, etc.

Once this ISDN TA/V handshaking has finished, the outcome is reported back to the computer in the form of a coded message. The front panel LCD reports the line speed, accompanied by a statement of the error correction type in use. For example, **Connected 64Kbps V.42** indicates a line speed of 64000 bps using V.42 error correction. This LCD message is also echoed to your computer screen.

13.2 Using the Number Directory

Your ISDN TA/V uses a segment of its non-volatile memory to store up to twenty frequently used ISDN numbers, and each storage location can hold a maximum of 20 characters. Any one of these storage locations can later be recalled, and the number dialed automatically.

13.2.1 Storing a Number in One of the Directory Locations

Assuming that your ISDN TA/V is in command mode (your computer is in terminal emulation and the ISDN TA/V is off-line) the command **&Zn=x** is used to identify the directory location and ISDN number to be stored. For example:

AT&Z6=12345678<CR>

will store in directory location 6 the number 12345678, and similarly:

AT&Z2=87654321<CR>

will store in directory location 2 the number 87654321.

13.2.2 Displaying the Directory Contents

The contents of your number directory can be displayed using the **&N** command. We strongly advise that you use this command to check that all stored numbers have been programmed correctly.

AT&N<CR>

13.2.3 Clearing the Contents of the Directory

Issuing the command **AT&N99<CR>** will clear the contents of all directory locations.

13.2.4 Clearing a Single Directory Location

A single entry within the directory can be erased using the **N*n*?** command, where **n** represents the directory location. For example, typing **ATN3?** will delete the contents of directory location 3.

13.2.5 Dialing a Number Stored in the ISDN TA/V's Directory

As we have briefly mentioned, one of the facilities of your ISDN TA/V is a 20-location ISDN number directory to which frequently used numbers can be saved and recalled. The dialing modifier command used to specify a directory location is **N*n*** (where **n** is the directory location). For example:

ATDN2<CR>

will instruct the ISDN TA/V to dial the number stored in its directory location number 2.

13.3 Clearing a Call

Disconnecting the call can be done in a number of ways. A controlled disconnection is one where you select the disconnect option from the menu of the remote computer service (termed as logging off), this causes the remote modem to disconnect first. Your own ISDN TA/V will sense the loss of signal, report **NO CARRIER** on both its front-panel LCD and your computer screen, and then hang up.

Alternatively you can initiate a disconnect by typing the command:

ATH<CR>

on the terminal or computer that is attached to the **CONTROL** port, or by typing **+++** (interrupt data flow command) followed by **ATH<CR>** on the computer that is attached to the DTE interface.

Caution

Remember that if you have dialed the call you will normally be billed for it. Always ensure that your own ISDN TA/V has disconnected properly.

13.4 Answering an Incoming Call

Using the default settings of Factory configuration 0, your ISDN TA/V has been configured to answer incoming calls automatically. This can be altered using TA/V commands as explained later in this manual.

On receipt of an incoming call, your ISDN TA/V's front-panel LCD displays **INCOMING RING**. The word **RING** will be echoed to your computer screen (providing your computer is running a communication-software program, and is in communication with the ISDN TA/V).

If autoanswer is disabled the call can be answered either manually using the attached handset; by selecting the **ANSWER** option from your communication software's menu; or by issuing the AT command **ATA<CR>**.

13.5 ISDN TA/V Response Codes

The type and complexity of responses that your ISDN TA/V displays in its LCD and to your screen is dependent on the setting of two AT commands, as outlined in this section.

The **Q** command is used to enable or disable your ISDN TA/V's response codes:

ATQ0<CR>	Enables response codes.
ATQ1<CR>	Disables response codes.
ATQ2<CR>	Enables the originating ISDN TA/V only to send response codes to the DTE. Required for most UNIX applications.

The **V** command setting dictates the format of these response codes:

ATV0<CR>	Responses displayed in numeric format.
ATV1<CR>	Responses displayed in text format.

The **X** command is used to determine which of the extended response codes will be displayed to you:

ATX0<CR>	Disables response codes 5-27.
ATX1<CR>	Enables response codes 5-16.
ATX2<CR>	Enables response codes 5-16.
ATX3<CR>	Enables response codes 5-16.
ATX4<CR>	Enables response codes 5-16.
ATX5<CR>	Adds EC suffix to response codes (20-27) if error correction is used.
ATX6<CR>	Adds either V.42 or V.110 suffix to response codes (20-27) if data compression or rate adaption is used.

13.5.1 Valid response codes

The valid response codes which will be displayed on-screen are:

Numeric Format	Text Format	Description
0	OK	Command executed.
1	CONNECT	Connected to the line.
2	RING	A ring voltage is being received on the line.
3	NO CARRIER	Carrier signal has not been detected, or has been lost.
4	ERROR	Invalid command.
85	RINGING	The remote ISDN TA/V is receiving a ring voltage on the line.

Additional response codes that will be displayed if the X parameter is set between 1 and 4 are:

Numeric Format	Text Format	Description
5	CONNECT 1200	Connected at 1200 bps
6	NO DIALTONE	ISDN line not available
7	BUSY	Busy signal detected on the line
8	NO ANSWER	No answer
10	CONNECT 2400	Connected at 2400 bps
11	CONNECT 4800	Connected at 4800 bps
12	CONNECT 9600	Connected at 9600 bps
13	CONNECT 12000	Connected at 12000 bps
14	CONNECT 14400	Connected at 14400 bps
15	CONNECT 19200	Connected at 19200 bps
16	CONNECT 7200	Connected at 7200 bps
19	CONNECT 300	Connected at 300 bps
28	CONNECT 38400	Connected at 38400 bps
30	CONNECT 57600	Connected at 57600 bps
34	CONNECT 115200	Connected at 115200 bps
44	CONNECT 48000	Connected at 48000 bps
46	CONNECT 56000	Connected at 56000 bps
48	CONNECT 64000	Connected at 64000 bps

Additional response codes that will be displayed if the X parameter is set to 5 or 6 (when set to X6 the EC suffix will be replaced by either a V.42 or V.110 suffix).

Numeric Format	Text Format	Description
6	NO DIALTONE	ISDN line not available
7	BUSY	Busy signal detected on the line
8	NO ANSWER	No answer
20	CONNECT 2400/EC	Connected at 2400 bps with error correction (or data compression)
21	CONNECT 4800/EC	Connected at 4800 bps "
22	CONNECT 9600/EC	Connected at 9600 bps "
23	CONNECT 12000/EC	Connected at 12000 bps "
24	CONNECT 14400/EC	Connected at 14400 bps "
25	CONNECT 19200/EC	Connected at 19200 bps "
26	CONNECT 7200/EC	Connected at 7200 bps "
27	CONNECT 300/EC	Connected at 300 bps "
29	CONNECT 38400/EC	Connected at 38400 bps "
31	CONNECT 57600/EC	Connected at 57600 bps "
35	CONNECT 115200/EC	Connected at 115200 bps "
45	CONNECT 48000/EC	Connected at 48000 bps "
47	CONNECT 56000/EC	Connected at 56000 bps "
49	CONNECT 64000/EC	Connected at 64000 bps "

14. DTE Interface Commands and S-Register Settings

This chapter concentrates on the AT commands and S-Register settings that affect the link between the ISDN TA/V and your DTE. The existing setting for an S-Register can be displayed using the **ATS*n*?<CR>** command (where **n** is the S-Register number you're interested in).

The factory configurations have been designed so that appropriate command settings are determined for you; however, if you need to alter any of them simply reference the appropriate command within this chapter and alter the ISDN TA/V's configuration accordingly.

The settings of Factory 0 are shown in bold type with all other variants being shown in plain text. The **AT** prefix and **<CR>** suffix required when commanding the ISDN TA/V to alter a setting are omitted.

14.1 Data Transmission Mode

Your ISDN TA/V can be used in a variety of transmission modes, enabling you to connect to a range of operating environments. The required mode is dependent on the computer or terminal to which the ISDN TA/V is attached, as well as the system to which you want to establish a communica-tion link. The command language used to instruct your ISDN TA/V is also governed by the setting of this AT command.

Note that the **&M** and **&Q** commands have the same effect, and either can be used.

&M0 or **&Q0**	Asynchronous mode using the AT command language.
&M1 or &Q1	Synchronous mode using the AT command language. This mode requires a synchronous interface card to be installed in your PC, supporting both asynchronous and synchronous operation through the same port. Commands are sent to the ISDN TA/V asynchronously via the AT command language. The ISDN TA/V automatically switches to the synchronous state when a connection to a remote device is established.

&M2 or &Q2	Synchronous operating mode where the ISDN TA/V dials the number stored in directory location 1 when the DTR signal turns off and then on (Control signal in X.21 mode), on the DTE interface. A synchronous interface card must be installed in your PC.
&M231 or &Q231	Asynchronous mode with the AT command set disabled.
&M232 or &Q232	Asynchronous mode using asynchronous V.25bis command of the ISDN TA/V. The AT command set is disabled (refer to **Chapter18** for details of the V.25bis dialing commands).
&M233 or &Q233	Synchronous mode using bisynchronous V.25bis command of the ISDN TA/V. The AT command set is disabled (refer to **Chapter 18** for details of the V.25bis dialing commands). A synchronous interface card must be installed in your PC.
&M234 or &Q234	Synchronous mode using HDLC V.25bis command of the ISDN TA/V. The AT command set is disabled (refer to **Chapter 18** for details of the V.25bis dialing commands). A synchronous interface card must be installed in your PC.
&M236 or &Q236	Synchronous mode with the AT command set disabled.
&M4 or &Q4	Asynchronous operating mode where the ISDN TA/V dials the number stored in directory location 1 when the DTR signal turns off and then on, on the DTE interface.

14.2 DTE Electrical Characteristics Conformance

The 25-pin DTE interface connector can be configured to electrically conform to one of a variety of ITU specifications, and is therefore compatible with a number of operating environments.

The DTE interface cable supplied with the ISDN TA/V is compatible with the connector being configured to supply the control signals of V.24/V.28 only. To configure the interface to conform to V.36 or X.21 (V.11), connect a cable whose wire to pin assignments match those described in **Appendix A** of this manual to the DTE connector on the rear panel of the ISDN TA/V. The ISDN TA/V will detect which cable has been connected to it, and will configure the interface accordingly.

14.3 Default Async Speed

Asynchronous DTE transmission speed will automatically be negotiated between the DTE and your ISDN TA/V when the DTE first sends an AT command to the ISDN TA/V. However, if the first communication between the ISDN TA/V and the DTE is initiated by the ISDN TA/V, i.e. when the ISDN TA/V is powered on and the first action is to answer a call, the DTE transmission speed will be governed by the setting of the command.

\R0	57600 bps	**\R1**	38400 bps
\R2	19200 bps	**\R3**	14400 bps
\R4	12000 bps	**\R5**	9600 bps
\R6	7200 bps	**\R7**	4800 bps
\R8	2400 bps	**\R9**	1200 bps
\R10	600 bps	**\R11**	300 bps
\R13	115200 bps		

14.4 Setting the Communications Format

The number of data bits, the parity, and the number of stop bits will be automatically negotiated between the DTE and your ISDN TA/V when the DTE first sends an AT command to the ISDN TA/V. However, if the first communication between the ISDN TA/V and the DTE is initiated by the ISDN TA/V, i.e. when the ISDN TA/V is powered on and the first action is to answer a call, the communications format will be governed by the setting of the **\B**, **\P**, and **\S** commands, which must echo the communications format settings within your communication-software program.

14.4.1 Number of Data Bits

Defined using the **\B** command as described below:

\B0	Seven data bits
\B1	Eight data bits
\B2	Nine data bits
\B3	Six data bits

14.4.2 Parity Bits

Defined using the **\P** command as described below:

\P0	None
\P1	Even parity
\P2	Odd parity
\P3	Mark
\P4	Space

14.4.3 Number of Stop Bits

Defined using the **\S** command as described below:

\S0	One stop bit
\S1	Two stop bits

14.5 Communications Signaling Requirements

The majority of communication software programs will accept the ISDN TA/V factory-configuration settings, including those of the communications signals behaviour, without requiring any changes to be made by the user. However, a number of these programs need the interface signals to be treated in a particular way, requiring you to alter them accordingly.

If you experience any problems connecting to another system, check the user manuals of both your communication software and the remote device to which the ISDN TA/V is connecting in case there are any special requirements relating to the communications signals.

14.5.1 DTR Control

Data Terminal Ready is the signaling circuit used to indicate to the ISDN TA/V when the attached computer/terminal is able to send or receive information. Whenever DTR is present on the DTE interface this is indicated by your ISDN TA/V's **TERMINAL** LED being lit.

How this signal is treated by the ISDN TA/V is determined by the **&D** command.

&D0	ISDN TA/V ignores the true status of DTR and treats it as always ON.
&D2	User controlled signalling. DTR is controlled by the DTE.

14.5.2 DSR Control

Data Set Ready is the signaling circuit used to indicate to the attached computer/terminal that the ISDN TA/V is ready to send information to the DTE. How this signal is treated by the ISDN TA/V is determined by the **&S** command.

&S0	DSR is forced on at all times.
&S1	Normal RS-232 signaling is respected. DSR is controlled by the DCE.
&S2	DSR is turned off for 1 or 2 seconds upon a disconnection.
&S3	The status of DSR follows DTR.
&S4	DSR on early. This option should not be used unless it is expressly needed to be compatible with an external autodialer device. The ISDN TA/V operates as per standard RS-232 signaling except that DSR comes on immediately when the ISDN TA/V establishes a physical connection to a remote device. This option violates the ITU requirements for control of DSR.
&S5	Delay until data. The ISDN TA/V operates as per standard RS-232 signaling except that DSR comes on when the ISDN TA/V goes into data mode, which is when CTS and DCD normally come on. This option is intended for use with DTEs which cannot operate with the long RTS/CTS delay which is inherent in V.32bis.

14.5.3 RTS Control

Request To Send is the signaling circuit used to indicate to the attached ISDN TA/V that the computer/terminal wants to send information. How this signal is treated by the ISDN TA/V is determined by the **&R** command.

&R0	Normal RS-232 signaling. In general this requires the DTE to switch RTS on whenever it wants to transmit data.
&R1	RTS is ignored.
&R2	RTS input controls the remote modem's DCD signal using simulated control carrier. To ensure correct operation of this facility, the remote ISDN TA/V must be configured with its DCD signaling command set to *simulated control carrier*. This option should be selected where the DTE requires DCD to toggle on and off in a simulated half duplex operation.

14.5.4 CTS Control

Clear To Send is the signaling circuit used to indicate to the attached computer/terminal that the ISDN TA/V is ready to receive information from the DTE. How this signal is treated by the ISDN TA/V is determined by the **\D** command. Note that CTS ignores RTS when RTS flow control is enabled.

\D0	CTS is forced on at all times.
\D1	Normal RS-232 signaling. CTS is always on when the ISDN TA/V is off-line, CTS follows RTS when on-line.
\D2	CTS is turned off for 1 or 2 seconds upon a disconnection.
\D3	The state of CTS follows the state of DTR.

14.5.5 RTS/CTS Delay

The length of time the ISDN TA/V will wait after receiving RTS, before raising CTS to the DTE, is configured into one of the ISDN TA/V's S-Register memory locations using the command **S26=*n*** (where **n** represents the delay in 10 millisecond increments). Definable in the range 0 to 255, the factory setting being **0** milliseconds.

14.5.6 DCD Control

Data Carrier Detect is the signaling circuit used to indicate to the attached computer/terminal that the ISDN TA/V has detected a valid carrier signal from the TA/V at the other end of the communications link. Whenever DCD is present on the DTE interface this is indicated by one or both of your ISDN TA/V's ON-LINE LEDs being alight. How this signal is treated by the ISDN TA/V is determined by the **&C** command.

&C0	DCD is forced on at all times.
&C1	Normal RS-232 signaling where DCD is on when the remote ISDN TA/V's carrier signal is detected, and off when it is not detected.
&C2	DCD is normally forced on although it turns off for approximately one second when the carrier is disconnected.
&C3	DCD follows the state of DTR.
&C4	Simulated control carrier. The state of DCD follows the state of the remote ISDN TA/V's RTS. To ensure correct operation of this facility, the remote TA/V must be configured with its RTS signaling command set to simulated control carrier. This option should be selected where the DTE requires DCD to toggle on and off in a simulated half-duplex operation.
&C5	DCD follows the state of DTR except when disconnecting a call; in which case DCD goes off to signal the disconnection while DTR remains on. DTR must be turned off and then back on again before DCD will follow and turn on as well.

15. User Commands

This chapter concentrates on the AT commands and S-Register settings that affect the dialing characteristics of your ISDN TA/V, as they are effected from your computer or terminal. The existing setting for an S-Register can be displayed using the **ATS*n*?<CR>** command (where **n** is the S-Register number you are interested in).

The factory configurations have been designed so that appropriate settings for these commands are determined for you; however, if you need to alter any of them simply reference the appropriate command within this chapter and alter the ISDN TA/V's configuration accordingly. The settings of Factory 0 are shown in bold type with all other variants being shown in plain text. The **AT** prefix and **<CR>** suffix required when commanding the ISDN TA/V to alter a setting are omitted.

15.1 Selecting AT or V.25bis Dialing Commands

Whether your ISDN TA/V will accept AT or V.25bis dialing commands is dependent on the setting of the **&M** or **&Q** command (see **Section 14.1**). Factory configurations 0 and 2 are configured to accept AT commands, while Factory 1 and 3 are configured to accept V.25bis dialing commands.

15.2 Defining the AT Escape Sequence Character Key and Response Timeout

The AT escape sequence characters are used to interrupt data flow and force the DTE interface into command mode, as described in **Section 11.5**. The ASCII value of the character is held within S-Register S2 and can be altered using the command **S2=n** where **n** is a value from 0 to 127.

Entering a value greater than 127 will disable the escape sequence, in which case your ISDN TA/V cannot be instructed to return from data mode to command mode until the call is disconnected.

The default setting for the escape character is **S2=43**, 43 being the ASCII value of the + character.

15.2.1 AT Escape Response Timeout Definition

S-Register S12 defines the time in 20-millisecond increments following the third escape character that the ISDN TA/V will wait before issuing an **OK** response. If one or more characters are received within this period the **OK** response will be suppressed. Whether this timeout has expired or not, the ISDN TA/V is forced into command mode and will respond to valid AT commands. If the characters that follow the escape sequence do not constitute a valid AT command, or contain an invalid-command option, the ISDN TA/V will immediately revert to data-transfer mode.

Following a valid AT command the ISDN TA/V will remain on-line and in command mode until the call fails, or the ISDN TA/V is commanded back on-line using the **ATO** command. **S12=*n*** is the command used to alter the escape response timeout, where **n** is a value from 0 to 255.

The default setting of **S12=50** results in a required escape response timeout of 1 second.

15.3 Effect of the BREAK Key on a Terminal's Keyboard

Similar in application to the escape sequence characters, the **BREAK** key on a terminal keyboard can be used to interrupt data flow. The effect on the data held within the ISDN TA/V's buffer, and the state of the ISDN TA/V varies according to the setting of the **\K** command, where:

\K0 A destructive break occurs each time the **BREAK** key is pressed. A break character is immediately sent and the ISDN TA/V reverts to command mode. All data in the ISDN TA/V's buffers is lost.

\K1 A break character will be sent with all data in the ISDN TA/V's buffers being discarded. The ISDN TA/V however remains in data mode.

\K2 An expedited break occurs each time the **BREAK** key is pressed. A break is immediately sent and the ISDN TA/V reverts to command mode. All data in the ISDN TA/V's buffers is held there until the ISDN TA/V reverts to data mode, at which time the buffered data is transmitted down the line.

\K3 A break character is sent, the ISDN TA/V remains in data mode and sends the data within its buffers.

\K4 A non-expedited break occurs each time the **BREAK** key is pressed. The data within the ISDN TA/V's buffers is sent to the remote ISDN TA/V before the break character is sent. The ISDN TA/V will then revert to command mode.

\K5 The data within the ISDN TA/V's buffers is sent to the remote ISDN TA/V, followed by the break character, although the ISDN TA/V remains in data mode.

15.4 Command Character Echo

The **E** command is used to determine whether command characters typed at your computer/terminal are echoed to your screen.

E0 Disables echo to the DTE.

E1 Enables echo to the DTE.

15.5 Defining the Command Terminator Key

The keyboard character used to action a command is defined within S-Register S3 using the ASCII value of the required character. This can be altered using the command **S3=*n*** where **n** is a value from 0 to 127.

The default setting for the terminator character is **S3=13**, 13 being the ASCII value of the carriage return key.

15.6 Defining the Backspace Character Key

The keyboard character used to action a backspace within a command line (move the cursor to the left and erase the previous character) is defined within S-Register S5 using the ASCII value of the required character. This can be altered using the command **S5=*n*** where **n** is a value from 0 to 127.

The default setting for the backspace character is **S5=08**, 08 being the ASCII value of the backspace key.

15.7 Defining the Line-Feed Character Key

A line feed is the character used by the ISDN TA/V to make its output readable when the response codes are configured to be given in text format (see **Section 13.5**). The keyboard character used to action a line feed is defined within S-Register S4 using the ASCII value of the required character. This can be altered using the command **S4=*n*** where **n** is a value from 0 to 127.

The default setting for the line feed character is **S4=10**, 10 being the ASCII value of the line-feed key.

15.8 ISDN TA/V Response (Result) Codes and Extended Response Codes

As described in **Section 13.5**, the format and type of response codes which will be sent from the ISDN TA/V to your computer/terminal is dependent on the settings of the **Q**, **X**, and **V** commands. Refer to **Section 13.5** for a full description of these commands and the options that they provide.

15.9 V.25bis Command-Mode Format

When the ISDN TA/V is using a configuration which requires V.25bis dialing commands (according to the **&M** or **&Q** command setting) as opposed to AT commands, the format of these commands is dictated by the value of S-Registers S62, S63 and S64.

15.9.1 ASCII or EBCDIC Code Format

S-Register S62 is used to identify to the ISDN TA/V the type of character coding used by the DTE while in V.25bis command mode:

S62=0	Specifies that ASCII character code will be used.
S62=1	Specifies that EBCDIC character code will be used.

15.9.2 Defining the V.25bis Idle Character

S-Register S63 is used to identify to the ISDN TA/V the type of idle fill used by the DTE while in HDLC V.25bis command mode: **S63=0** represents a Mark and S63=1 represents a Flag.

15.9.3 Defining the V.25bis Line Terminator Character

S-Register S64 is used to identify to the ISDN TA/V the line terminator character used by the DTE while in V.25bis command mode:

S64=0	Carriage return + line feed characters.
S64=1	Carriage return character.
S64=2	Line feed character.

15.10 The ISDN TA/V's Response to Valid and Invalid Commands

When the ISDN TA/V is configured to respond to AT commands, using one of the Q command settings described in **Section 13.5**, it will respond to valid and invalid commands according to the value of S-Register S84.

S84=0	Normal response codes are enabled.
S84=1	The ISDN TA/V will respond to an AT command with OK, irrespective of whether the AT command was valid or not.
S84=2	The ISDN TA/V will respond to any AT command with OK, but will not implement those that would normally result in a change to a configuration.

15.11 Audible Alert Control

The **&B** command is used to determine whether a buzzer is sounded whenever the ISDN TA/V's front-panel LCD displays an important message.

&B0	The buzzer is disabled.
&B1	An audible alert will sound to bring attention to call progress events displayed on the LCD.
&B2	An audible alert will sound to bring your attention to all events displayed on the LCD.

15.12 Reverting to Power-Up Configuration Settings

The **Z** command resets the ISDN TA/V, loading the configuration settings stored in the power-up configuration location, in non-volatile memory:

ATZ<CR>

Note that using this command clears the command buffer, and therefore any commands which follow the Z in a command line are ignored.

15.13 Unit Identification Commands

The **I** commands are used to check the ISDN TA/V's hardware and software identify codes.

I0	Displays the ISDN TA/V product code. This code is held within S-Register S38, and can be changed to allow compatibility with certain software packages
I1	Requests that a checksum of the ISDN TA/V's firmware ROM is performed. The response is displayed as two sets of four hexadecimal digits, separated by a colon,. e.g., **124A:3FC6**
I2	Instructs the ISDN TA/V to validate that the firmware checksum is correct by comparing it with a stored value. Note that due to the time taken to calculate the checksum, the ISDN TA/V response may take up to 10 seconds, and will be in the format of **OK** or **ERROR**.
I3	Displays the serial number of the ISDN TA/V.
I4	Displays the model/product number of the ISDN TA/V.
I5	Displays the part number of the ISDN TA/V's main circuit board.
I6	Displays the part number of the ISDN TA/V's firmware.
I7	Displays the name of the ISDN TA/V as an ASCII string.

16. ISDN Line-Dialing Characteristics

This chapter focuses on the AT commands and S-Register settings that affect the dialing characteristics of your ISDN TA/V over the line. The existing setting for an S-Register can be displayed using the **ATS*n*?<CR>** command (where **n** is the S-Register number you are interested in).

The factory configurations have been designed so that appropriate settings for these commands are determined for you; however, if you need to alter any of them simply reference the appropriate command within this chapter and alter the ISDN TA/V's configuration accordingly. The settings of Factory 0 are shown in bold type with all other variants being shown in plain text. The **AT** prefix and **<CR>** suffix required when commanding the ISDN TA/V to alter a setting are omitted.

16.1 ISDN Line Transmission Rate

S-register S41 determines the transmission data rate over the ISDN line. By default this parameter is configured as S41=1, thereby enabling automatic sensing of the appropriate rate up to 64000 bps. In synchronous operating mode the setting of S41 dictates the DTE rate. In asynchronous mode the S41 setting dictates the asynchronous character rate down the line.

S41=1	Autosensing the data rate up to 64000 bps.
S41=32	V.110 rate set to 1200 bps.
S41=33	V.110 rate set to 2400 bps.
S41=35	V.110 rate set to 4800 bps.
S41=36	V.110 rate set to 7200 bps.
S41=37	V.110 rate set to 9600 bps.
S41=38	V.110 rate set to 8000 bps.
S41=39	V.110 rate set to 12000 bps.
S41=41	V.110 rate set to 16000 bps.
S41=42	V.110 rate set to 19200 bps.

S41=43	V.110 rate set to 32000 bps.
S41=44	V.110 rate set to 38400 bps.
S41=45	V.110 rate set to 48000 bps.
S41=46	V.110 rate set to 56000 bps.
S41=47	V.110 rate set to 64000 bps.

16.2 Enabling and Disabling Auto-Answer

The number of rings that the ISDN TA/V will wait before automatically answering a call is determined by the setting of S-Register S0. This can be altered using the command **S0=*n*** where **n** is a value from 0 to 255–This may be restricted according to the regulations of the country in which the ISDN TA/V is being used. The ring count is incremented every two seconds when a call is present.

To disable this automatic answering facility the value of this S-Register should be set to 0 (**S0=0**). The default setting is **S0=1**, indicating that (providing DTR is high on the ISDN TA/V's interface) the ISDN TA/V will automatically answer a call after the first ring.

16.3 Causes of a Disconnection

This section details the commands and S-Register settings that determine when your ISDN TA/V will disconnect a call.

16.3.1 No Answer Timer

The length of time, in seconds, that an originating ISDN TA/V waits for an answer from the remote modem or ISDN TA/V before abandoning the call is determined by the setting of S-Register S7. The default setting is **S7=40**, which can be altered using the command **S7=*n*** where **n** is a value from 1 to 255 seconds. This range of values will be restricted according to the regulations of the country in which the ISDN TA/V is being used. Entering a restricted value will result in an error message being displayed.

16.3.2 Enabling/Disabling the Fast Disconnect Facility

During a normal disconnect sequence your ISDN TA/V will ensure that its data buffers are emptied before dropping the call. When you issue a disconnect command, fast disconnect drops the call immediately without first emptying the data buffers. Whether fast disconnection or normal disconnection is used by your ISDN TA/V is dependent on the setting of S-Register S85.

S85=0	Normal disconnection takes effect.
S85=1	The fast disconnection facility is used.

16.3.3 Disconnecting on Receipt of a Long Space Character

The **Y** command setting determines the action your ISDN TA/V will take if it detects a long space character. A long space is the equivalent of a break which has a duration of 2 or more seconds. Long space disconnect should be disabled in synchronous data mode.

Y0	Long spaces are ignored.
Y1	The ISDN TA/V disconnects if a long space is detected. Transmission of long spaces is enabled.

16.3.4 No Data Disconnection Timer

The **\T** command is used to determine the time, in 1-minute increments, that the ISDN TA/V will allow a line to remain open while no data traffic is being passed down it.

\T0	Disables the no data disconnect timer.
\T*n*	The line will be disconnected if no data is detected for the period specified by **n**, which can be set between 1 and 255 minutes.

17. Error Correction, Flow Control, Data Compression, Rate Adaption

This chapter addresses the AT commands and S-Register settings that affect the method of error correction and flow control used by your ISDN TA/V. Use the **ATS*n*?<CR>** command (where **n** is the S-Register number you're interested in) to display the existing S-Register setting.

The factory configurations have been designed so that appropriate settings for these commands are determined for you; however, if you need to alter any of them simply reference the appropriate command within this chapter and alter the ISDN TA/V's configuration accordingly. The settings of Factory 0 are shown in bold type with all other variants being shown in plain text. The **AT** prefix and **<CR>** suffix required when commanding the ISDN TA/V to alter a setting are omitted.

17.1 Defining Whether Error Compression, and/or Rate Adaption Will Be Used

Defined using the **\N** command. The type of error correction protocol used by your ISDN TA/V, and whether rate adaption is implemented or not, must be configured to be compatible with that used by the remote ISDN TA/V, and in the majority of cases **\N10** will prove to be the optimum setting. However, if this option is not compatible with the remote device, you will have to select the appropriate setting from the list below. If you do not know which protocol the remote device is configured to use, and have tried to establish a connection using the default value but found it to be unsuccessful, contact the operator of the remote modem for assistance.

\N8	Strict V.110 rate adaption is employed with a maximum asynchronous data rate of 19200 bps.
\N9	V.110 rate adaption is employed with a maximum asynchronous data rate of 38400 bps.
\N10	V.110 rate adaption with an asynchronous data rate up to 38400 bps, or V.42bis error correction and data compression if it is negotiated.

The maximum synchronous data rate is always 64000 bps. Selecting V.110 rate adaption or V.42bis error correction is made by reconfiguring the **\N** command in combination with S-register S41 (see **Section 16.1**).

If this command is altered while the ISDN TA/V is on-line, it does not take effect until after the call has been cleared.

17.1.1 Error-Correction Negotiation Buffer

The **\C** command setting determines whether the answering ISDN TA/V stores received data in its memory buffers during the interval that an error-correction protocol is being negotiated between the two devices.

\C0	No data is buffered during the error-correction negotiations. Spurious data which the remote device sends to establish the link may be passed to the DTE.
\C1	Received data is stored within the ISDN TA/V's buffers during the negotiations.
\C2	No buffering of data occurs during the link negotiations, and the ISDN TA/V switches to buffer mode when an error correction cancel character is received. This option is best used if both error-correcting and non-error-correcting modems frequently call your ISDN TA/V, and you want to speed up the connection time with non-error-correcting ISDN TA/Vs by avoiding the error-correction negotiations.

17.1.2 Defining an Error-Correction Cancel Character

This feature is only referenced if the **\C** command is defined as **\C2**. The error-correction cancel character enables the remote ISDN TA/V user to stop the error-correction negotiations between the data-communication devivces, by simply pressing a keyboard key. The ISDN TA/Vs will then connect in non-error-correcting buffer mode.

The keyboard character that will be recognised by your ISDN TA/V as the error-correction cancel character is defined by the **%A** command setting, using the ASCII value of the required character. The default setting is **%A13**; the numeral 13 being the ASCII value of the carriage-return key.

When comparing incoming characters for a match against the error correction cancel character, your ISDN TA/V ignores parity and passes the matching character to the DTE as data.

17.2 V.42bis Data-Compression Characteristics

Only used on links which are using the LAPM error-correction protocol, V.42bis data compression can increase the throughput rate of data by up to 300%. The **"H** command setting determines whether V.42bis data compression is used or not.

"H0	V.42bis compression is disabled.
"H1	V.42bis compression is only actioned on transmitted data.
"H2	V.42bis compression is only actioned on received data.
"H3	V.42bis compression is actioned on both the transmitted and received data.

It should be noted that data which has already been compressed (by a software program for example) may experience a slight decrease in throughput speed when V.42bis data compression is enabled. This slowdown will however be hardly noticeable; it is therefore recommended that this compression technique is always enabled.

17.3 Flow-Control Characteristics (XON/XOFF)

Defined using the **\Q** and **\G** commands. The type of flow control you should use on a given communication link is normally dictated by the requirements of the service you're connecting to, and whichever of the two methods your ISDN TA/V is configured to use must also be configured into the operational settings of your communication software program.

\Q0	ISDN TA/V to DTE flow control is disabled.
\Q1	Enables bidirectional software flow control, governed by XON/XOFF characters from the ISDN TA/V or the DTE. An XOFF character stops the flow of data. XON restarts it.
\Q2	Enables unidirectional hardware flow control from the ISDN TA/V to the DTE. The CTS signal being dropped stops data flow, and CTS on restarts it.

\Q3	Enables bidirectional RTS/CTS hardware flow control. Dropping RTS/CTS stops data flow. Raising RTS/CTS restarts it.
\Q4	Enables unidirectional software flow control from the ISDN TA/V to the DTE, using XON/XOFF characters.
\Q5	Enables unidirectional software flow control from the DTE to the ISDN TA/V, using XON/XOFF characters.
\Q6	Enables unidirectional hardware flow control from the DTE to the ISDN TA/V, using RTS signal.

17.3.1 XON/XOFF Pass-Through Control

Where flow control of the ISDN TA/V is controlled from the local DTE using XON/XOFF characters (**\Q1** or **\Q5** is set), the **\X** command setting determines whether these flow-control characters are passed over the line to the remote device or not.

\X0	The ISDN TA/V performs flow control according to the XON/XOFF characters received from the DTE, but doesn't pass these characters through to the remote device.
\X1	The ISDN TA/V performs flow control and passes the XON/XOFF characters to the remote device.

The setting of this command is ignored if the connected ISDN TA/Vs are configured to use an error-correction protocol, since the error correction routine automatically handles flow control between the two devices.

17.4 Buffer Disconnect Timer

S-Register S49 determines, in seconds, how long the ISDN TA/V will continue to try to send data which is in its transmit buffers, after being locally commanded to disconnect. This timer also applies to data in the receive buffers when the ISDN TA/V is commanded to disconnect from a remote site.

The default value for this timer is **S49=10**, allowing ten seconds for the ISDN TA/V to empty its transmit or receive buffers before disconnecting. This value may be altered using the **S49=*n*** command, where **n** is a value from 0 to 255. Setting a value of 0 will force an immediate disconnect (data within the ISDN TA/V's buffers will be discarded).

18. V.25bis Dialing Commands

V.25bis is an ITU communication standard which defines a means of initiating communications synchronously or asynchronously over a PSTN or ISDN line.

V.25bis provides an alternative method of originating and answering calls when the communication environment calls for it. For example, when the ISDN TA/V has been configured for V.25bis operation, you use the commands supported by this standard to dial an ISDN number (similar to using the AT command **D**), store numbers (similar to the AT command **&Z*n*=x**), or dial the number stored (similar to the AT command dial modifier **DS=*n***).

The following chapter discusses those V.25bis commands supported by your ISDN TA/V, and the response to those commands.

18.1 Call Request Commands

Call request commands are issued from the DTE to the ISDN TA/V and are responsible for initiating any dial calls. Call request commands include call request with number provided (**CRN**), and call request with stored memory address provided (**CRS**).

18.1.1 Call Request with Number Provided (CRN)

The **CRN** command dials the ISDN number entered from the DTE. CRN is similar to the **ATD** command. The CRN command format is:

CRN*n* Where **n** is the ISDN number to be dialed.

18.1.2 Call Request with Stored Memory Address Provided (CRS)

The **CRS** command dials the ISDN number stored in the request directory location. CRS is similar to the **ATDS** command. The CRS command is:

CRS*x* Where **x** is directory location 1-20.

The ISDN TA/V responds to the command with either a **VAL** (valid) or **INV** (invalid) response followed by a call progress report such as connect (**CNX**) or failure (**CFI**).

18.2 Call Responses

A call response indicates if the command was accepted by the ISDN TA/V. Call response includes call failure indication (**CFI**) and call connecting (**CNX**).

18.2.1 Call Failure Indication (CFI)

The **CFI** response is issued to the DTE if the ISDN TA/V fails a **CRN** or **CRS** command. **CFI** is similar to the AT result codes **BUSY**, **NO ANSWER**, **NO CARRIER**, **NO DIALTONE**, and **ERROR**. The **CFI** response is:

CFI*xx* Where **xx** is:

- ET Engaged tone. Is similar to the result code BUSY.
- NS Number not stored. Is similar to the result code ERROR.
- CB Local DCE busy. Is similar to the result code ERROR.
- RT Timeout on ring tone. Is similar to the result code NO CARRIER.
- AB Abort call on-timeout. Is similar to the result codes NO DIALTONE and ERROR.
- NT Answer tone not detected. Is similar to the result code NO ANSWER.
- FC Forbidden call. Is similar to the result code ERROR.

18.2.2 Call Connecting Response (CNX)

The CNX response informs the DTE that the ISDN TA/V has connected to the remote ISDN TA/V. CNX is similar to the AT result code CONNECT. The CNX response format is CNX.

18.3 Call Answer Commands

18.3.1 Incoming Call Response (INC)

The **INC** response informs the DTE that the ISDN TA/V has detected a ring tone. At this point, the DTE can issue the **DIC** command to disable the ISDN TA/V from answering the call. **INC** is similar to the AT result code **RING**.

18.3.2 Disregarding an Incoming Call (DIC)

The **DIC** command prevents the ISDN TA/V from answering an incoming call. This command is only valid once the DTE receives an incoming call (**INC**) response from the ISDN TA/V. A **DIC** must be issued within 5 seconds of receiving an **INC**. The **DIC** command format is **DIC**.

If **DIC** is issued within 5 seconds, the ISDN TA/V sends the **VAL** response to the DTE. If **DIC** is issued after 5 seconds, **INV** is returned.

18.3.3 Connecting to an Incoming Call (CIC)

The **CIC** command forces the ISDN TA/V to cancel any **DIC** commands and answer an incoming call. This command is only valid when the DTE issues a **DIC** command. **CIC** must be issued within 10 seconds after sending a **DIC**. **CIC** is similar to the **ATA** command.

If **CIC** is issued within 10 seconds, the ISDN TA/V sends the **VAL** response to the DTE. If **CIC** is issued after 10 seconds, **INV** is returned.

18.4 Storing Numbers In Memory (PRN)

The **PRN** command allows the DTE to enter and store a number to a specific directory location. **PRN** is similar to the **AT&Z** command. The **PRN** command format is:

PRN*x;n*	Where **x** is the directory location 1-20 and **n** is the ISDN number to be stored.

18.5 Requesting a List of Stored Numbers (RLN)

The **RLN** command displays numbers stored in the ISDN TA/V's directory location. If the **RLN** command is entered without specifying a directory location, then all directory locations and their numbers display. If a directory location is entered, then only that number displays. The **RLN** command format is:

RLN	Which displays all directory locations, or
RLN*x*	Where **x** is a directory location.

18.6 List Stored Number Response (LSN)

LSN is a response to an **RLN** command issued by the DTE. If a directory location is specified, then the ISDN number for that location is displayed. If no directory location is specified, then all ISDN numbers stored in memory are displayed. The LSN response format is:

LSN*x*;*n*	Where **x** is the directory location and **n** is the ISDN number.

18.7 Command Responses

A **VAL** or **INV** command response indicates that the command entered was respectively either a valid or invalid entry.

The **VAL** response indicates that the ISDN TA/V has accepted the V.25bis command issued by the DTE. **VAL** is similar to the AT result code **OK**.

The **INV** response indicates that the ISDN TA/V has received an incorrect V.25bis command from the DTE. **INV** is similar to the AT result code **ERROR**. The **INV** response format is:

INV*xx*	Where **xx** is either:	
	CU	Command unknown
	MS	Message syntax error
	PS	Parameter syntax error
	PV	Parameter value error

18.8 Reverting to AT Command (BAK)

The **BAK** command is used to revert from V.25bis command mode to AT command mode. Note that when the ISDN TA/V is in AT command mode it will not accept V.25bis commands. To revert to V.25bis command mode an appropriate data transmission mode command must be issued (see **Section 14.1** for details).

Appendix A — DTE Pin Assignments and Connecting Cables

Your ISDN TA/V is equipped with a serial interface marked **DTE**, which physically presents the characteristics of a DCE and supports any of the ITU recommendations V.24/V.28, X.21/V.11, and V.36, according to the wiring configuration of the connected cable.

X.21/V.11 Interface Characteristics

Pinning for a cable to connect the DTE interface to a KiloStream service or X.21/V.11 device supporting speeds up to 64000 bps is specified below:

DB25 Male Connector Pin Number	Signal name	DB15 Male Connector Pin Number
2	Transmit Data A (TXDA)	2
3	Receive Data A (RXDA)	4
7	Signal Ground	8
12	Interface automatic identifier	
13	Indicate B (INDB)	12
14	Transmit Data B (TXDB)	9
15	Indicate A (INDA)	5
16	Receive Data B (RXDB)	11
17	Clock A (CLKA)	6
19	Clock B (CLKB)	13
23	Control B (CTRLB)	10
24	Control A (CTRLA)	3

V.24/V.28 Interface Characteristics

One cable for is included with your ISDN TA/V for connecting the DTE interface to a V.24/V.28 device supporting data rates up to 19200 bps. The pinning for that cable is shown below:

DB25 Male Connector Pin Number	Signal name	DB25 Female Connector Pin Number
2	Transmit Data (TXD 103)	2
3	Receive Data (RXD 104)	3
4	Request To Send (RTS 105)	4
5	Clear To Send (CTS 106)	5
6	Data Set Ready (DSR 107)	6
7	Signal Ground (102)	7
8	Data Carrier Detect (DCD 109)	8
15	Transmit Clock (TXCLK 114)	15
17	Receive Clock (RXCLK 115)	17
18	Analogue Loop test (141)	18
20	Data Terminal Ready (DTR 108)	20
21	Remote Digital Loop test (140)	21
22	Ring Indicator (RI 125)	22
24	External Clock (EXCLK)	24
25		25

V.36 Interface Characteristics

The required cable when connecting the DTE interface to a KiloStream service or device supporting V.36 interface characteristics at a data rate of up to 48000 bps is:

DB25 Male Connector Pin Number	Signal name	34-pin M-Block Female Connector Pin Number
2	Transmit Data A (TXDA 103)	P
3	Receive Data A (RXDA 104)	R
4	Request To Send (RTS 105)	C
5	Clear To Send (CTS 106)	D
6	Data Set Ready (DSR 107)	E
7	Signal Ground (102)	B
8	Data Carrier Detect (DCD 109)	F
11	Interface automatic identifier	
13	Serial Clock Transmit B (SCTB 114)	AA
14	Transmit Data B (TXDB 103)	S
15	Serial Clock Transmit A (SCTA 114)	Y
16	Receive Data B (RXDB 104)	T
17	Serial Clock Receive A (SCRA 115)	V
18	Analogue Loop test (141)	
19	Serial Clock Receive B (SCRB 115)	X
20	Data Terminal Ready (DTR 108)	H
21	Remote Digital Loop test (140)	
22	Ring Indicator (RI 125)	
24	External Clock (EXCLK)	
25		

Appendix B — AT Command Summary

AT commands are issued from an asynchronous DTE, such as a PC, and are used to control the ISDN TA/V's operating and software configuration. They can be issued from the DTE interface attached computer, or from a dedicated terminal/computer attached to the **CONTROL** port. All commands issued to the **CONTROL** interface will be actioned immediately. Commands issued via the DTE interface can only be actioned when the ISDN TA/V is off-line or in command mode, and only when the DTE interface is configured to accept AT commands (see **&M** or **&Q** command settings).

This appendix is a listing of all the AT commands which effect your ISDN TA/V. It details every value that each command can be set to, and highlights the setting for Factory configuration 0 in bold text.

Cmd	Section	Description
AT	11.4.1	Attention command prefix. Indicates a command string has started and determines the DTE's data rate and communications format.
A/	11.4.5	Repeat last command string. This command must not be preceded by the AT prefix or followed by the command terminator key.
A	13.4	Answer mode. ISDN TA/V goes off-hook and attempts to establish a connection without waiting for a ring.
Dn	13.1	Dial. Instructs the unit to dial the number entered for **n**.
DNn	13.2.5	Dial the ISDN number stored in directory location **n** (from 1 to 20).
En	15.4	Command character echo, where **n** is:
		E0 Disables echo to the DTE.
		E1 Enables echo to the DTE.
H	13.3	On-hook command. Used to disconnect the ISDN TA/V from the ISDN line.

Cmd	Section	Description	
In	15.13	ISDN TA/V identification, where **n** is:	
		I0	Displays the ISDN TA/V product code.
		I1	Requests a checksum of the ISDN TA/V's firmware ROM.
		I2	Validates the firmware checksum.
		I3	Displays the ISDN TA/V serial number.
		I4	Displays the model/product number.
		I5	Displays the part number of main circuit board.
		I6	Displays the part number of the firmware.
		I7	Displays the ISDN TA/V's name as an ASCII string.
O	11.5.1	Return to data mode from on-line command mode.	
Qn	13.5	Response code facility, where **n** is:	
		0	Enables response codes.
		1	Disables response codes.
		2	Enables the originate ISDN TA/V only to send response codes to the DTE. Required for most UNIX applications.
Sn?	14	Display value of S-Register where n is the register number.	
Sn=x	15	Change S-Register. Alters the S-Register value where **n** is the register number and x is the new value.	
Vn	13.5	Response code format, where **n** is:	
		0	Displays response codes in numeric format.
		1	Displays response codes in text format.

Cmd	Section	Description
Xn	13.5	Extended response codes; dial tone detection and busy tone detection, where n is:
		0 Disables response codes 5-27.
		1 Enables response codes 5-16.
		2 Enables response codes 5-16.
		3 Enables response codes 5-16.
		4 Enables response codes 5-16.
		5 Adds EC suffix to response codes (20-27) if error correction is used.
		6 Adds either V.42 or MNP suffix to response codes (20-27) if data compression is used.
Yn	167.3.3	Long space disconnect, where **n** is:
		0 Long spaces are ignored.
		1 The ISDN TA/V disconnects if a long space is detected. Transmission of long spaces is enabled.
Zn	12.2.1	Load a user defined configuration as the active configuration, where **n** is:
		0 Loads the power-up configuration as the active configuration.
		1 Loads User 1 as the active configuration.
		2 Loads User 2 as the active configuration.
&Bn	15.11	Audible alert control, where **n** is:
		0 Buzzer is disabled.
		1 An alert sounds to bring your attention to call progress events displayed on the LCD.
		2 An alert sounds to bring your attention to all events displayed on the LCD.

Cmd	Section	Description
&Cn	14.5.6	DCD control, where **n** is:
		0 DCD is forced on at all times.
		1 Standard RS232 signaling where DCD is on when the remote ISDN TA/V's carrier signal is detected, and off when it is not detected.
		2 DCD is normally forced on although it turns off for approximately one second when the carrier is disconnected.
		3 DCD follows the state of DTR.
		4 Simulated control carrier. The state of DCD follows the state of the remote ISDN TA/V's RTS.
		5 DCD follows the state of DTR except when disconnecting a call; in which case DCD goes off to signal the disconnection while DTR remains on.
&Dn	14.5.1	DTR control, where **n** is:
		0 ISDN TA/V ignores the true status of DTR and treats it as always ON.
		2 User controlled. DTR is controlled by the DTE.
&Fn	12.2.1	Load a factory default configuratin as the active configuration, where **n** is:
		0 Loads Factory 0 as the active configuration.
		1 Loads Factory 1 as the active configuration.
		2 Loads Factory 2 as the active configuration.
		3 Loads Factory 3 as the active configuration.

Cmd	Section	Description
&Mn	14.1	Data transmission mode selection, where **n** is: **0** Asynchronous mode using AT commands. 1 Synchronous mode using AT commands. 2 Sync operating mode where the ISDN TA/V dials the number stored in directory location 1 when the DTR signal (or Control) turns off then on, on the DTE interface. 231 Asynchronous mode, AT command set disabled. 232 Asynchronous mode using asynchronous V.25bis command of the ISDN TA/V. 233 Synchronous mode using bisynchronous V.25bis command of the ISDN TA/V. 234 Synchronous mode using HDLC V.25bis command of the ISDN TA/V. 236 Synchronous mode with the AT command set disabled. 4 Asynchronous operating mode where the ISDN TA/V dials the number stored in directory location 1 when the DTR signal turns off then on, on the DTE interface.
&N	13.2.2	Display the dialing directory contents.
&N99	13.2.3	Delete the dialing directory contents.
&Qn	14.1	Same effect and options as the &M command.
&Rn	514.5.3	RTS control, where **n** is: 0 Normal RS-232 signaling. **1** RTS is ignored. 2 Simulated control carrier. RTS input controls the remote ISDN TA/V's DCD signal using simulated control carrier.

&Sn	14.5.2	DSR control, where n is:	
		0	DSR is forced on at all times.
		1	Normal RS-232 signaling is respected.
		2	DSR is turned off for 1 or 2 seconds upon a disconnection.
		3	The status of DSR follows DTR.
		4	The ISDN TA/V operates as per standard RS-232 signaling except that DSR comes on immediately when the ISDN TA/V has established the physical connection to the remote device.
		5	The ISDN TA/V operates as per standard RS-232 signaling except that DSR comes on when the ISDN TA/V goes into data mode.
&Vn	12.3	Display the active configuration.**&V** displays the configuration's main characteristics Where **n** is:&	
		1	Displays command settings relating to all screens.
		2	Displays command settings relating to the user interface.
		3	Displays command settings relating to the user commands.
		4	Displays command settings relating to the dialing, answering and clearing a call.
		5	Displays command settings relating to the ISDN line.
		7	Displays command settings relating to the protocol/buffer used.

Cmd	Section	Description
&Wn	12.4.2	Save the active configuration to memory. **&W** stores it as the power-up configuration. Where **n** is: 1 Stores the active configuration in User 1. 2 Stores the active configuration in User 2.
&Zn=x	13.2.1	Store ISDN numbers. The ISDN TA/V saves in directory location n (1 to 20) the numbers and associated dialing modifies entered for x (up to 40 characters). To clear a single ISDN directory location, use the same command so that n identifies the directory location to be cleared, but enter nothing for x.
\Bn	14.4.1	Number of data bits, where **n** is: 0 Seven data bits. **1** Eight data bits. 2 Nine data bits. 3 Six data bits.
\Cn	17.1.1	Early data buffered, where **n** is: **0** No data is buffered during the error-correction negotiations. 1 Received data is stored within the ISDN TA/V's buffers during the negotiations. 2 No buffering of data occurs during the link negotiations, ISDN TA/V switches to buffer mode when an error-control fallback is received.

Cmd	Section	Description	
\Dn	14.5.4	CTS control, where **n** is:	
		0	CTS is forced on at all times.
		1	Normal RS-232 signaling. CTS is always on when the ISDN TA/V is off-line, CTS follows RTS when on-line.
		2	CTS is turned off for 1 or 2 seconds upon a disconnection.
		3	The state of CTS follows the state of DTR.
\Kn	15.3	AT escape by break, where **n** is:	
		0	A destructive break occurs each time the **BREAK** key is pressed. The break character is immediately sent and the ISDN TA/V reverts to command mode, all data within the ISDN TA/V's buffers is lost.
		1	The break character will be sent with all data in the ISDN TA/V's buffers being discarded. The ISDN TA/V however remains in data mode.
		2	An expedited break occurs each time the **BREAK** key is pressed. The break character is immediately sent and the ISDN TA/V reverts to command mode. All data within the ISDN TA/V's buffers is held there until the ISDN TA/V reverts to data mode, at which time the buffered data is transmitted down the line.
		3	The break character is sent, the ISDN TA/V remains in data mode and sends the data within its buffers.
		4	A non-expedited break occurs each time the **BREAK** key is pressed. The data within the ISDN TA/V's buffers is sent to the remote ISDN TA/V before the break character is sent. The ISDN TA/V will then revert to command mode.

Cmd	Section	Description	
\Kn	15.3	**5**	The data within the ISDN TA/V's buffers is sent to the remote ISDN TA/V, followed by the break character, although the ISD TA/V remains in data mode.
\Nn	17.1	Error-correction mode, where **n** is:	
		8	Strict V.110 rate adaption is employed with a maximum asynchronous data rate of 19200bps.
		9	V.110 rate adaption is employed with a maximum asynchronous data rate of 38400bps.
		10	V.110 rate adaption with an asynchronous data rate up to 38400bps, or V.42bis error correction and data compression if it is negotiated.
\Pn	14.4.2	Parity bits, where **n** is:	
		0	None.
		1	Even parity.
		2	Odd parity.
		3	Mark.
		4	Space.
\Qn	17.3	Flow control, where **n** is:	
		0	ISDN TA/V to DTE flow control is disabled.
		1	Bidirectional software flow control is enabled using XON/XOFF characters.
		2	Enables unidirectional hardware flow control from the ISDN TA/V to the DTE.

Cmd	Section	Description	
\Qn	17.3	**3**	Bidirectional RTS/CTS hardware flow control is used.
		4	Enables unidirectional software flow control from the ISDN TA/V to the DTE, using XON/XOFF characters.
		5	Enables unidirectional software flow control from the DTE to the ISDN TA/V, using XON/XOFF characters.
		6	Enables unidirectional hardware flow control from the DTE to the ISDN TA/V, using RTS signal.
\Rn	14.3	Default async speed on the DTE.	
		0	57600 bps
		1	38400 bps
		2	19200 bps
		3	14400 bps
		4	12000 bps
		5	9600 bps
		6	7200 bps
		7	4800 bps
		8	2400 bps
		9	1200 bps
		10	600 bps
		11	300 bps
		13	115200 bps

Cmd	Section	Description
\Sn	14.4.3	Number of stop bits, where **n** is: **0** One stop bit. 1 Two stop bits.
\Tn	16.3.4	No data disconnect timer. The value of n defines the no data disconnect time in 1-minute increments between 1 and 255. A value of 0 disables the facility.
\Xn	17.3.1	XON/XOFF passthrough flow control. **0** XON/XOFF characters are not passed to the remote ISDN TA/V. 1 XON/XOFF characters are passed to the remote ISDN TA/V.
%An	17.1.2	Error correction cancel character. Where **n** is an ASCII value from 0 to 127, representing the required keyboard character.
"Hn	17.2	V.42bis data compression. 0 V.42bis data compression is disabled. 1 V.42bis data compression is only actioned on transmitted data. 2 V.42bis data compression is only actioned on received data. **3** V.42bis data compression is actioned on both the transmitted and received data.
+++	11.5	Data traffic interrupt.

Appendix C — S-Register Summary

S-Registers affect the operating parameters of your ISDN TA/V and are only applicable when the DTE dialer type configuration option is set for AT command (using the **&Q** or **&M** command).

To display the existing value of an S-Register type: **ATS*n*?<CR>** where **n** is the register number. To modify the value of an S-Register type: **ATS*n*=*r*<CR>** where **n** is the register number and **r** is the new value.

Reg	Section	Description	Default	Range
S0	16.2	Auto-answer ring number	1	0 = disabled, 1-255 rings.
S2	15.2	AT escape character	43	1-127 ASCII.
S3	15.5	Command terminator key	13	1-127 ASCII.
S4	15.7	Line feed character	10	1-127 ASCII.
S5	15.6	Backspace character	8	1-127 ASCII.
S7	16.3.1	Wait for answer time	40	1-255 seconds. Refer to details of restrictions imposed by the coutry of use.
S12	15.2.1	AT escape response timeout	50	0-255 in 20 millisecond jumps.
S18	10.7	Test timeout	0	0-255 seconds. 0 = disabled.
S26	14.5.5	RTS/CTS delay	0	0-255 10ths of a second.
S41	16.1	Data transmission rate	1	1 = 64000 autosensing, 32 = 1200, 33 = 2400, 35 = 4800, 36 = 7200, 37 = 9600, 38 = 8000, 39 = 12000,

(S-Register Summary, Cont.)

Reg	Section	Description	Default	Range
S41	16.1	Data Transmission Rate	1	41 = 16000, 42 = 19200. 43 = 32000, 44 = 38400. 45 = 48000, 46 = 56000, 47 = 64000.
S49	17.4	Buffer disconnect timer	10	1-255 (seconds), or 0 = immediate disconnect.
S62	15.9.1	V.25bis character coding	0	0 = ASCII, 1 = EBCDIC.
S63	15.9.2	V.25bis idle character	0	0 = Mark, 1 = Flag.
S64	15.9.3	V.25bis new line character	0	0 = CR+LF, 1 = CR, 2 = LF.
S84	15.10	AT command mode	0	0 = normal, 1 = no ERROR, 2 = no strap or ERROR.
S85	16.3.2	Fast disconnect	0	0 = normal, 1 = fast disconnect.

Appendix D — ASCII Character Code Chart

Decimal ASCII Value	Binary Value	Hex Value	Control Character	Key
000	00000000	00	NUL	CTRL-@
001	00000001	01	SOH	CTRL-A
002	00000010	02	STX	CTRL-B
003	00000011	03	ETX	CTRL-C
004	00000100	04	EOT	CTRL-D
005	00000101	05	ENQ	CTRL-E
006	00000110	06	ACK	CTRL-F
007	00000111	07	BEL	CTRL-G
008	00001000	08	BS	CTRL-H
009	00001001	09	HT	CTRL-I
010	00001010	0A	LF	CTRL-J
011	00001011	0B	VT	CTRL-K
012	00001100	0C	FF	CTRL-L
013	00001101	0D	CR	CTRL-M
014	00001110	0E	SO	CTRL-N
015	00001111	0F	SI	CTRL-O
016	00010000	10	DLE	CTRL-P
017	00010001	11	DC1	CTRL-Q
018	00010010	12	DC2	CTRL-R
019	00010011	13	DC3	CTRL-S
020	00010100	14	DC4	CTRL-T
021	00010101	15	NAK	CTRL-U
022	00010110	16	SYN	CTRL-V
023	00010111	17	ETB	CTRL-W
024	00011000	18	CAN	CTRL-X
025	00011001	19	EM	CTRL-Y
026	00011010	1A	SUM	CTRL-Z
027	00011011	1B	ESC	CTRL-[
028	00011100	1C	FS	CTRL-/
029	00011101	1D	GS	CTRL-]
030	00011110	1E	RS	CTRL-^
031	00011111	1F	US	CTRL-_
032	00100000	20	SP	Spacebar

Decimal ASCII Value	Binary Value	Hex Value	Control Character	Key
033	00100001	21		!
034	00100010	22		“
035	00100011	23		#
036	00100100	24		$
037	00100101	25		%
038	00100110	26		&
039	00100111	27		‘
040	00101000	28		(
041	00101001	29		)
042	00101010	2A		*
043	00101011	2B		+
044	00101100	2C		,
045	00101101	2D		-
046	00101110	2E		.
047	00101111	2F		/
048	00110000	30		0
049	00110001	31		1
050	00110010	32		2
051	00110011	33		3
052	00110100	34		4
053	00110101	35		5
054	00110110	36		6
055	00110111	37		7
056	00111000	38		8
057	00111001	39		9
058	00111010	3A		:
059	00111011	3B		;
060	00111100	3C		<
061	00111101	3D		=
062	00111110	3E		>
063	00111111	3F		?
064	01000000	40		@
065	01000001	41		A
066	01000010	42		B
067	01000011	43		C
068	01000100	44		D
069	01000101	45		E
070	01000110	46		F

Decimal ASCII Value	Binary Value	Hex Value	Control Character	Key
071	01000111	47		G
072	01001000	48		H
073	01001001	49		I
074	01001010	4A		J
075	01001011	4B		K
076	01001100	4C		L
077	01001101	4D		M
078	01001110	4E		N
079	01001111	4F		O
080	01010000	50		P
081	01010001	51		Q
082	01010010	52		R
083	01010011	53		S
084	01010100	54		T
085	01010101	55		U
086	01010110	56		V
087	01010111	57		W
088	01011000	58		X
089	01011001	59		Y
090	01011010	5A		Z
091	01011011	5B		[
092	01011100	5C		\
093	01011101	5D		]
094	01011110	5E		^
095	01011111	5F		_
096	01100000	60		`
097	01100001	61		a
098	01100010	62		b
099	01100011	63		c
100	01100100	64		d
101	01100101	65		e
102	01100110	66		f
103	01100111	67		g
104	01101000	68		h
105	01101001	69		i
106	01101010	6A		j
107	01101011	6B		k
108	01101100	6C		l

Decimal ASCII Value	Binary Value	Hex Value	Control Character	Key
109	01101101	6D		m
110	01101110	6E		n
111	01101111	6F		o
112	01110000	70		p
113	01110001	71		q
114	01110010	72		r
115	01110011	73		s
116	01110100	74		t
117	01110101	75		u
118	01110110	76		v
119	01110111	77		w
120	01111000	78		x
121	01111001	79		y
122	01111010	7A		z
123	01111011	7B		{
124	01111100	7C		|
125	01111101	7D		}
126	01111110	7E		~
127	01111111	7F	DEL	Delete

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