

# **BOCA PRO16 RACK**

## ***Reference Guide***

**Product Code:**

**PRO16RK: Boca PRO16 Rack Chassis**

**PRO16RM: Boca PRO16 Rack Modem**

**PRO16RC: Boca PRO16 Rack Controller**

**PRO16RP: Boca PRO16 Rack Power Supply**



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## INTRODUCTION

Welcome to the *Boca PRO16 Reference Guide*, a comprehensive guide to the efficient use of your modem.

This reference manual provides all the information needed to make maximum use of your equipment and software.

### How to Use This Guide

The *Boca PRO16 Reference Guide* is divided into the following sections:

#### **Introduction**

- Provides you with an easy-to-understand guide to what's in this manual and how you can make the most of the information.

#### **Getting Started**

- A complete description about how to get started using your equipment, including basic details and more advanced topics.

#### **Testing**

- Details each of the many tests you can carry out to determine the working condition of your modem, the telephone line, or the remote modem.

#### **Error Correction**

- Examines and explains the error correction features, including V.42bis data compression, of your equipment.

#### **Security**

- Examines and explains the data security and encryption features of your equipment.

#### **Synchronous & Dumb Modes**

- Full details on how to use your modem for synchronous operations.

#### **Dumb Mode**

- Provides product specified information on Dumb Mode operation.



**V.25bis Operations**

- ❑ Describes how your modem implements V.25bis and how it interacts with AT commands.

**AT Commands**

- ❑ Provides a complete description of all commands available in your modem.

**S Registers**

- ❑ Introduces you to S Registers and how to use them.
- ❑ Contains a description of the available S Registers.

**Troubleshooting**

- ❑ Provides basic guidelines for solving problems.

**Sample Setups**

- ❑ Provides sample setups showing how commands can be combined.

**Appendices**

- ❑ The appendices contain useful lists, as well as an ASCII table.

**Glossary of Communications Terms**

- ❑ Provides descriptions of modem, facsimile and other communications terms.

## Conventions

Throughout this guide, we use certain symbols, type styles and conventions to help you. For example, you might find a line that looks like this:

- Type:  
ATI9 <E> (that is 'ATI9' not 'AT19')

What you actually type appears in a special typeface:

**ATI9**

Whatever appears on your screen will also be displayed in this manual in this special typeface—for example: messages:

**CONNECT**

When we want you to press the ENTER key, we use a symbol: <E> (which means 'and press ENTER')

On some keyboards the ENTER key is labelled RETURN. You press RETURN or ENTER, as appropriate for your keyboard. The same is true for keyboards showing a symbol, rather than RETURN or ENTER.

RETURN = ENTER

In some cases where the <E> symbol might be confusing, we will tell you to 'Press the ENTER key'.

When you see the bullet (•), it usually starts an action statement. We want you to take some specific action, such as:

- Switch your computer on
- Type:

**ATI9 <E>**

Note that we do not use a (.) full stop after an action statement. We do that to avoid confusion when you are asked to type commands and other information. When we list general information, we use a box (o), like this:

- How to begin dialing
- Using MNP for error-free communication

When we have special information we want you to take NOTE of, we use a pointing finger (☞), like this:

- ☞ Before proceeding, complete both copies of the Warranty form.

Information we want you to pay special attention to is placed in a WARNING box, like this:

**WARNING: Regulations require that the modem, when operating in originate mode, waits no longer than 30 seconds for a carrier to be detected from a remote modem**

DEFAULTS are settings which are preset in the factory. Default settings are indicated in this guide by the symbol: ■

For example, if the default was **AT&G0** in this list:

- AT&G0 Do not generate guard tones
- AT&G1 Generate Guard tones of 550Hz
- AT&G2 Generate Guard tones of 1800Hz

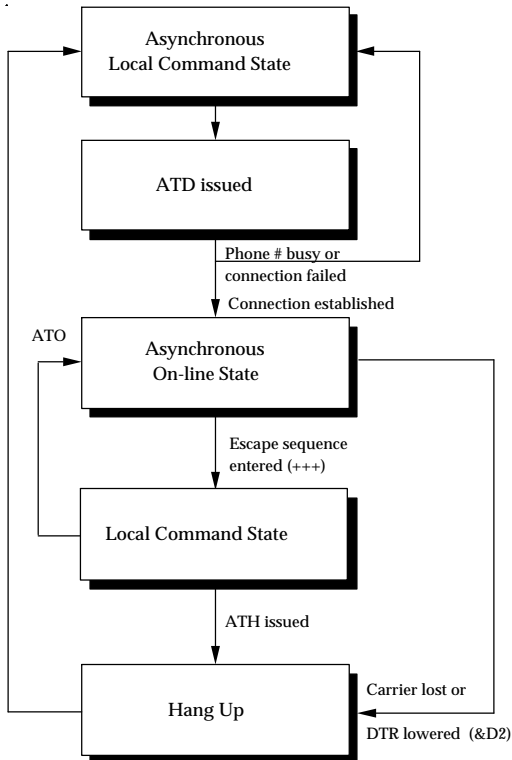
There is a Glossary at the back of this Reference Guide to assist you with unfamiliar words.

## GETTING STARTED

## Dialing

The AT commands may be used to initiate dialing with the modem. Your modem does not require a telephone handset to be connected to it in order to dial.

Getting Started



The **D** (Dial) command is used to initiate a telephone call. The most basic form of the **D** command is:

**ATD NUMBER**

where the number is the telephone number you are dialing. Having set your communications software for 2400 bps operation:

- Type:

**ATD01234 <E>**

Your modem will begin to dial.

☞ If your modem receives a character from your computer while dialing is being performed, it will immediately hang up, send a NO CARRIER response message to the computer and return to local command state.

After a few seconds the message CONNECT will appear on the screen.

If a NO CARRIER message appears, then your modem has not been able to make a connection. Check your communications software is set for 2400 bps operation and your modem is correctly connected to your computer and the telephone line. You may use the **A/** command to redial.

To hang up the modem, enter an escape sequence (+++). The modem will respond with an OK message.

- Type:

```
ATH <E>
```

The modem will hang up.

☞ Your computer must assert the DTR signal before dialing can start. Usually, this is done by your communications software. If the DTR signal is lowered at any stage of communications, after the **&D2** command has been issued, the modem will hang up and return to local command state. Interpretation of the DTR signal may be changed with the **&D** command.

## Dial Modifiers

Dial modifiers are characters than can be included in a phone number to make the modem perform special tasks while dialing.

For example, not all modem users will be using a dedicated telephone line. Some users will have their modems connected to PBXs. To allow users of PBXs to operate their modems successfully, dial modifiers are supported on the modem.

Most PBXs require you to dial 0 or 9 (in order to obtain an outside line) and wait for a dial tone before dialing the actual phone number.

Using dial modifiers, you can successfully dial the phone number 12345 through a PBX using the command:

```
ATD0,12345
```

The , (comma) dial modifier causes the modem to pause for a short time after dialing 0. This allows most PBXs sufficient time to obtain a line before dialing.

The factory default delay for the , modifier is two seconds. You may change the length of this delay if necessary. Its length is determined by the value in S Register 8.

Another method of making the modem wait for a dial tone is to include the W dial modifier. The W modifier causes the modem to examine the phone line to ensure a dial tone has been applied before dialing starts:

**ATD0W12345**

If the modem cannot detect a dial tone within the time specified by S Register 7, the modem will return to local command state and send a NO DIALTONE message to the computer (if either the **X2**, **X4**, or **X5** commands have been issued).

Due to differences with some older telephone exchanges, dial tone detection may not be possible with your modem. Your modem will only recognize dial tones between 200 Hz and 600 Hz.

If your telephone line supports tone dialing then a useful dial modifier is the T modifier. Inserting a T modifier before the number you are dialing causes the modem to tone dial that number. For example:

**ATDT12345**

This will cause the modem to dial the phone number 12345.

The modem also supports a P dial modifier which allows it to pulse dial. These modifiers may be placed at any point in the number you are dialing and they may be intermingled in the same number.

For example, your telephone line may be connected to a PBX that supports tone dialing internally, but only pulse dialing externally. You could overcome this problem by using the T and P dial modifiers in the following way:

**ATDT0,P12345**

The modem tone dials 0 to request an external line, waits for the PBX to obtain the line and then pulse dials 12345.

Although most telephone exchanges support tone dialing, there are still a few pulse only exchanges. If you can hear a continuous dial tone when you lift the handset, you will probably be able to tone dial. If you are in

any doubt, use pulse dialing. The modem will automatically pulse dial if you have not previously included either the **T** or **P** modifiers in your phone numbers. Exchanges that support tone dialing generally support pulse dialing as well.

More information about dial modifiers can be found in the Command Descriptions chapter of this guide.

☞ Pulse dialing may not be supported in New Zealand. Refer to your Installation Guide for details.

## Hanging Up

The **H** command is used to hang up the modem. After you have finished communicating with another computer you must hang up your modem. Similarly, you must hang up the phone after calling another person. If you don't, no one will be able to call you and you may even be charged for the length of time the phone was off the hook.

To hang up your modem:

- Type:

**ATH <E>**

The modem will return an OK response message.

## Stored Number Dialing

Your modem has the ability to store phone numbers which may be dialed at a later time. This is similar to 'abbreviated dialing', which may be supported by your telephone.

To store a phone number use the **&Z** command. For example:

- Type:

**AT&Z1=012345 <E>**

The phone number 012345 will be stored as phone number one.

The **S** dial modifier is used to dial a phone number that has been stored in your modem:

- Type:

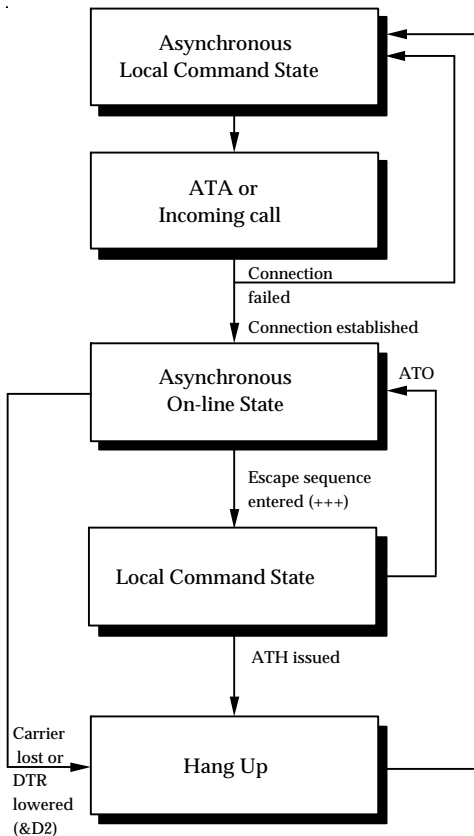
**ATDS=1 <E>**

The modem will dial stored phone number one.

Do not include an **AT**, **D** command, or **S** dial modifier in the stored phone number. If synchronous mode 2 is being used, the (semi-colon) dial modifier should not be included.

## Answering Calls

As well as dialing other modems, your modem can answer calls made to it by other modems.





Your modem is pre-configured to automatically answer any incoming call, provided it is switched on, is in local command state, DTR is high and is not performing a test. If you receive a call on the phone line the modem is connected to, it will answer the call and attempt to connect to the calling modem.

S Register 0 contains the number of rings the modem will wait before answering a call. If a value of 4 is placed in S Register 0, the modem will answer an incoming call immediately after the fourth ring. If a 0 value is placed in S Register 0, the modem will *not* answer an incoming call.

The communications standard used by the modem in its attempt to connect with a calling modem is determined by the B command.

If the phone does ring, and verbal response codes are selected (**ATV1**), the modem will issue RING messages until the number of rings stored in S Register 0 is reached. The modem will then go on line, transmit an answer tone, and attempt to connect to the calling modem using the communications standard selected by the B command.

By default the modem is set to B0. B0 is the auto range setting. This should connect to virtually all communications standards and normally you do not have to alter this.

As soon as a connection is established, the modem will send a CONNECT message to your computer and enter on-line state in answer mode.

## The AT Commands

The AT commands are a group of special commands recognized by your modem. These commands derive their name from the letters AT, which are used to prefix commands. Before continuing:

- Run your communications software and enter local mode (or terminal mode) at 2400 bps. Refer to your communication software manual for details.

## The Attention Code

An AT (sometimes known as the ATtention code) usually precedes all commands being sent to the modem. It is used to gain the modem's attention, informing it that you are about to send a command. For example:

- Type the command:

**AT19 <E>**

Your modem's firmware identity message will appear on your computer screen. If you type **I9** only, your modem will not respond. If you type **AT19**, your modem will report an **ERROR**.

You may enter the attention code in all upper case, or all lower case letters, such as: **AT** or **at**

## Multiple Commands

You may place multiple modem commands after an AT provided the total number of characters does not exceed 80. For example, a valid command to display the modem's firmware identity twice is:

- Type in the command:

**AT1919 <E>**

An AT is not required in front of the second **I9** command. You only need one attention code for each command line. To make this command more readable, you can add spaces between the two commands:

- Type in the command:

**AT I9 I9 <E>**

The modem will execute the command as if the spaces are not there.

## The Escape Sequence

When you issue commands to the modem all dialogue is occurring between your computer and the modem. This situation is known as local command state.

When you connect to a remote system, dialogue will be occurring between your computer and the remote system. This is known as on-line state. Because the modem assumes, after it enters on-line state, all the data you send it is to be sent on to the remote modem, it ignores any AT commands you give it while in on-line state.

To force the modem to return to local command state, enter an escape sequence. An escape sequence consists of a one second delay, three + characters typed rapidly and another one second delay. For example:

- Type:

**AT&T1 <E>**

The modem will enter on-line state (this command actually causes the modem to enter test mode, but is equivalent to entering on-line state).

Now try to view the modem's firmware identity code:

- Type:

**ATi9 <E>**

Your command will be ignored. This is because the modem assumes you are typing characters to be sent to a remote system.

Now enter an escape sequence. Do not type any characters for one second, type +++ rapidly and wait another full second. The modem will respond with an OK message to indicate it has returned to local command state. You will be able to view the modem's firmware identity.

Before continuing:

- Type:

**AT&T0 <E>**

This command is used to halt the test.

## The Repeat Command

The repeat command is used to re-execute the last command issued to the modem. Issue the **ATI9** command and the modem's firmware identity code will be displayed on the screen.

• Type:

**A/**

The identity code will appear again.

You don't have to enter AT before the repeat command. You also do not have to press the ENTER key. This is the only modem command which does not require you to enter AT before it, and one of the few commands which does not require you to press the ENTER key. The **A/** command is intended primarily for re-dialing a telephone number that was previously engaged.

## The Help Command

Your modem will display information about the AT commands it supports if you type a question mark (?) in your AT command. For example:

• Type:

**AT? <E>**

Your modem will display a list of all the commands it supports.

• Type:

**AT?DTR <E>**

Your modem will display a summary of commands involving DTR.

• Type:

**AT?\N3%C&D2 <E>**

Your modem will display summaries of the **\N**, **%C** and **&D** commands.

## Response Codes

Your modem is capable of telling you, with on screen messages, what it is doing. These messages are known response codes or result codes, and you will see them from time to time.

For example:

After a command is successfully executed, the response is: OK

After a connection is established, the response is: CONNECT

A complete list of Response Codes can be found in Appendix A.

## TESTING

Your modem has in-built test facilities that allow you to determine whether you are experiencing a failure of either the modem, the telephone line or the remote modem. The modem's AA (Auto-Answer) LED will flash whenever a test is being performed.

### The Test Timer

The modem has a test timer which provides for the automatic termination of tests. S Register 18 allows you to specify the maximum length of time of any of the five tests available with the modem. The test timer may be set between 1 and 255 seconds or disabled by selecting zero seconds (the default).

If the test timer is disabled, tests must be terminated by issuing the **&T0** command.

### Terminating a Test: &T0

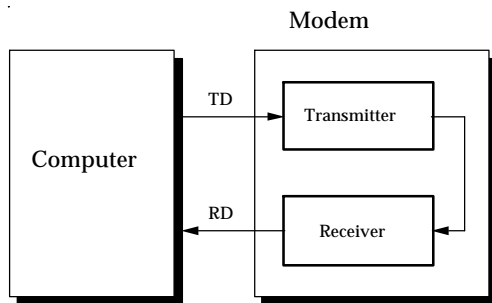
The **&T0** command is used to terminate any of the tests supported by the modem. If the modem is performing a test and you wish to terminate it:

- Type: **AT&T0 <E>**

The modem will respond with OK, indicating that testing has been halted.

### Local Analog Loopback Test: &T1

The Local Analog Loopback test checks the flow of data between your computer and the modem. With this test, the modem loops back any characters you type at the keyboard.



Local Analog Loopback Test

- ☞ Do not start this test while you are connected to a remote modem. The local analog loopback test will cause the modem to hang up.

To start the local analog loopback test:

- Type: AT\N0 <E>

This disables error correction.

- Type: AT&T1 <E>
- Type a few sentences

Your screen should display what you are typing. If your modem passes the test:

- Type an escape sequence

You will be returned to local command state. Terminate the test by:

- Type: AT&T0 <E>
- Type: AT\N3 <E>

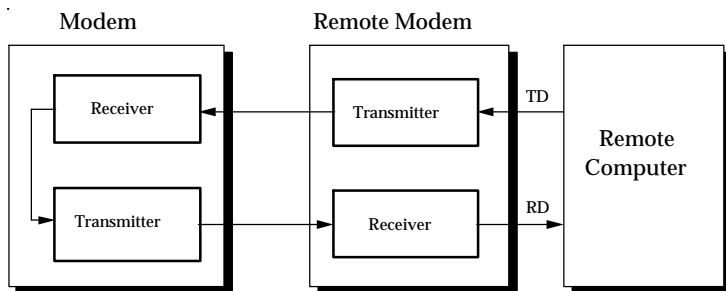
If you have set the test timer, the test will be terminate automatically. An OK message will appear as soon as the timer expires.

- ☞ If your modem does not pass this test — the message was corrupted or there was no response from the modem at all — contact your dealer for assistance.

## Local Digital Loopback Test: &T3

The local digital loopback test (LDL) allows a remote modem to test its operation. This provides testing of modems which do not support the local analog loopback or remote digital loopback tests.

- ☞ This test is not available when V.21, V.23, V.32, Bell 103 or Bell 212A communication is selected. Error correction must be switched off prior to starting the test.



**Local Digital Loopback Test**

To start an LDL test:

- Type: `AT\N0 <E>`
- Type: `AT&T3 <E>`

The operator of the remote computer should now type a few sentences to show that the modem is operating correctly. When the remote operator has completed the test, the test may be terminated by:

- Type: `AT&T0 <E>`
- Type: `AT\N3 <E>`

An OK message will appear.

If you have set the test timer, the test will be automatically terminated and an OK message will appear when the timer expires.

☞ The remote modem cannot terminate a local digital loopback test. The test may only be terminated by the modem which initiated it.

## Grant RDL from Remote Modem: &T4

The `&T4` command configures your modem so it will grant an RDL test if requested by a remote modem. This is the factory default setting.

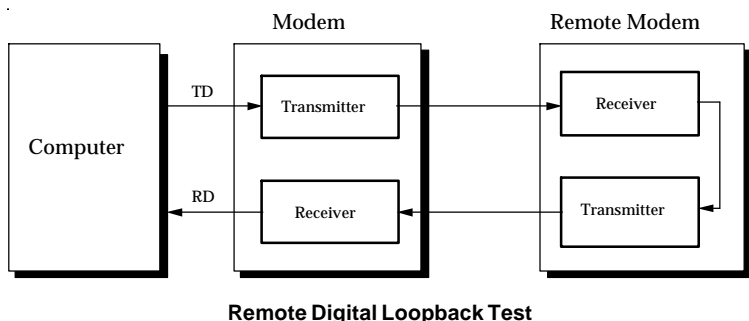
## Deny RDL from Remote Modem: &T5

The `&T5` command configures your modem so it will prevent a remote modem from starting an RDL test. If you request an RDL and the `&T5` command has been issued to the remote modem, your modem will return to on-line state without commencing an RDL test.

## Remote Digital Loopback Test: &T6

The Remote Digital Loopback test (RDL) is similar in function to the local analog loopback test, except that it tests your modem, the remote modem and the telephone line. If your modem can successfully complete a local analog loopback test, you can be sure that it is not at fault.

☞ This test is not available when V.21, V.23, V.32, Bell 103 or Bell 212A communication is selected. Error correction must be switched off prior to starting the test.



To start an RDL you must be connected to a remote system that also supports RDL testing.

The modem's test modes do not work if error correction is switched on. Prior to connecting to the remote modem, you must disable error correction:

- Type: `AT\N0 <E>`

Once you have connected to the remote modem:

- Type: `+++`
- Type: `AT&T6 <E>`
- Type a few sentences to check that the remote modem is both receiving and transmitting the characters correctly. Your screen should display what is being typed.

To terminate the test:

- Type an escape sequence

The test will be terminated and you will be returned to local command state.

- Type: `AT&T0 <E>`

An OK message will appear.

If you have set the test timer, the test will be automatically terminate, and an OK message will appear when the timer expires.

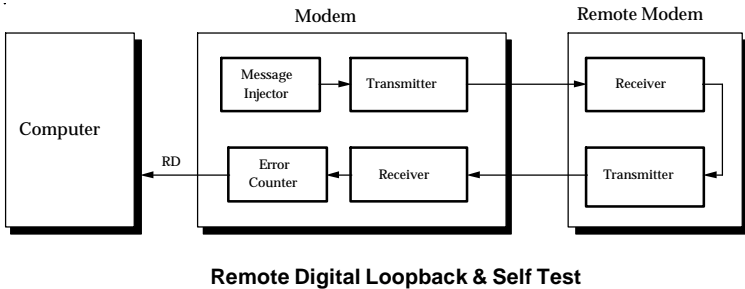
☞ If only a few characters are corrupted, you can probably blame telephone line noise. If the majority of the test you are receiving is corrupted, either the remote system or your modem is to blame. Perform a local analog loopback test to check the operation of your modem.



## Remote Digital Loopback With Self Test: &T7

The remote digital loopback and self test is similar to a remote digital loopback, except the modem performs all the testing for you.

☞ This test is not available when V.21, V.23, V.32, Bell 103 or Bell 212A communication is selected. Error correction must be switched off prior to starting the test.



To begin an RDL with self test, you must be connected to a remote system that supports RDL testing.

The modem's test modes do not work if correction is switched on. Prior to connecting to the remote modem, you must disable error correction:

- Type: `AT\N0 <E>`

Once you have connected to the remote modem:

- Type: `+++`
- Type: `AT&T7 <E>`

Your modem will begin to send a defined data pattern to the remote system, which will loop the data back to your modem.

To terminate the test:

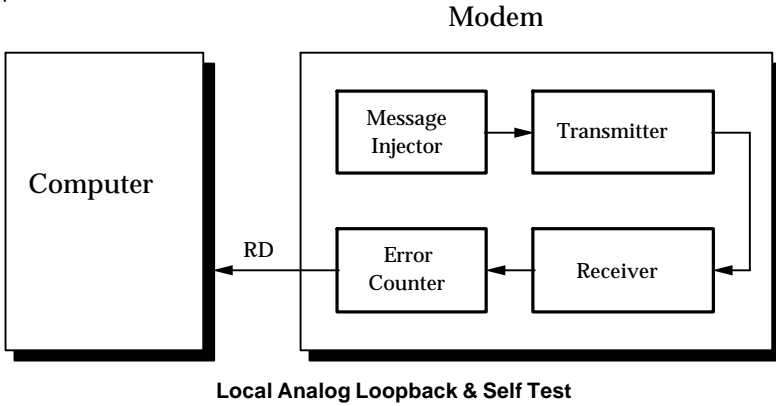
- Type: `+++`
- Type: `AT&T0 <E>`
- Type: `AT\N3 <E>`

The number of errors detected by the modem will be displayed. An error count of 255 indicates that 255 or more errors occurred during the test.

If you have set the test timer, the test will be automatically terminated, and an OK message will appear when the timer expires.

## Local Analog Loopback & Self Test: &T8

The local analog loopback and self test is similar to the local analog loopback except the modem performs all the testing for you.



To start this test:

- Type: AT\N0 <E>
- Type: AT&T8 <E>

Your modem will begin to loopback a defined data pattern.

To terminate the test:

- Type: AT&T0 <E>
- Type: AT\N3 <E>

The number of errors detected by the modem will be displayed. An error count of 255 indicates that 255 or more errors occurred during the test.

If you have set the test timer, the test will be automatically terminated, and an OK message will appear when the timer expires.

## ERROR CORRECTION

### Error Correction Protocols

This section examines the error correction and data compression features of your modem. The modem offers both V.42 (LAP-M) and MNP® (Microcom Networking Protocol™) error correction protocols. These protocols allow data errors to be detected by the receiving modem, provide flow control between remote systems and improve the overall throughput of data transfers.

Your modem also supports V.42bis and MNP5 data compression. V.42bis is a high performance data compression enabling you to speed up, theoretically by four times, data throughput on some types of data. MNP5 allows you to speed up data throughput by up to two times on some types of data.

Two types of error correction protocols are offered by your modem; V.42 (or LAP-M) and MNP.

☞ Error correction protocols are not available when a V.23 connection is established.

V.42 is an international standard for error correction between modems. V.42 ensures any errors introduced into your data by telephone line noise is automatically corrected before it is received by your computer. Because V.42 is a CCITT standard, it has become very popular in modems all over the world. V.42 also supports a fallback mode to MNP, in order to remain compatible with modems introduced prior to V.42.

Before V.42 existed, MNP was the de-facto standard for modem error correction. MNP classes 2-4 are supported by your modem for error-correction (an additional class of MNP is supported for data compression). Because MNP is a far less complex error correction protocol than V.42, it outperforms V.42. The section titled “Which Error Correction Do I Use?” provides more information about the performance and compatibility merits of V.42 and MNP.

The `\N` command is used to select the type of error correction used by your modem.

## Data Compression

Two forms of data compression are supported by your modem; V.42bis and MNP 5.

V.42bis is based on the Lempel-Ziv compression technique (similar to the techniques used by PC compression programs) and can work with both V.42 and MNP. V.42bis is very good at compressing data that has repetitions of sequences of characters. For example, in an English sentence there are usually repetitions of 'ions' or 'ings' or 'ere'; V.42bis works by creating a library of these repetitions and substituting small symbols for them. V.42bis is also able to switch off data compression if the type of data being sent is unsuitable for compression.

MNP 5 is MNP's stable-mate; it uses 'run length encoding' and a variation of the Huffman compression technique. It can double your data throughput on some types of data and MNP 5 works best when there are lots of characters repeated in sequence or a particular character repeated. For example, if you have a file which contained 50 zero characters in sequence MNP 5 will do a good job of compressing them (in some instances, better than V.42bis) – this is run length encoding. Or, if you had a text file where every second character was an 'i' and the other characters were random, MNP 5 would again outperform V.42bis (in this instance, Huffman coding provides superior compression). However, MNP 5 does not employ V.42bis' automatic switching techniques. If the data you are sending is not suitable for compression (for example, an application file or a graphics file), it can actually take longer to send than if data compression was not being used.

For this reason, it is best to use V.42bis whenever possible. If the modem you connect to does not support V.42bis, it is best not to use MNP 5 unless you are only transferring plain text information. If possible, use one of the many popular data compression programs available for computers to compress applications, graphics and other non-text files.

The %C command is used to select the type of data correction used by your modem.

## Reliable Mode

Reliable mode allows the modem to use error correction to connect to another modem. If the modem you attempt to connect to does not support a compatible method of error correction, your modem will hang up and return a NO CARRIER message.

Use `\N6` to select V.42/MNP reliable mode, `\N4` to select V.42-only reliable mode or `\N2` to select MNP-only reliable mode.

## Auto-Reliable Mode

Auto-reliable mode allows your modem to use V.42 or MNP if the remote modem also supports these. If the remote modem does not support a compatible type of error correction, your modem will fallback to either constant speed or variable speed mode.

☞ The `\J` command determines whether your modem falls back to constant speed or variable speed mode.

`\N3` selects V.42/MNP auto-reliable mode and `\N5` selects V.42-only auto-reliable mode. Your modem supports special CONNECT messages for connections made with either reliable or auto-reliable modes. When the `AT\V1` command is issued and your modem connects in either reliable or auto-reliable mode, one of the following messages will be sent to your computer.

NUM/VERBAL		
20	CONNECT/REL	300bps connection with error correction
22	CONNECT 1200/REL	1200 bps connection with error correction
23	CONNECT 2400/REL	2400 bps connection with error correction
24	CONNECT 4800/REL	4800 bps connection with error correction
25	CONNECT 9600/REL	9600 bps connection with error correction
26	CONNECT 12000/REL	12000 bps connection with error correction
27	CONNECT 14400/REL	14400 bps connection with error correction
28	CONNECT 7200/REL	7200 bps connection with error correction
43	CONNECT 16800/REL	16,800 bps connection with error correction
44	CONNECT 19200/REL	19,200 bps connection with error correction
45	CONNECT 21600/REL	21,600 bps connection with error correction
46	CONNECT 24000/REL	24,000 bps connection with error correction
47	CONNECT 26400/REL	26,400 bps connection with error correction
48	CONNECT 28800/REL	28,800 bps connection with error correction
49	CONNECT 38400/REL	38,400 bps connection with error correction
50	CONNECT 57600/REL	57,600 bps connection with error correction
70	CONNECT 76800/REL	76,800 bps connection with error correction
71	CONNECT 96000/REL	96,000 bps connection with error correction
72	CONNECT 115200/REL	115,200 bps connection with error correction
73	CONNECT 230400/REL	230,400 bps connection with error correction

☞ The PRO16RK modem supports eight special connect messages 20 to 28.

When the **AT\V0** command is issued (default), your modem will generate standard CONNECT messages for both normal and error-corrected connections. If the **X0** command has been issued, the CONNECT/REL will be the only 'error correction' response code generated, regardless of the connection speed.

☞ Issue the **%U1** command if you want your modem to issue CONNECT/LAP-M response codes when a V.42 connection is established.

The **\V8** command will display details of the error correction and data compression negotiated with the remote modem. This information is displayed immediately before the CONNECT message.

The **\V9** command will display details of the error correction and data compression negotiated with the remote modem as well as diagnostic information. This information is displayed immediately before the CONNECT message.

## Improving Performance with MNP 10

MNP 10 is neither an error correction or data compression technique. MNP 10 works in conjunction with error correction and data compression to improve the performance of your modem when operating with poor or varying quality telephone lines (as sometimes found with overseas or cellular telephone connections).

With MNP 10 operating, your modem can automatically resize the MNP packets, depending upon the line quality. When an MNP connection is established, data is transferred in small 'chunks' known as packets. When the line quality drops, MNP 10 reduces the size of packets being transferred in order to maintain data throughput. MNP 10 will increase the packet size to take advantage of improved line quality.

If the line quality becomes very good or very bad, MNP 10 can automatically step between line speeds. MNP 10 attempts to use the highest speed applicable to the quality of the telephone connection. If the telephone line quality drops while you are connected to another MNP 10 modem, thus introducing errors into your data, and the smallest packet size is being used, the modems will 'step-down' in speed until the error rate

become acceptable. Similarly, if the line quality improves and the modems are using the largest packet sizes, the modems will 'step-up' in speed until the best compromise of error rate and line speed is found.

MNP 10 will also make multiple attempts at establishing an error-corrected connection to another modem (more so than MNP 2-4). This gives you a better chance of making a connection when operating with poor line quality. If the telephone line drops out, MNP 10 will attempt to reconnect up to the maximum time permitted by your country's telecommunications rules. Thus, if there is a short line drop-out, MNP 10 will provide minimal interruption whereas other modems will disconnect entirely.

MNP is the only type of error correction allowed with MNP 10 and is only available when connected to another modem that supports MNP 10. The **#K** command is used to select MNP 10.

### Speed Changes

Although MNP 10 is able to cope with bad telephone connections, your modem must be able to first make a connection with another modem before it can make use of MNP 10. For this reason you may wish to use the **AT%H1** command to force your modem to connect at 1200 bps and then 'upshift'. Most telephone lines will cope with V.32 or V.32bis connections, however connecting at 1200 bps will ensure you make a connection. You may also use the **J** dial modifier to force your modem to make the initial MNP 10 connection at 1200 bps.

When MNP 10 changes line speed (either up or down) there will be a slight interruption to your communications. For this reason you should always use flow control to ensure data is not lost when MNP 10 changes line speed.

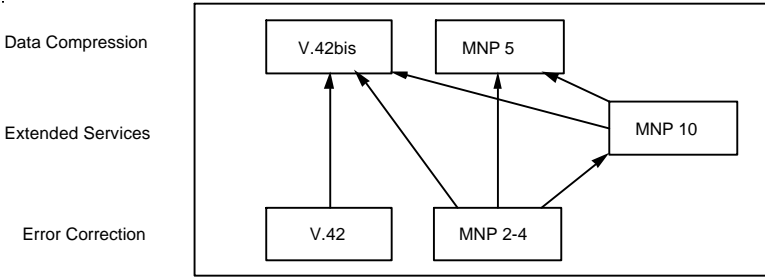
If you wish to establish the connection prior to MNP 10 upshifting or downshifting, issue the **%H9** command. This allows you to use the connection before MNP 10 attempts to change the connection speed.

### Cellular Modem Users

If you are making modem calls with a cellular phone, issue the **AT#K2** command. This tells MNP 10 to try even harder to maintain the connection if your cellular call momentarily drops out.

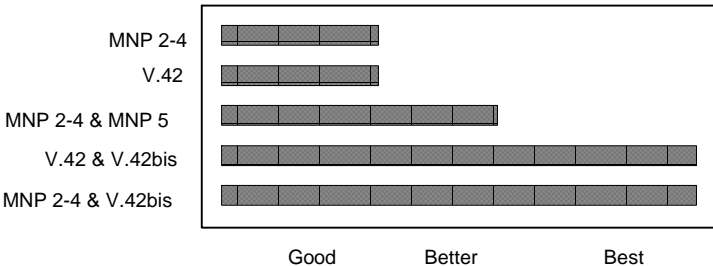
## Which Error Correction Do I Use?

Your modem supports the following combinations of error correction and data compression.



With such a choice, you may be wondering which combination you should be using. The table below shows the relative performance of each combination of error connection and data compression.

Error Correction



If you are connecting to various makes and models of modems, V.42/V.42bis auto-reliable mode is probably the best alternative (**AT\N3%C2**). V.42/V.42bis auto-reliable mode will also connect to another modem that supports MNP with V.42bis data compression. For overseas or cellular connections, use MNP 10 if possible (**AT\N3%C2#K1**).

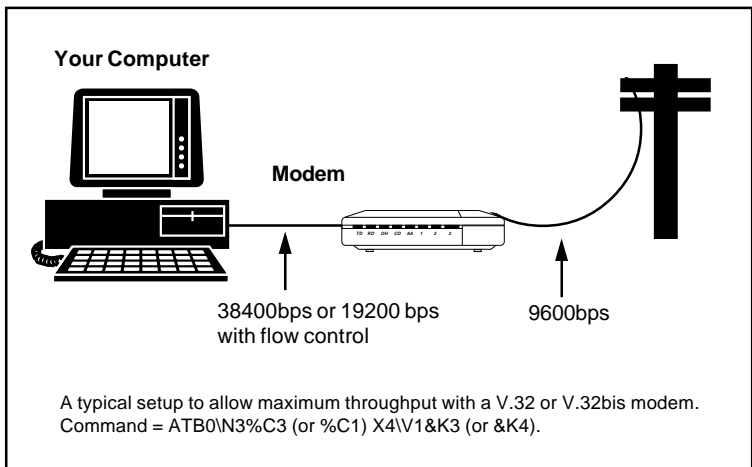


## Increasing Data Throughput with Error Correction and Data Compression

Data throughput refers to the amount of data being transferred. Error correction and data compression allow you to increase data throughput in comparison to if error correction and data compression were not selected.

To allow error correction and data compression to operate with the highest possible throughput, the terminal speed of your modem (the speed it communicates with your computer) must be higher than the line speed (the speed it communicates with the remote modem).

The best way to operate with error correction and data compression is to set your modem for a constant speed of 19,200 bps, 38,400 bps or higher (set the terminal speed of your computer to 19,200 bps, 38,400 bps or higher and issue the command `AT\N3` to the modem) with flow control. RTS/CTS flow control is the preferred form of flow control. Your communications software must also be set to use the same type of flow control.



In addition to the information in the *Modem Reference Guide*, the following details are applicable specifically to the ProRack Modem.

The PRO16RK modem supports eight special CONNECT messages for connections made with either reliable or auto-reliable modes.

<i>NUMERIC</i>	<i>VERBAL</i>
20	CONNECT/REL
22	CONNECT 1200/REL
23	CONNECT 2400/REL
24	CONNECT 4800/REL
25	CONNECT 9600/REL
26	CONNECT 12000/REL
27	CONNECT 14400/REL
28	CONNECT 7200/REL

☞ Some computers cannot cope with receiving data at speeds above 19,200 bps. If you wish to run at high speeds, you should install a COM port that has a 16550 chip in place of your regular COM port. The 16550 chip allows your computer to accept data at very high speeds.

## SECURITY AND ENCRYPTION

Your modem has many sophisticated security features. They are discussed in this section. Your modem limits caller access by means of user names and passwords. User names and passwords are stored in the modem's non-volatile memory.

The amount of memory your modem has reserved for this function depends on the model. The PRO16RK modems have 20Kbytes while other models have 1.2Kbytes. With typical length user names, passwords and commands over 600 users can be saved in 20Kbytes (40 in 1.2Kbytes)

With each user name and password a modem command of up to 30 characters may be specified. This allows the implementation of callback to users. Callback is where the modem rings a specified phone number. Even if an unauthorized caller manages to break the modem's security, that caller must be connected to the phone number specified in the remote modem's database.

Also discussed in this section is the topic of DES (Data Encryption Standard) encryption, which allows you to encrypt data being passed to a remote modem.

Only use a reliable error correction mode when using DES encryption. This will ensure you will only establish encrypted connections. Refer to the \N command (in the Commands sections of this guide) for details of the reliable error correction modes supported by your modem.

### The Security Menu

All additions and changes to your modem's user and password lists are performed through the Security Menu. This menu is displayed when you use the #S command.

- Type: AT#S <E>

A prompt will appear: Enter Security Password:

When you first receive your modem, all passwords will be set as a single ENTER.

- Press the ENTER key

The Security Menu will be displayed:

SECURITY MENU

- |                                     |                                     |
|-------------------------------------|-------------------------------------|
| 0 - Quit                            | 1 - List Users                      |
| 2 - Add or Change Users             | 3 - Delete All Users                |
| 4 - View Access Record              | 5 - Reset Access Record             |
| 6 - Security Off                    | 7 - Security On                     |
| 8 - Change Security Password        | 9 - Encryption Controls             |
| A - Stored Phone Numbers Displayed  | B - Supressed                       |
| C - Set Password Expiry Days        | E - Minimum Password Length         |
| D - Download Security file to host  | U - Upload Security file from host  |
| L - Encryption Parameters/Keys LOCK | F - FREE Encryption and Dial Enable |
| K - OutDial Disable                 | M - Dial Stored Phone Numbers Only  |

Access Security: OFF Security Database and Security Mode: FREE

Stored Phone Numbers: DISPLAYED OutDial: ENABLED

Enter Security Function :

## Entering a Security Password

You may choose to have a dedicated security password, thus changing the password assigned for the first security user. To enter a new security password:

- Select Option 8 from the Security Menu <E>

You will be prompted to enter a new security password. Your modem is case insensitive. Up to 8 characters may be used, including spaces.

When you enter your password, each character will appear on the screen as a # character.

- Type in your new password <E>

You will be prompted to re-enter the new security password.

- Type in your new password again <E>

Your new password will be stored in your modem's non-volatile memory.

## Adding and Changing Users

Your modem allows you to add new users and change existing users. Selecting option 2 on the Security Menu will result in a prompt:

Enter Name:

To add a new user:

- Type in the name of the new user <E>

User names must not be longer than 30 characters. They are case insensitive.

To change an existing user:

- Type in the name of the user you wish to change <E>

You will be prompted to enter a new name.

- Type in the new name <E>
- If the user is found you will be given the option to change the password, delete the user or zero his access counters.

If you are adding a new user or changing a user, you will be prompted for a new Password (maximum characters = 15).

The modem will now prompt you to enter a modem command. Modem commands consist of up to 30 characters and may include spaces. When you enter a new command, the previous command will be overwritten.

☞ Do not include an Attention Code (AT) with your command. Your modem automatically places an AT at the start of this command when it is executed.

If you do not want to specify a modem command or want to leave the current command as it is:

- Press ENTER

If you want to remove the existing command but do not wish to replace it with another command:

- Press the Spacebar <E>

See details on Callback Security later in this section for more information about using commands with your user names.

## Removing Users

Your modem allows you to remove individual users or all the users currently stored in your modem. To remove an individual user:

- Select option 2 from the Security Menu

You will be prompted to enter a new user name.

- Type in the name of the user you wish to delete <E>

If the user is found, select the 'D' option to delete.

To delete all the users stored in your modem:

- Select option 3 from the Security Menu

You will be prompted to confirm that you wish to remove all user names, passwords and commands

- Press Y <E>

### Listing Existing Users

To list all user names, and commands.

- Select option 1 from the Security Menu <E>

Your modem will list the user names. Passwords are never displayed.

☞ Your computer must be capable of displaying at least 80 characters per line for the user list to be displayed in its correct format.

### The Access Record

Selecting option 4 and option 5 from the Security Menu allows you to view and change the access records. Your modem keeps a tally of the number of successful (granted) and unsuccessful (denied) attempts to connect to your modem using each user name.

Your modem allows every caller three attempts to enter the correct user name and password. If the caller cannot correctly enter the password, a record is made by your modem that an unsuccessful attempt has been made to use that particular user name.

If the number of unsuccessful calls for any user name reaches 255, that user name will be locked and callers will no longer be able to use it, even if the correct password is used. You will not be able to use that particular user name until the access record for all users has been reset.

If, however, the caller does correctly enter the password, your modem records that a successful attempt was made to connect with that user name.

You should regularly check the number of successful and unsuccessful attempts to connect to your modem.

- Select option 4 to view the access record <E>

An unusually high number of unsuccessful attempts to connect with a particular user name may indicate someone is trying to violate your modem's security.

Over a period of many months one of the security users may legitimately accumulate 255 errors, in which case, your modem will automatically lock that user. If this occurs, select option 2, enter the user's name and select the Z option to clear his access record. Each attempted access with an unknown name increments the 'Invalid Usernames Received' count at the top of the list.

## Enabling Modem Security

Selecting option 6 or option 7 allows you to disable or enable your modem's security mode. With security mode enabled, whenever your modem answers an incoming call it will demand the caller enter a user name and password — the following message will appear on the caller's computer screen:

Enter Name:

If only one of the modems is configured to use error correction, there will be a slight delay between the time the modems connect and when the caller is asked to enter his user name.

When the caller enters his name all characters will be displayed as # characters. The caller is allowed three attempts to correctly enter his name. Your modem is not case sensitive to user names.

If the caller enters a valid user name, your modem will ask the caller to enter the password associated with that user name.

Enter Password:

If the caller enters his password correctly, your modem will send the message ACCESS GRANTED and the caller will have access to the computer connected to your modem.

If the caller cannot, within three attempts, enter the correct user name and password, your modem will send the message ACCESS DENIED and will hang up.

## Quitting the Menu

The Quit Security Menu option allows you to return to local command state from the security menu.

- Press **0** <E>

Your modem will issue an OK message. You will be returned to local command state.

## Callback Security

As mentioned earlier, your modem allows you to specify a modem command with every user name and password. This feature allows you to implement modem *callback*. Callback means that after a caller has successfully connected, your modem will hang up and then dial the caller.

Even if an unauthorized caller successfully connects to your modem, that caller will have to be using the phone line which your modem is going to call back.

Three commands are required to implement callback. First, you must hang up your modem with a **H** command.

Before your modem can call the caller back, it must wait for the caller's modem to hang up and return to local command state. **S Register 27** contains a value representing the number of seconds your modem will wait before commencing dialing. The default value for this register is 0 — your modem will begin to dial as soon as it receives a dial command.

It is necessary, therefore, to place another value in **S Register 27** to allow the caller's modem sufficient time to hang up before your modem begins to dial. A 30-second delay should be sufficient time to allow most modems to hang up, so place an **S27=30** in the command.

Using a 30-second delay means the telephone exchange, in most cases, will disconnect the call. This ensures unauthorized callers cannot 'fool' callback security by not hanging up after your modem hangs up. Alternatively, contact your telephone company — some telephone companies offer an automatic disconnect facility, which assumes a caller cannot remain off-hook after the modem has hung up.

Place a **D** command and the caller's phone number in the command. Assuming the caller's phone number is 1234567, you will now have a command which looks like this:

**H S27=95 D1234567**

After the user has called back and has completed the call, your modem will hang up, automatically issue an **ATZ** command to restore all the stored settings and return to local command state, ready to answer incoming calls.



- ☞ UK Modems. Telephone exchanges in the UK may not hangup after 30 seconds. Consult the supplier of your telephone line for a possible solution.
- ☞ If security is enabled, the answering modem will not assert DCD or DSR until a valid user name and password are received. If \Q5 is selected, CTS will not be asserted until a valid user name and password are received.

## Downloading the Security File

Selecting option 'D' from the security menu will enable a dump of the security database to your computer for storage or editing. You will be asked to type 'Y' to start the download.

The file format is:

"<user name>", "<password>", "<command>", nnn, mmm CR LF  
where nnn and mmm are the 3 digit Granted and Denied Access Counts  
and CR and LF are Carriage Return and Line Feed.

The last entry has only a CR LF

Example: "FRED", "NURK", "HS27=30DT3277502", 000, 000 is a valid entry.

- ☞ The download will take place at the current terminal speed.  
No flow control is acknowledged. If your computer cannot accept the file at the current data rate exit security and autobaud to a lower speed.

## Uploading the Security File

Selecting option 'U' from the security menu will enable a security file in the format described under the Download command to be uploaded into the modem.

You will first be warned that your existing database will be overwritten and then told to start uploading the file.

When the upload is finished the modem will return to the security menu.

The upload will take place at the current terminal speed. The modem can accept data at 115Kbps.

- ☞ If the data is not in the correct format, the file can be corrupted, so edit with care and always keep a copy of the unmodified download file.

## Encryption

Your modem supports Data Encryption Standard (DES) encryption. DES encryption allows you to encrypt data being passed to a remote modem. The remote modem must support Cipher Feedback (or CFB) DES encryption in order to decrypt the data sent from your modem.

The **#E1** command is used to select DES encryption.

The modem requires you to enter an encryption *Key* and an *Initial Value*. These are two 16-character hexadecimal numbers. Both the Key and Initial Value are specified by the user, making the encrypted data virtually impossible to decrypt without access to the Key and Initial Value.

Both modems must have DES encryption and error correction selected and must use the same encryption Key and the same Initial Value.

### WARNING

**Only use a reliable error correction mode when using DES encryption. This will ensure you will only establish encrypted connections. Refer to the \N command (in the Commands sections of this guide) for details of the reliable error correction modes supported by your modem.**

To enter the DES Key and Initial Value:

- Type: AT#S <E>

If your modem offers security features the Security Menu will appear (refer to the start of this chapter):

- Type: 9 <E>

You will be prompted with the following message:

Enter Current DES Key

If your modem does not offer security features the Security Menu will not be displayed — you will be prompted to type the current DES key. The default DES Key is 16 zeros. If you have not entered a Key yet:

- Type in 16 zeros <E>

or

- Type in the Key previously stored in the modem <E> When you enter the Key, each character will appear on your computer screen as the S character.

After successfully entering the Key, the Encryption Controls Menu will appear on your screen.

```

ENCRYPTION CONTROLS MENU
1  =   Enter DES Key
2  =   Enter DES IV - initial value
0  =   Quit
Enter Encryption Function :

```

The Encryption Controls Menu allows you to alter the Key or IV (Initial Value).

- Enter the Key and Initial Value as a 16-character hexadecimal number <E>

You will be prompted to re-enter the Key and Initial Value, to verify the correct Key and Initial Value has been entered. You may then return to local command state.

- Select the Quit option from the Encryption Menu
- Select the Quit option from the Security Menu

To enable DES encryption, issue the **AT#E1** command. The next time your modem establishes a connection with another modem, it will encrypt outgoing data and attempt to decrypt incoming data.

## SuperSecure Advanced Security Mode

- The PRO16RK modems include SuperSecure mode. SuperSecure mode allows you to :
  - Have an individual password and an individual DES KEY.
  - Automatically change the DES key in a random manner after each connection without the keys ever being knowable.
  - Have a different password on the answering modem to the originating modem.
  - Timed expiration of passwords.

With these new features, a link between two modems will be very secure. No other modem can dial either modem and connect because the third party will not know the keys of the other users, even if both passwords are known.

### Entering a Key for Each User

- Enter AT#E2 to enable SuperSecure mode
- Select the security menu using AT#S
- Enter the security password to gain access to the security menu
- Set up the modem's primary DES KEY and Initial Value (IV) as per standard DES setup
- Select Option 2 to add new users
- Enter the username
- Enter the password to be used by your modem (not necessarily the same as the password on the modem you are going to dial)

☞ Do not use a / character in any password, because this character is reserved

- When the modem prompts you for a command, do not enter a command because you will not be prompted for the DES KEYS
- Enter the 16 hex digit DES secondary KEY for the user, all 16 digits must be keyed
- Enter the 16 hex digit DES secondary Initial Value (IV) for the user, all 16 digits must be keyed
- Enter the 2 hex digit Key Encryptor (KE) for the user, both digits must be keyed

☞ The Key, IV and KE can have any value but must be exactly the same on both answering and originating modems.

☞ For maximum security do not use keys or initial values that have easy to remember values.

☞ A KE of 00 turns off random key rotation.

- Enter as many users as you wish while in this mode
- Press ENTER at the username prompt to return to the menu

You do not have to turn security on to use SuperSecure. The #E2 option forces it on always.

- Enter 0 to exit the security menu

☞ The remote modem must not only support SuperSecure but must also have a matching username/password and KEYS before access can be gained.

## Accessing a System Using SuperSecure

If both your modem and the remote modem have been correctly setup you can:

- ☐ Dial the remote system.
- ☐ The modems will connect and enter security dialog mode using the modem's primary key.
- ☐ This key must be the same for both modems.
  - Enter your username
  - Press ENTER
  - Enter your user password stored in the remote modem then '/'
  - Enter your password stored in your modem
  - Press ENTER

☞ You may backspace to correct errors but you will not be able to see what is typed since all characters are echoed as #

- Do not use the / character in any password
- If the password is the same on both modems then only one password needs to be entered

## Connection

- ☐ You will then CONNECT if the username, both passwords, all of the KEYS, IVs and KEs match.
- ☐ The data will be correct and error free, but encrypted on the line using a KEY unknown to anyone.

## Disconnection

- ☐ If the primary DES KEY mismatches you will not be able to read the "username" prompt.

❑ The modems will disconnect if:

- The secondary key, IV or KE mismatches (you will also receive a message)
- An error corrected link cannot be established
- Wrong username and/or password is used. You will be given another two changes to enter them before the modem disconnects

**Example:**

ATDT 456 4321

RINGING

RINGING

Enter name: MarkStein

Enter password: Fudge/Vanilla

Access granted

- 'Fudge' is Mark Stein's password on the remote system
- 'Vanilla' is the password on the local modem
- 'Access granted' confirms that the passwords are correct
- Secondary keys mismatch if the secondary KEY, IV or KE are different

### Enabling Rotating Secondary Keys

❑ If you enter a KE of 00 for the user, then the secondary key will remain the same for each connection.

❑ If the KE is not 00 then this value is used as a seed to create a random new secondary key for the user on each connection.

❑ After the initial connection is made with the KEY, IV and KE you have entered, these values will change on both modems to new values which are not accessible by any means.

❑ If an event occurs that corrupts the KEY, IV or KE on either modem, then both modems will have to be manually set back to a known starting point.

☞ To ensure random unknown keys, make two connections between the secure modems after they have been initialized.

## Symmetrical Operation

- Either modem can originate the call
- Remote modem's password is first.
- Local modem's password is second

## Automatic Synchronization

- The keys only change after a successful connection is achieved at both ends.
- If either modem drops out during the security handshake before the CONNECT message, the modems will automatically resynchronize on the next connection.

## Password Expiration Option

You may specify the number of days you have before the password must be changed. By default this option is OFF, to enable it select the C option from the security menu. You will then be prompted for the number of days before a password expires (1-255 days). The access record (Option 4) displays the password age limit and the age of each user's password.

- When a password is within 5 days of expiration, a message will be given before the connect message.
- After the password has expired, you will be informed and will not be allowed another connection until a new password is entered. The access record also notes if you have been informed of the expiration.
- Either the remote or the local password or both may expire.
- There is no real time clock inside the modem. When the modem is turned off the clock stops. Therefore the expiration timers actually time the number of days that the modem is turned on and not elapsed days

## Entering a Password in the Remote Modem's Database

When connected in SuperSecure, you may change your password.

- Enter \*\*\*\* with a 1 second guard time on either side of the stars
- Enter your current password
- Enter your new password
- Verify your new password
- You will then be returned online

## Entering a New Password in the Local Modem's Database

When connected in SuperSecure, you may change your password by

- Enter in the escape sequence +++
- Enter in the \*S command
- Enter your new password
- Verify your password
- ATO to return online

☞ If you are not online or in the current session of SuperSecure, you must identify yourself by entering your current username and password before being able to enter your new password.

## Minimum Password Length

You can specify the minimum password length accepted by the modem by the E option from the Security Menu. Its power-on default is 3 characters.

## Additional User Options

When a new user is entered into the database you will be prompted for 'Options' after the password has been entered. You may key S or E or both, if you do not want either option key ENTER.

☞ S Specifies that the user is a supervisor and has full remote access rights to the remote modem.

- If you key \*\*\*\* you will be able to issue almost all AT commands on the remote modem and access the full security database if you have the global security password. (See remote access)



☞ E Your user password does not expire.

- This would be for automated systems that cannot respond to prompts to enter a new password when it expires

## Uploading and Downloading the SuperSecure Database

☞ To ensure the integrity of your modem's security database the sensitive fields are encrypted with the modem's primary key. Your password and DES KEYS are scrambled but will be restored when uploaded into a modem with the same primary key.

☞ You may delete unwanted records and modify the unencrypted fields, but the encrypted must not be touched.

☞ If you wish to enter a new user, you may do so using the same format as the other records. The three digit control field at the start of each record should be set to the following values for a new user:

- 000 Not SuperSecure User, no DES keys specified (use for dialback)
- 001 DES keys specified
- 003 DES keys specified, Supervisor Status
- 005 DES keys specified, No password expiration
- 007 DES keys specified, No password expiration and Supervisor Status

☞ The record format is:

aaa, "<username>", "<encrypted password>", "<command>",  
 "bbb,ccc,ddd,eee,fff,ggg", "<encrypted key>", "<encrypted> IV",  
 "<encrypted KE>"CR,LF

- aaa is 3 digit control number
- bbb is 3 digit access granted count
- ccc is 3 digit access denied count
- ddd is 3 digit days since password change
- eee is 3 digit reserved
- fff is 3 digit reserved
- ggg is 3 digit reserved

☞ The control number should not be touched on existing users.

## Security Database Lock Option

From the Security Menu you may elect to LOCK the security database with the 'L' option. When locked, the user cannot change the #E setting or clear the security database even with the &F. command or power-on reset with the Mode Switch depressed.

The only way to alter the database or #E selection is to enter the Security Menu with the security password and unlock the database with the 'F' (Free) command.

The current state: LOCKED or FREE is displayed below the Security Menu.

☞ Shorting out the NOVRAM battery will erase the database but will result in the modem being only partially functional. Such modems need to be returned to the factory for re-configuration.

## Outdial Disable Option

If modems are to be used only for receiving calls option 'K' can be selected. This does not allow the modem to dial out. If an attempt to do so, users will be informed that a SECURITY LOCKOUT is in place and the call will not be successful.

The outdial feature will be useful for system administrators who wish to control the use of modems within remote offices or restrict modems to being used for receiving calls only.

## Dial Stored Phone Numbers Only Option

Option 'M' is similar to Option 'K' but restricts the modem to dialing only those numbers listed in the stored phone number fields as set with the &Z command.

The stored numbers must then be dialed using the ATDS=X command where X is the position of the stored number as set with the AT&Z command.

New stored numbers cannot be added by the user once the dial restriction has been enabled.

## General Notes on Data Security

☞ By using SuperSecure you now have

- Ensured that the phone link between two modems is secure
- Ensured that no other user can access either modem when #E2 is enabled

☞ The weak link in the system is now the cable between your modem and your computer.

- It should be kept visible at all times to prevent wire tapping
- The modem, computer and interconnecting cable should be physically secure to prevent access

☞ With specialized equipment, the data on the lines and the image on an screen can be read, due to wires and video screens radiating radio frequency signals which can be picked up over a distance. You may need advice on radio frequency screening if this concerns you.

## SYNCHRONOUS MODES

This section explains the use of your modem in synchronous modes. A *dumb* mode or *manual* mode allows some of the functions of your modem to be accessed via the front panel switches.

Some of the information in this section assumes you have read the Getting Started Section.

Your modem offers two synchronous modes, conforming to the Hayes modem synchronous modes 1 and 2. These modes allow synchronous communication over two-wire PSTN or leased lines when connected to asynchronous/synchronous computers or dedicated synchronous terminals.

### Synchronous Operation

Your modem supports two synchronous modes. Mode 1 allows operation with computers which support asynchronous and synchronous communication on a single RS-232 port. Mode 2 allows your modem to be operated with dedicated synchronous terminals.

Although your modem can only operate over a single two-wire connection, it will still perform full-duplex synchronous communication. Half-duplex operation could be simulated by controlling the state of the RTS and CTS signals.

### Terminal Speeds

Your synchronous terminal or host should use the clock signals provided by the modem to synchronize transmit and receive data. The clock speed will represent the actual connection speed of the modem.

☞ When synchronous mode is selected, your modem cannot operate in constant speed mode or use the error correction or data compression facilities of the modem. Only variable speed mode is available in synchronous connections (this refers to the modem's terminal speed).

## Line Speeds

Your modem supports a number of synchronous line speeds.

<b>Command</b>	<b>Speed</b>
B8	V.22bis/2400bps
B10	V.32/4800bps
B11	V.32bis/7200bps
B13	V.32/9600bps
B15	V.32bis/14,400bps
B16	V.Fast Class/14,400bps
B17	V.Fast Class/16,800bps
B18	V.Fast Class/19,200bps
B19	V.Fast Class/21,600bps
B20	V.Fast Class/24,000bps
B21	V.Fast Class/26,400bps
B22	V.Fast Class/28,800bps

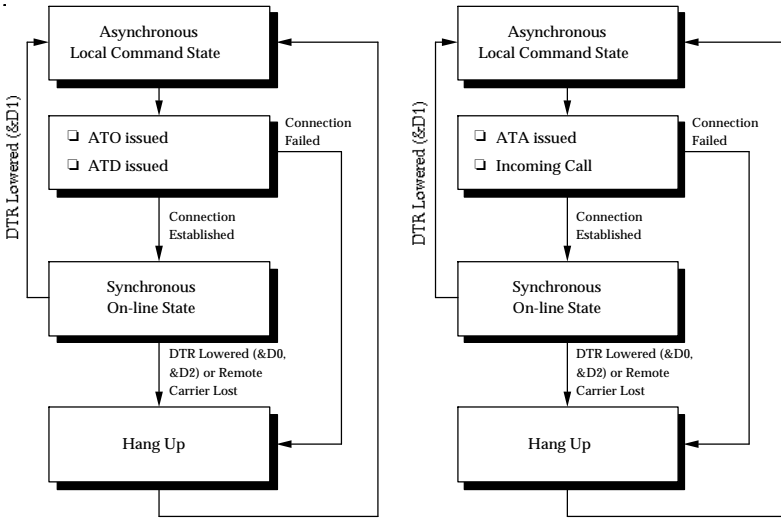
When operating in synchronous mode, your modem should always be configured with a locked, non-auto-ranging **B** setting (this refers to modem line speed).

For V.34 or V.FC, the B setting only sets the maximum speed. The modem will automatically determine the highest usable speed for the line.

## Synchronous Mode 1

Your modem is capable of dialing remote systems in asynchronous mode and then automatically switching to synchronous mode once connection has been made. If the connection is lost, your modem will hang up and return to asynchronous local command state.

The computer required to support synchronous communication with your modem must be capable of switching between synchronous and asynchronous modes with the same RS-232 port, as well as controlling the state of the DTR signal under software supervision.



**Synchronous Mode 1 Originate and Answer Mode**

### Selecting Synchronous Mode 1

Synchronous mode 1 is selected with the **&M1** command.

- Type: AT&M1 <E>

Your modem will enter synchronous mode whenever it successfully connects to a remote modem.

You should also:

- Type: AT&D2 <E>

This allows hang up via your computer's DTR signal.

☞ Your computer will not be able to hang up the modem if the DTR Option Switch is in the DOWN position (DTR will always be asserted). DTR must be lowered to make the modem hang up.

To return to asynchronous operation:

- Type: AT&M0 <E>

### Dialing

Your computer must be in asynchronous mode before dialing commences. To begin dialing use the **D** command. Response codes sent to the computer depend upon the settings of the **X**, **V** and **Q** commands. As soon as a connection can be established, your modem will assert CTS and enter synchronous on-line state. If connection cannot be made, your modem will hang up and return to asynchronous local command state.

Character echo and response codes should not be selected when synchronous communications are used. Use the **E0** and **Q1** commands to disable character echo and response codes.

As soon as your modem has completed dialing it will examine the state of the DTR signal. If DTR is asserted your modem will go on line in synchronous mode, otherwise the modem will hang up and return to asynchronous local command state.

☞ Data should only be transmitted once DCD, DTR and CTS have been asserted. Your computer should not assume that if CTS is asserted then it is safe to begin transmitting data — your modem will keep CTS asserted whenever it is in local command state.

### Hanging Up

Your modem will hang up and return to asynchronous mode if carrier is lost for longer than the period defined by S Register 10 or if DTR is lowered after the **&D2** command has been issued.

### Answering Calls

To automatically answer incoming calls, S Register 0 must be set to a non-zero value (as with asynchronous auto-answering). Once a call has been answered there is no means of returning to asynchronous mode apart from hanging up the modem. This will occur if the carrier is lost for a period in excess of the time defined by S Register 0 or if DTR is lowered after the **&D2** command has been issued.

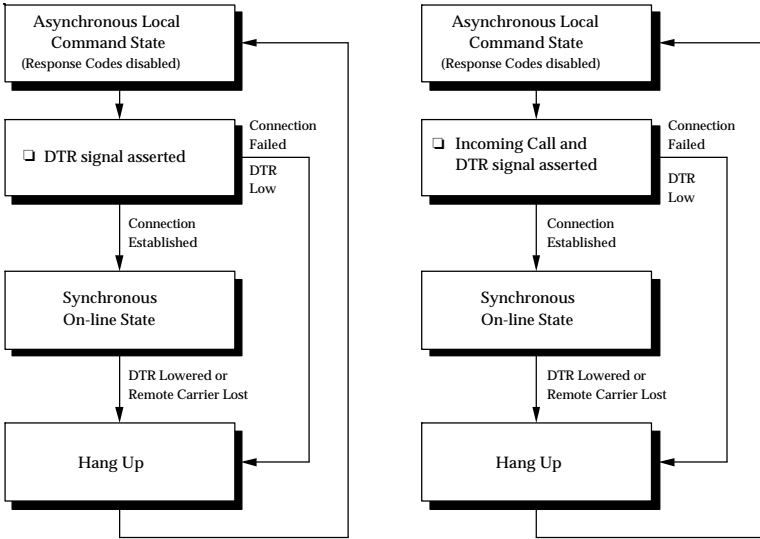
## Synchronous Mode 2

Synchronous mode 2 is specifically designed for use with dedicated synchronous terminals. The phone number to be dialed is stored in the modem, the synchronous terminal causing the modem to dial by asserting the DTR signal.

When the terminal asserts the DTR signal (DTR makes an OFF-ON transition), your modem will dial stored phone number zero. The phone number may contain dial modifiers. See the Command Descriptions chapter of this guide for details on the **&Z** command.

Before connecting your modem to your synchronous terminal, the modem must first be configured using an asynchronous terminal or computer.

The Sample Setups section of this manual details a common configuration for synchronous mode 2.



***Synchronous Mode 2 Originate and Answer Mode***

### Selecting Synchronous Mode 2

Synchronous mode 2 is selected with the **&M2** command.

- Type: **AT&M2 <E>**

Your modem will enter synchronous mode whenever it successfully connects to a remote modem.

You should also:

- Type: **AT&D2 <E>**

This allows you to dial and hang up.

To return to asynchronous mode:

- Type: **AT&M0 <E>**

Your modem will remain in asynchronous mode.

### Dialing

Dialing will commence as soon as the DTR signal is asserted (an OFF-ON transition occurs). Your modem will not generate response codes when synchronous mode 2 is selected. All call progress is indicated by your modem's speaker (the **M** command controls the operation of your modem's speaker).



As soon as your modem connects to a remote modem it will assert the DSR and DCD signals.

## Hanging Up

Your modem will hang up and return to quiet asynchronous mode if the carrier is lost for longer than the period defined by S Register 10 or if DTR is lowered.

## Answering Calls

Whenever your modem receives an incoming call it will assert the **RI** signal. The terminal may accept the call by asserting the DTR signal as soon as the number of rings defined by S Register 0 is reached. The terminal may refuse the call by keeping DTR low eight seconds after the number of rings in S Register 0 is reached.

Your modem will not dial the stored number in response to DTR being asserted between the time an incoming call is initially detected and the call being cleared.

## Leased Line Operations

A leased line, or private line, is a telephone line that permanently connects two or more locations. The leased line does not have any switching equipment associated with it. Leased-line operation with the modem is selected with the **&L** command.

The **&L** command informs your modem that communications will occur over leased lines, with no answer tones being generated by the modem. If the modem detects a loss of the remote carrier signal while leased-line operation is selected, it will attempt to re-establish the connection rather than hang up.

If you select leased line operation with the **&L1** command, you must issue the **ATA** command to answer a call, and the **ATD** command to initiate a call.

If you use **&L2** or **&L3** to select Auto leased line operation, you do not need to issue the **ATA** or **ATD** commands; **&L2** selects Originate mode automatically and **&L3** selects Answer mode automatically. To dial or answer, raise DTR; to return to local command state, lower DTR.

☞ You will require a special phone cable (available from your dealer) to connect your modem to a leased-line socket. The phone cable supplied with your modem is suitable for use with normal, dial-up, voice (PBX) lines.

Before commencing leased-line communications, it is recommended that a non-auto-ranging **B** setting be specified.

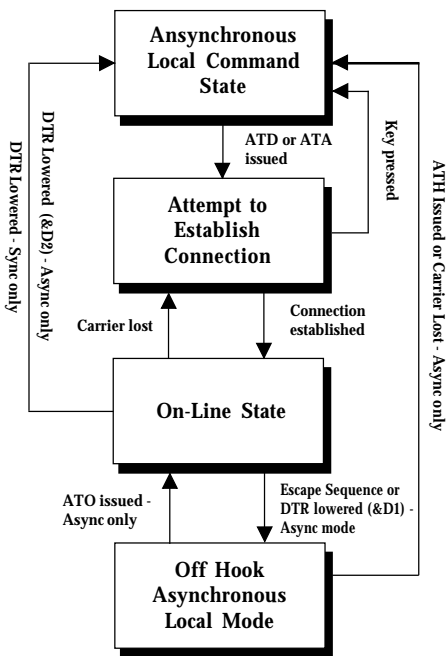
☞ If error correction is required, select a Reliable mode, not an Auto-Reliable mode. (See the `\N` command.)

Auto-ranging and fallback are disabled in leased-line mode. Your modem will only attempt to connect using the communications standard specified by the **B** command and the terminal speed.

Once a connection has been established, if your modem detects a loss of carrier it will continuously attempt to re-establish the connection.

### Smart Leased-Line Mode

Leased-line operation is available in both asynchronous and synchronous mode 1.



Smart Leased-Line Mode (&L1)

## Calling and Answering Using &L1

When operating in smart mode (&L1 set), the **ATD** and **ATA** commands are used to initiate and answer calls respectively.

☞ Your modem will hang up and return to local command state if your computer transmits characters while the modem is attempting to establish or re-establish a connection (unless **&N0** has been issued).

## Auto Leased Line Operation (&L2 or &L3)

You can select Auto leased line operation with the **&L2** or **&L3** command. In Auto leased line operation you do not need to issue the **ATA** command to answer a call, or the **ATD** command to initiate a call. Issue the **&L2** command to automatically select Originate mode, or the **&L3** command to automatically select Answer mode.

In Auto leased line operation **AT** commands can only be entered while DTR is low. Irrespective of the **&D** setting, your modem will remain in idle mode when DTR is low, and will go on-line when DTR is high. If DTR is lowered when your modem is on-line, it will hang up and return to idle mode. If power is lost, your modem will enter on-line state when DTR is restored.

☞ Your communications software must be capable of altering the state of the DTR signal to work successfully with the **&L2** and **&L3** commands.

## Hanging Up

There are five ways of hanging up your modem when leased-line mode is selected.

- ❑ If your modem is attempting to establish or re-establish a connection, sending characters to it will cause it to hang up (unless **&N0** has been issued).
- ❑ If synchronous mode is selected, lowering the DTR signal will cause your modem to immediately hang up.
- ❑ If asynchronous mode is selected, issuing the **ATH** command will cause the modem to hang up.
- ❑ If asynchronous mode is selected (**&L2** or **&L3**), lowering DTR will cause the modem to hang up.

☞ XON/XOFF flow control should not be selected for leased-line connections. Your modem will prematurely hang up if your computer sends an XON/XOFF character while the modem is attempting to re-establish a connection.

## Improving the Reliability of Leased-Line Connections

If you are experiencing data errors over leased lines, issue the `%L` command to lower the transmit level of your modem.

You may need to experiment with the levels, but start between `%L15` and `%L19`.

The transmit level should be changed on both modems.

## DUMB MODE OPERATION

Your modem has two methods of operating with your computer. The commonly used method is “smart mode”, where the computer issues “AT” commands to the modem to make it dial and hang up. For computers which do not offer an asynchronous port or cannot communicate synchronously using V.25bis commands, dumb mode permits manual control of your modem.

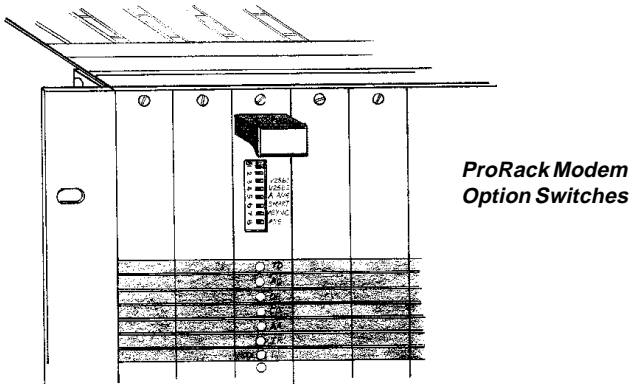
### Selecting Dumb Mode on PRO16RK Modems

To select Dumb mode on a ProRack modem:

- Place front panel Option switch 6 in the On (or Left) position

To select Smart mode:

- Place front panel Option switch 6 in the Off (or Right) position



### Setting Up your Modem

In most instances, your modem will need to be configured prior to entering Dumb mode. All configuration of your modem is performed using the AT commands.

For example, if you wish to have your modem dial a stored telephone number when the computer asserts (or “raises”) the DTR signal, you must first store the telephone number in the modem and select stored number dialing operation, using the AT commands.

## Selecting Communications Speeds on ProRack Modems

If you are dialing in Dumb mode, the communication speed it uses is dependant upon the setting of the front panel Mode LEDs.

To change the speed at which your modem connects after dialing

- Place front panel Option switches 5 and 6 in the On (or Left) position to select Dumb mode and disable auto-answer
- Press the Mode button until the correct speed is indicated on the front panel Mode LEDs

☞ Your modem cannot dial if auto-answer is enabled; verify that Option switch 5 is in the Off (or Right) position..

Refer to the table printed in your modem *Installation Guide* — it shows the meaning of each combination of the Mode LEDs.

To change the speed at which your modem connects after answering an incoming call:

- Place front panel Option switch 6 in the Off (or Right) position to select Smart mode
- Connect your modem to a personal computer — refer to the modem *Installation Guide* for details
- Run a communications program and enter “local mode” or “terminal mode”
- Type: ATBx&W <E>

where “x” is a valid setting of the B command. For example, ATB13&W selects V.32 (9600 bps) mode.

The B command is used to set the communications standard used by your modem.

## Hints for Unix Computers and Multiplexers

Many Unix computers and multiplexers which offer synchronous communications ports cannot cope with the response messages generated by the modem. For this reason, you may wish to switch off response messages before you connect your modem to the Unix computer or multiplexer.

- Place front panel Option switch 6 in the Off (or Left) position.
- Connect your modem to a personal computer, a Unix computer or a serial server — refer to the modem *Installation Guide* for details
- Run a communications program (for Windows, or TIP or CU for Unix) and enter “local mode” or “terminal mode”
- Type: ATE0Q1&N0&W <E>
- Exit the communications program

This command switches off response messages and character echo, causes the modem to ignore characters sent to it from the host while dialing or answering, and saves the changes in the modem.

## Dialing in Dumb Mode

❑ Store a telephone number in the modem and then have the computer raise the DTR signal.

☞ PRO16RK modems can dial only by raising the DTR signal to dial a stored telephone number.

## Using DTR to Dial

You may commence dialing by having your computer raise its DTR signal.

Place switch 6 in the Off (or Right) position.

- Connect your modem to a personal computer — refer to the modem *Installation Guide* for details
- Run a communications program and enter “local mode” or “terminal mode”
- Type: AT&Z0=phoneno <E>

Where “phoneno” is the telephone number you want your modem to dial. This stores the number as stored telephone number zero.

☞ If you are using your modem over leased lines, do not store a phone number.

- Type: AT&D2&M4 <E>

or:

Type: AT&D2&M2 <E>

Issue the **&M4** command if you wish to use asynchronous communications; issue **&M2** if you wish to use synchronous communications.

- Type: AT&Wn <E>

The modem set up is saved to profile n=0-3

- Place Option switch 8 in the On (or Left) position.
- If necessary, use the Mode button to select the required communication speed

The connection speed of the modem is indicated by the Mode LEDs. Refer to the table printed in your modem *Installation Guide*; it shows the meaning of each combination of Mode LEDs.

- Raise the DTR signal on your computer



DTR must change from “low” to “high” to commence dialing. Your modem dials the stored telephone number zero. The OH and CD LEDs glow when the modem connects.

To hang up:

- Have your computer lower the DTR signal, or press the Talk/Data button to Talk

## Answering Calls in Dumb Mode

Your modem is able to answer incoming calls, automatically or by manual intervention.

### Automatic Answering

Your modem is able to auto-answer incoming calls in Dumb mode. You do not need a telephone handset to have your modem answer incoming calls.

Place Option switch 6 in the Off (or Right) position.

- Connect your modem to a personal computer — refer to the modem *Installation Guide* for details
- Run a communications program and enter “local mode” or “terminal mode”
- Type: ATBx <E>

where “x” is a valid setting of the B command. The B command is used to set the communications standard used by your modem.

- Type: AT&D2&M0 <E>

or:

Type: AT&D2E0Q1&M1 <E>

Issue the &M0 command if you wish to use asynchronous communications; issue &M1 if you wish to use synchronous communications.

- Type: AT&W <E>

The modem set up is saved.

- Place Option switch 6 in the On (or Left) position.

- Place Option switch 8 in the Off (or Right) position.
- Place Option switch 5 in the Off (or Right) position.

If the &D2 command has been issued to the modem, DTR must be raised by your computer.

Your modem answers incoming calls after the number of rings specified in S Register 0.

## The Option Switches

The Option switches allow you to control the operation of your modem in Dumb mode, as well as providing additional features in Smart mode.

The PRO16RK modem offers the following front panel Option switches:

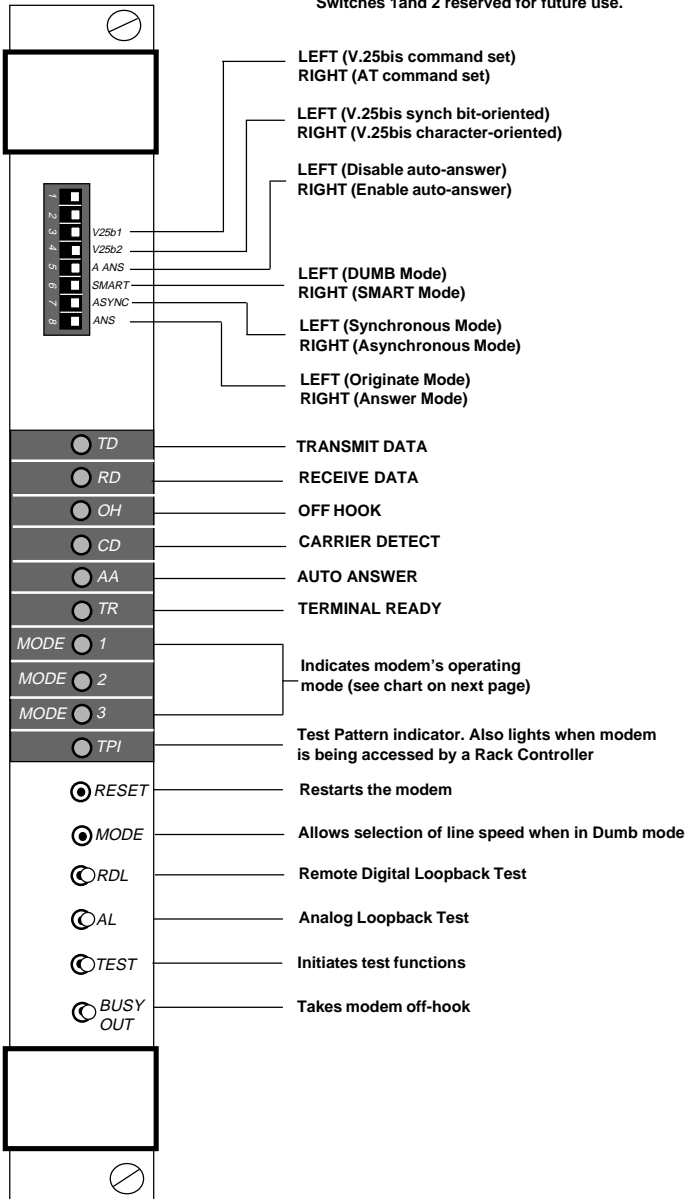
<b>Description</b>	<b>Switch</b>
Auto-answer enabled	5 - Off (Right)
Auto-answer disabled	5 - On (Left)
Smart mode	6 - Off (Right)
Dumb mode	6 - On (Left)
Asynchronous operation	7 - Off (Right)
Synchronous operation	7 - On (Left)
Answer mode	8 - Off (Right)
Originate mode	8 - On (Left)

V.25bis mode is selected with Option switches 3 and 4:

<b>Description</b>	<b>Switch 3</b>	<b>Switch 4</b>
AT command mode	Off (Right)	n/a
V.25bis synchronous (HDLC framing)	On (Left)	Off(Right)
V.25bis sync (BSC character framing)	On (Left)	On (Left)

See diagrams on next two pages.

\* Switches 1 and 2 reserved for future use.



Front Panel Mode LEDs			
Line Modulation	Mode 1	Mode 2	Mode 3
28800 bps	* F	O	O
26400 bps	* F	O	●
24000 bps	* F	●	●
21600 bps	* M	O	O
19200 bps	* M	●	O
16800 bps	* M	O	●
14400 bps	O	O	O
12000 bps	O	O	●
9600 bps	O	●	O
7200 bps	O	●	●
4800 bps	●	O	O
2400 bps	* S	O	O
1200 bps	* S	O	●
V23	* S	●	O
V21	* S	●	●
Fax 14400 bps	O	* S	* S
Fax 9600 bps	O	O	* S
Fax 7200 bps	O	●	* S
Fax 4800 bps	●	O	* S
Fax 2400 bps	●	●	* S

LED: On = O , Off = ● ,  
 Flashing: \* S = Slow, \* M = Med, \* F = Fast

## CCITT V.25bis OPERATIONS

V.25bis is a modem command set specified by the CCITT. Like the AT command set, it allows you to control your modem. However, V.25bis commands may be issued to the modem in asynchronous or synchronous mode (AT commands may only be issued when the modem is operating in asynchronous mode). This means V.25bis is suitable for mainframe and minicomputers which only support synchronous communications ports. The implementation of V.25bis supported by your modem is based upon the 1988 revision of the V.25bis specification, however not all aspects of the V.25bis specification have been implemented.

☞ V.25bis operation is supported in both smart and dumb modes.

### Selecting V.25bis Operation

To select V.25bis mode, issue the appropriate **#M** command. Three V.25bis modes are supported by your modem:

- ❑ Asynchronous V.25bis. The modem operates in asynchronous mode using V.25bis command rather than AT commands. Issue the **AT#M1** command to select this mode.
- ❑ Synchronous V.25bis with HDLC framing. The modem communicates and accepts V.25bis commands in synchronous mode with HDLC framing. Issue the **AT#M2** command to select this mode.
- ❑ Synchronous V.25bis/BSC mode. The modem communicates and accepts V.25bis commands in synchronous mode with character framing (BSC mode). Issue the **AT#M3** command to select this mode.

The **&W** and **Z** commands must be issued after the **#M** command in order for V.25bis command mode to be selected. Alternately, issue the **&W** command after the **#M** command and switch the modem off and on or lower DTR (after an **&D3** command has been issued).

☞ When you reset the modem (for example, you issue the **&F** command or issue the **RST** command or switch the modem off and on), you must issue an **ATZ** command to select V.25bis command mode; your modem always resets and powers-up in AT command mode, regardless of the setting of the **#M** command.

The setting of the Option switches always take precedence over the **#M** command.

The **%R2** option will be required for most V.25bis setups. This setting ensures that the CTS signal is only asserted when the modem is ready to accept a new command (in command mode).

### Overridden Settings

Almost all AT commands and S Registers stored before entering V.25bis mode will have effect except for the following commands.

<b>AT Command</b>	<b>V.25bis Operation</b>
&D	Will act as if &D2 is selected
S0	Will act as if S0=1

These override settings are not stored in your modem's non-volatile memory; they are active only while V.25bis command mode is active. If you issue the **&V** command to view the modem's configuration the original settings will be displayed.

## V.25bis Commands

Six V.25bis commands are supported by your modem:

<b>Command</b>	<b>Description</b>
CRN <i>n</i>	Dial phone number <i>n</i>
CRS <i>x</i>	Dial stored phone number <i>x</i>
PRN <i>x:n</i>	Save <i>n</i> as stored phone number <i>x</i>
DIC	Disregard an incoming call
CIC	Connect to an incoming call
RST	Restore factory default parameters

## Data Formats

Not all data formats are supported when V.25bis operation is selected. Use only the types of parity shown in the following table:

<b>Mode</b>	<b>Parity</b>
Async V.25bis	Even parity
Sync BSC	Odd parity
Sync HDLC	Bit 7 always zero in the information field.

Commands issued with the wrong parity are ignored by your modem.

## V.25bis Indications

V.25bis indications are similar to the response codes, sent when your modem is operating in AT command mode. Six V.25bis indications are supported by your modem:

<b>Verbal</b>	<b>Meaning</b>
VAL	Command accepted and executed
CNX	Connection established
INC	Incoming call detected
CFI AB	Call failure, abort
CFI ET	Call failure, engaged
INV	Invalid command

These are the only indications supported by your modem. When operating in asynchronous V.25bis mode, these indicators are suffixed with Carriage Return and Line Feed characters and V.25bis indicators will only be sent to your computer if DTR is raised.

## Dialing

Your modem supports two methods of dialing in V.25bis mode; “addressed calling” (similar to using an **ATD** command) and “direct calling” (similar to DTR dialing with the **&M4** command). The CRN command is used to initiate a telephone call. The most basic form of the CRN command is:

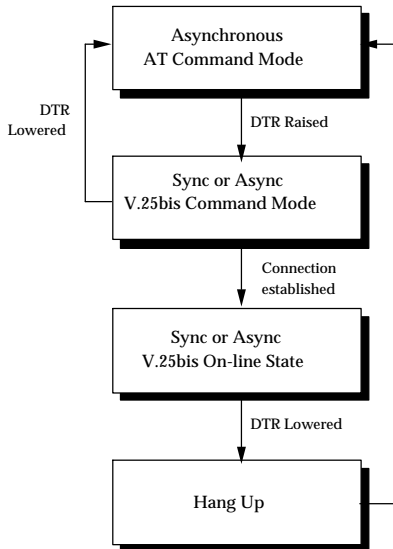
CRN *number*

where the *number* is the telephone number you are dialing.

For example:

- Type: CRN 01234 <E>

Your modem will dial 01234

**V.25bis Originating Mode**

If a connection can be made to a remote modem a CNX indicator will be sent by the modem. If a CFI AB indicator appears, your modem has not been able to make a connection.

To hang up the modem, your computer or communications software must make DTR low.

## Dial Modifiers

Dial modifiers are characters that can be included in a phone number to make the modem perform special tasks while dialing.

For example, not all modem users will be using a dedicated telephone line. Some users will have their modems connected to PBXs. To allow users of PBXs to operate their modems successfully, dial modifiers are supported by your modem.

Most PBXs require you to dial 0 or 9 (in order to obtain an outside line) and wait for a dial tone before dialing the actual phone number.

Using dial modifiers, you can successfully dial the phone number 12345 through a PBX using the command:

- Type: CRN 0<12345



The < dial modifier causes the modem to pause for a short time after dialing 0. This allows most PBXs sufficient time to obtain a line before dialing.

The factory default delay for the < modifier is two seconds. You may change the length of this delay if necessary. Its length is determined by the value in S Register 8.

Another method of making the modem wait for a dial tone is to include the : (colon) dial modifier. The : modifier causes the modem to examine the phone line to ensure a dial tone has been applied before dialing starts. For example:

- Type: CRN 0:12345

If the modem cannot detect a dial tone within the time specified by S Register 7, the modem will return to local command state and send a CFI AB indicator to the computer.

☞ Due to differences with some older telephone exchanges, dial tone detection may not be possible with your modem. Your modem will only recognize dial tones between 200 Hz and 600 Hz.

If your telephone supports tone dialing then a useful dial modifier is the T modifier. Inserting a T modifier before the number you are dialing causes the modem to tone dial that number. For example:

- Type: CRN T12345 <E>

This will cause the modem to dial the phone number 12345.

The modem also supports a P dial modifier which allows it to pulse dial. These modifiers may be placed at any point in the number you are dialing and they may be intermingled in the same number. For example, your telephone line may be connected to a PBX that supports tone dialing internally, but only pulse dialing externally. You could overcome this problem by using the T and P dial modifiers in the following way:

- Type: CRN T0<P12345 <E>

The modem tone dials 0 to request an external line, waits for the PBX to obtain the line and then pulse dials 12345.

Although most telephone exchanges support tone dialing, there are still a few pulse only exchanges. If you can hear a continuous dial tone when you lift the handset, you will probably be able to tone dial. If you are in any doubt, use pulse dialing. The modem will automatically pulse dial if you have not previously included either the **T** or **P** modifiers in your phone numbers. Exchanges that support tone dialing generally support pulse dialing as well.

More information about dial modifiers can be found in the Command Descriptions section of this guide.

### Hanging Up

To hang up your modem when operating in V.25bis mode, lower DTR. Your modem will hang up whenever DTR goes low.

### Stored Number Dialing

Your modem has the ability to store phone numbers for redialing at a later time.

For example, to store a phone number use the PRN command:

- Type: PRN 1;012345 <E>

The phone number “012345” will be stored as phone number one.

To dial a phone number that has been stored in your modem:

- Type: CRS 1 <E>

The modem will dial stored phone number one.

Stored phone numbers are shared by V.25bis mode and AT Command mode. Thus, if you store a phone number while AT Command mode is active, you may dial that store phone number in V.25bis mode, or vice versa.

### Direct Dialing

Direct dialing refers to your modem’s ability to dial a stored phone number when the DTR signal of your computer is raised. This form of dialing is particularly suited to synchronous computers and is referred in other parts of this guide as ‘DTR Dialing’.

☞ The **&M** command (used to select various methods of DTR dialing in AT command mode) has no effect when the mode is operating in V.25bis command mode.

To select direct dialing:

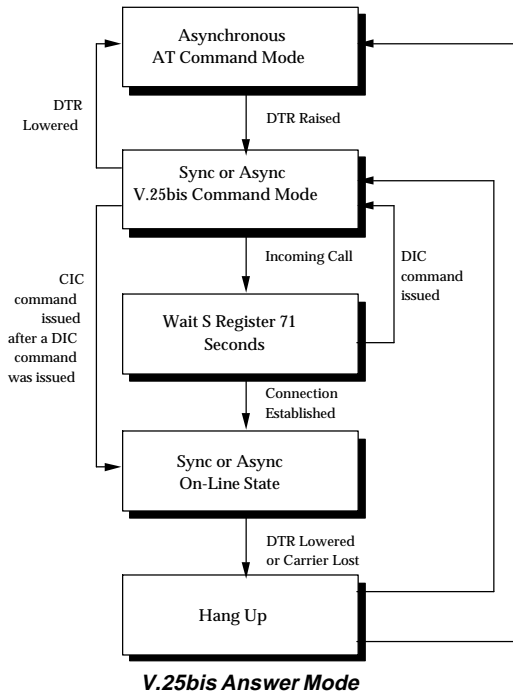
- Type: AT#D1 <E>

When DTR next goes from low to high, the modem will dial the stored phone number zero. Please note, some dial modifiers supported in V.25bis command mode are different to those supported in AT command mode and, thus, will be ignored by the modem if they are not appropriate for the selected command mode. Refer to the previous section, 'Stored Number Dialing', for more information about storing phone numbers in your modem; refer to the Command Descriptions section of this guide for more information about the dial modifiers supported in V.25bis mode.

☞ Direct dialing is also supported in V.25bis dumb mode.

## Answering Calls

Your modem is pre-configured to automatically answer incoming calls. If you receive a call on the phone line the modem is connected to, it will answer the call and attempt to connect to the calling modem.



When V.25bis mode is selected, your modem will automatically answer incoming calls after one ring – the setting of S Register 0 is ignored when V.25bis mode is selected. The communications standard used by the modem in its attempt to connect with a calling modem is determined the **B** command.

If the phone does ring, the modem will issue an INC message to indicate an incoming call has been detected and will wait the number of seconds defined by S Register 71. S Register 71 allows you to ignore a call by issuing a DIC command before the number of seconds defined by S Register 71 is reached. Thus, if S Register 71 is set to 10, you have 10 seconds after a call is detected to issue a DIC command; if you do not issue the DIC command within 10 seconds, your modem will attempt to connect to the calling modem.

☞ If you issue the **DIC** command but then want to answer the call, issue the **CIC** command. The **CIC** command will cause your modem to answer a call after the DIC command has been issued.

The modem will then go on line, transmit an answer tone, and attempt to connect to the calling modem using the communications standard selected by the **B** command.

As soon as a connection is established, the modem will send a CXN message to your computer and enter on-line state in answer mode.

## Selecting Speeds

The following section describes how to select the terminal and line speed of the your modem when operating in V.25bis command mode.

### Terminal Speeds

The **#Q** command is used to select the terminal speed in V.25bis command mode.

The **AT#Q** command determines whether to use a predefined terminal speed or the terminal speed when the last AT command was issued. Refer to the Command Descriptions section for details of the **#Q** command. Refer to the chapter titled 'Getting Started' for details of how the terminal speed is used by your modem.

By default, your modem will use the same speed as when the last AT command was issued.

## Line Speeds

The line speed at which your modem operates is determined by the **ATB** command. The line speed must be selected before you select V.25bis mode.

By default B0 is selected. This will automatically select the highest common speed with the remote modem. See B command.

Refer to the chapter titled 'Getting Started' for details of how to set the line speed of your modem.

## Modem Cable

In order to operate correctly, your modem cable must support the following signals:

<b>DB25 Pin</b>	<b>Signal</b>
2	Transmit Data (TxD)
3	Receive Data (RxD)
4	Request to Send (RTS)
5	Clear to Send (CTS)
6	Data Set Ready (DSR)
7	Signal Ground
8	Data Carrier Detect (DCD)
15	Transmit Clock (TxC)†
17	Receive Clock (RxC)†
20	Data Terminal Ready (DTR)
22	Ring Indicator (RI)
24	External Clock (XCLK)†

† - Not required for asynchronous operation

## Synchronous Character Encoding

Your modem supports both NRZ and NRZI character encoding when operating in synchronous mode. The #N command is used to select the character encoding technique suitable for use with the computer to which your modem is connected.

Refer to the chapter titled 'Command Descriptions' for details of the #N command.

## Asynchronous Notes

The Backspace character may be used to edit V.25bis commands in asynchronous mode. No other editing characters are supported by the modem.

All control characters, other than Carriage Return and Backspace, are ignored by your modem.

Your modem will echo Carriage Return characters only, even if your computer issues Carriage Returns and Line Feeds at the end of a command.

## BSC Notes

Commands must start with a STX and end with an ETX to be accepted by the modem.

Control characters that do not form part of the frame are treated as a normal characters. This usually results in the modem issuing an INV indication.

## HDLC Notes

Commands must be correctly framed to be accepted by the modem. The address field must be FF, the control field must be 03 (hex) or 13 (hex) or a bad FCS field or an abort is received.

If a succession of V.25bis indications are to be sent to your computer, the poll bit (or final bit) will be set to zero for all but the last V.25bis indication, to signify that more V.25bis indications follow.

Control characters that do not form part of the frame are treated as a normal characters. This usually results in the modem issuing an INV indication.



# COMMAND DESCRIPTIONS

Note that for commands whose descriptions are marked with this symbol, you should not type AT before, nor a carriage return after the command.

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COMMAND	MEANING
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+++	Escape Sequence
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When the modem is in on-line-state, issuing an escape sequence will force it to return it to on-line command state, without disconnecting.

*Unlike other commands, you should not type AT before the escape sequence, nor type a carriage return after it.* Instead, wait a full second before you type the escape sequence and then a full second after typing it. As soon as the modem returns to local command state, it will respond with the message: OK

This waiting period before and after the escape sequence is called the Escape Sequence Guard Time. This allows the modem to distinguish the escape sequence from the normal flow of information between modems.

You can change the *character* used for the escape sequence by changing the value of S Register 2.

You can change the *length* of the escape sequence guard time by changing the value of S Register 12.

### Options

+++ Return to local command state

### See Also

S Register 2 Escape Sequence Character

S Register 12 Escape Sequence Guard Time

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**COMMAND      MEANING**


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**\*\*\*\*                      Remote Access Sequence**


When the modem is connected to a remote modem and is in on-line state, the remote modem may type this command to force the modem to enter Remote Access mode.

Remote Access mode simply means the remote modem will be able to issue AT commands to your modem, just as if you were typing them at your computer keyboard.

Remote Access mode may be switched on or off with the #A command. Remote Access mode is password protected by default.

To enter Remote Access mode, the operator of the remote modem should:

- Type: \*\*\*\*

The remote operator must wait one second before and after typing the Remote Access sequence. The AT command must not be typed in front of the Remote Access sequence, nor type a carriage return after it. You may change the character used in the Remote Access sequence by changing the value of S Register 67.

If the #A2 command has been issued to your modem, when it receives a request to enter Remote Access mode, it displays:

**Enter Password:**

on the computer screen of the remote operator. The remote operator must type your modem's security menu password and press ENTER. Each letter of the Remote Access password is displayed on the remote computer screen as # character.

If no password has been saved, remote access is denied.

If the password is successfully typed, the following prompt appear on the remote computer screen:

### Remote Control Enabled

If the **#A1** command has been issued, your modem does not ask for a password upon receiving the remote access sequence.

The remote operator may then type AT commands to the remote modem. The following commands are not allowed:

ATA, ATD, ATH, ATZ, AT&T

To exit Remote Access mode, the remote operator must:

- Type: ATO

### Options

\*\*\*\* Request remote access

### See Also

#A command	Universal Remote Access
S Register 66	Remote Access Guard Time
S Register 67	Remote Access Character

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## COMMAND MEANING

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### ? Interactive Command Help

Your modem will display information about the AT commands it supports if you type a question mark (?) in your AT command.

You can view the modem help as 'pages' of information. This allows you to read the information at your own pace.

Press the **Spacebar** to view the next help page, **Backspace** or **Delete** to view the previous page, or **ENTER** to quit from the help pages.

You may also search for certain commands or words.

S Registers 96 and 97 allow you to change the length and width of each help page to suit your communications software.

### Options

**AT?** Display a list of all the commands your modem supports.

**AT?&T** Display a summary of the **&T** command.

**AT?\N3%C2&D2** Display summaries of the **\N**, **%C** and **&D** commands.

**AT?MNP** Display all of the commands which affect MNP.

### See Also

S Register 96 Help Screen Length

S Register 97 Help Screen Width

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### COMMAND MEANING

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**A/ Repeat Last Command**

This command orders the modem to re-execute the last command you entered.

Unlike other commands, the Repeat Last Command should not be preceded by an **AT**, nor followed by a carriage return.

This command must be typed on one line by itself.

### Options

**A/** Repeat last command

---

### COMMAND MEANING

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**A Answer**

This command enables you to answer an incoming call manually.

On receiving an incoming call, the modem will send a RING message code to your computer. When you see the ring message:

- Type: **ATA <E>**

Your modem will send an answer tone to the calling (originating) modem and wait to receive a carrier signal in return.

The **B** command selects which communication standards your modem will attempt to connect to.

If a connection cannot be established with the originating modem within the time specified in S Register 7, your modem will hang up and return a NO CARRIER message before returning to the local command state.

### Options

ATA Answer an incoming call

### See Also

- B command Select Communication Standard
- S Register 0 Ring to Answer On
- S Register 1 Current Ring Count
- S Register 7 Wait Time for Carrier

Command Descriptions

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## COMMAND MEANING

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### **Bn** Select Communications Standard

Your modem is capable of connecting to remote systems using a variety of communications standards. This command enables you to select the communications standards you want to use.

### Options

<i>Command /Speed</i>	<i>Command/Speed</i>
B0 n Auto-Connect	B16 V.34 at 14,400bps
B1 Auto-Connect	B17 V.34 at 16,800 bps
B2 Auto-Connect	B18 V.34 at 19,200 bps
B3 V.21 at 300 bps	B19 V.34 at 21,600 bps
B4 Bell 103 at 300 bps	B20 V.34 at 24,000 bps
B5 V.23 at 1200/75 bps	B21 V.34 at 26,400 bps
B6 V.22 at 1200 bps	B22 V.34 at 28,800 bps
B7 Bell 212A at 1200 bps	B23 (Reserved for V34bis)
B8 V.22bis at 2400 bps	B24 (Reserved for V34bis)
B9 Auto-Connect	B25 (Reserved)
B10 V.32 at 4800 bps	B26 (Reserved)
B11 V.32bis at 7200 bps	B27 V.34 at 2400bps

<i>Command /Speed</i>	<i>Command/Speed</i>
B12 V.32 (Non-TCM) at 9600 bps	B28 V.34 at 4800bps
B13 V.32 at 9600 bps	B29 V.34 at 7200bps
B14 V.32bis at 12,000 bps B30	V.34 at 9600bps
B15 V.32bis at 14,400 bps B31	V.34 at 12,000bps

Appending ! to the B command locks the modem to the specified speed e.g. ATB19! forces the modem to operate only at V.34 21,600bps

☞ V.34 will automatically fallback to V.FC if the remote modem does not support V.34

**See Also**

- A command Answer
- \*C commandDisable V.34
- B command Select Communication Standard
- D command Dial

Command Descriptions

COMMAND	MEANING
D	Dial

This command allows you to dial a telephone number. The basic dialing command is:

**ATD** followed by the telephone number.

For example:  
To dial the number (09) 111-1234

- Type: ATD091111234 <E>

You can use hyphens, spaces or parentheses. They will be ignored by the modem, but they will make it easier to read the command line.

For example:

ATD (09) 111-1234

☞ The **D** command must be the final command on a command line, unless you use the ; dial modifier.

As well as digits, you may include the following characters when using tone dialing:

A B C D \* #

Dial modifiers may be included in the dial command when either tone or pulse dialing.

### Example

ATD12345 Dial number 12345

### See Also

S Register 6 Dial Tone Wait Time

S Register 8 Pause Dial Modifier Delay

### Dial Modifiers

Dial modifiers enable you to change the characteristics of dialing. (Definitions for all modifiers appear on the following pages.)

#### Modifier Meaning

- , pause
- ; return to local command state
- P use pulse dialing
- T use tone dialing
- R reverse mode
- @ wait for quiet answer
- J initiate MNP 10 at 1200 bps
- M initiate MNP 10 at 4800 bps
- K MNP 10 cellular option
- L last number redial
- F *or* ^ disable calling tones
- ! hook flash
- S=n dial stored phone number **n**
- W wait for dial tone



## Dial Modifier Definitions

### , **pause**

This modifier orders the modem to pause before dialing the rest of the phone number. This is useful when using a PBX and you need to dial a number to connect to an outside line.

For example: If you must dial 0 to connect to an outside line before dialing (09) 111-1234

- Type: ATD0,091111234 <E>

The length of the pause is determined by the value in S Register 8.

☞ UK Modems. If your PBX requires more than four seconds to obtain a line, add no more than one extra , to your dial command.

### ; **return to local command state**

This modifier orders the modem to return to local command state — without disconnecting — after it has dialed the number.

You may use this modifier to communicate with a mainframe computer using security callback. Your modem dials the number of the mainframe computer and then immediately returns to local command state. Another ATD command can then be used to generate the tones required for the callback identity number.

The ; used in conjunction with the **M2** command, allows you to return to local command state with the speaker turned on, allowing you to monitor the progress of the call at the remote modem.

### **P use Pulse dialing**

### **T use Tone dialing**

Your modem can use either pulse (decadic) or tone (DTMF) dialing.

The P dial modifier orders the modem to use pulse dialing. The T dial modifier orders the modem to use tone dialing.

If you are not sure which dialing is used by your phone, lift up the handset and listen. If you hear a continuous dial tone, you probably can use tone dialing. Normally, only older telephone exchanges do not support tone dialing.

If you are still in doubt, use pulse dialing. Most exchanges supporting tone dialing also support pulse dialing, although the reverse is not always true. Contact the supplier of your telephone line if you wish to have tone dialing accessible on your line.

☞ Pulse dialing may not be supported in New Zealand. Refer to your Installation Guide for details.

## **R reverse mode**

This modifier enables you to switch to *answer mode* after dialing. When connecting to another modem, one modem must be in *originate mode* and the other in *answer mode* to establish a connection. When you use a dial command, your modem is normally in the *originate mode*.

The **R** dial modifier enables you to connect to *originate only* modems. This is also useful when you want to send information at 1200/75 bps (CCITT V.23 standard communications).

If you communicate with another computer in originate mode at 1200/75 bps, you will be sending data at 75 bps and receiving at 1200 bps. If you have a lot of information to send and not much to receive, it makes sense to switch to answer mode, so that you are sending at the faster rate. For example:

To dial the number 999-9876 and switch to answer mode:

- Type: ATD9999876R <E>

## **@ wait for quiet answer**

The @ modifier orders the modem to wait for one or more rings within the time specified by S Register 7, followed by a period of five seconds of silence occurring some time before dialing the remaining numbers in a phone number.

The default value of S Register 7 is 30. Using this default, the modem will dial the first number, listen for a period of five seconds silence during the next 30 seconds and then, if the silence is detected, dial the next part of the number.

If five seconds of continuous silence is not detected, the modem will hang up and return a message: NO ANSWER

If the phone number is engaged, the modem will return a message: BUSY

This modifier is useful for remote access databases which require an identification code to be tone dialed before those databases generate an answer tone.

For example:

To tone dial a remote database on 999-1234, wait for a five-second silence and then tone dial an ID code of 1234:

- Type: ATDT9991234@1234 <E>

### **J initiate MNP 10 at 1200 bps**

This modifier allows you to select MNP 10 and make the initial connection at 1200 bps (V.22). MNP 10 is able to automatically adjust the line speed to suit the quality of the phone line. Refer to the chapter titled 'Error Correction' for details of MNP 10.

For example:

To dial the number 999-9876 using MNP10:

- Type: ATDJ9999876 <E>

### **M initiate MNP 10 at 4800 bps**

This modifier allows you to select MNP 10 and make the initial connection at 4800 bps (V.32). MNP 10 is able to automatically adjust the line speed to suit the quality of the phone line.

For example:

- Type: ATDM9999876 <E>

### **K MNP 10 Cellular Option**

The K dial modifier allows MNP 10 automatic power level adjustment for this call only. Normally MNP 10 power level adjustment is switched on and off with the )M command.

### **F or ^ disable calling tones**

The F dial modifier (or the dial modifier ^) allows you to switch off calling tones for a data call.

## L last number redial

This modifier allows the last number dialed to be re-dialed. The L can be used as a modifier after a number prefix (but cannot have any number following). The last number dialed is saved in NVRAM. The last number dialed is displayed on the &V display.

For example:

- Type: ATD9999876 <E>

ATDL will dial 9999876

- Type: ATDT02L <E>

This will set tone mode, then dial 02 and then 9999876

## ! hook flash

The ! dial modifier issues a hook flash signal — the modem hangs up for a short period.

Hook flashes are commonly used with PBXs to transfer calls.

For example:

To dial 0, hook flash and then dial 12345:

- Type: ATD0!12345 <E>

S Register 29 sets the duration of the hook flash.

## S=n dial stored phone number n

The modem allows you to store phone numbers in *non-volatile memory*. The S dial modifier enables you to dial these phone numbers.

The *n* indicates which stored number you want to dial. To store numbers, use the &Z command. Refer to your Product Guide for information regarding how many phone numbers your modem can store.

For example:

To dial the stored number two:

- Type ATDS=2 <E>

**W wait for dial tone**

The **W** modifier causes the modem to wait for a dial tone before dialing. If the modem does not detect a dial tone within 30 seconds, it returns a message of `NO DIALTONE`, hangs up and returns to local command state.

You can change the dial tone waiting period from the default period of 30 seconds by changing the value in S Register 7.

☞ When using the **W** modifier, the length of time your modem waits for a dial tone is determined by the value contained in S Register 7 (Wait for Carrier) and not the value in S Register 6 (Wait for Dial Tone).

☞ UK Modems. Setting S Register 7 with a value above 58 may invalidate the approval of your modem. S Register 7 must be set to 20 before issuing the **W** dial modifier.

If the modem received any characters from the computer while it is waiting for a dial tone, it will hang up, return to local command state and send a `NO CARRIER` message.

For example:

To wait for a dial tone and then dial 111-0123:

- Type: `ATDW1110123 <E>`

**See Also**

&Z command	Store Phone Number
S Register 6	Wait Time for Dial Tone
S Register 7	Wait Time for Carrier
S Register 8	Length of Dial Pause
S Register 29	Hook Flash Duration

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COMMAND	MEANING
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<b>E</b>	<b>Echo</b>
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The **E** commands enables you to select whether the characters you type at your keyboard (while in the local command state) will be echoed back to the screen by the modem.

### Options

- ATE0      Disable local command state echo
- ATE1      Enable local command state echo

Range: 0-1

---

COMMAND	MEANING
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---

<b>H</b>	<b>Hang Up</b>
----------	----------------

The **H** command forces the modem to hang up.

The **H0** command (Hang up) is used to terminate a call.

The **H1** command (Go off- hook) can be used to make your modem appear as busy to a remote modem trying to dial in.

When you issue the **H1** command, the modem goes off-hook but will *not* generate carrier or answer tones.

The **H2** command causes the modem to go off-hook after the current connection terminates. This is used to take a modem out of service without interrupting the current connection.

### Options

- ATH0      Hang up
- ATH1      Go off-hook
- ATH2      Go off-hook after current connection terminates

### Range

0-2

---

**COMMAND    MEANING**


---

**I                    Identity**

Your modem contains a product identity code, also known as the firmware identity code.

You can use the **I** command to display these codes.

**Options**

- ATI0    Display numeric identity code
- ATI1    Return a checksum of modem's firmware
- ATI2    Verify modem firmware checksum and return a result of OK or ERROR
- ATI3    Display model identifier
- ATI4    Display code revision and creation date
- ATI5    Display manufacturer identification
- ATI8    Display complete product identification
- ATI9    Display complete product identification

**Range**

0-5, 8, 9

---

**COMMAND    MEANING**


---

**L                    Speaker Volume Control**

Your modem has a volume control which allows you to adjust the volume of its internal speaker.

Your modem is preset for comfortable listening levels in a normal office environment, so most users will not need to change the preset volume of their modem.

There are four speaker volume levels:

- 0**    Lowest volume level
- 1**    Low volume level
- 2**    Medium level
- 3**    Highest volume level

To adjust the volume level:

- Type: ATL0 <E>  
       (or type 1,2,3 as appropriate)

ATL0	Lowest volume level
ATL1	Low volume level
■ ATL2	Medium level
ATL3	Highest volume level

### Range

0-3

### See Also

M command Monitor

---

## COMMAND MEANING

---

### M Monitor

Your modem has a built-in speaker enabling you to monitor the progress of calls. You can listen for dial tones, busy signals, a successful connection to another modem, or someone answering your call.

The **M** command controls the operation of the speaker.

☞ Some modems also provide volume control via the **L** command.

### Options

ATM0	Speaker is always off
■ ATM1	Speaker is on whenever the modem is dialing or answering a call. When a connection is established, the speaker is switched off
ATM2	Speaker is always on
ATM3	Speaker is off whenever the modem is dialing or once a connection is established
ATM4	Speaker is on whenever the modem is dialing or answering. The speaker will also be on during retrains or rate changes.

### Range

0-4

### See Also

L Command Speaker Volume Control



---

**COMMAND      MEANING**


---

**O                      Return to On-Line State**

The **O** command enables you to return to on-line state from command state. When you are on-line (connected to a remote computer), anything you type is treated as data by your modem.

If you want to send commands to your modem, you must return to local command state by typing the escape sequence (+++). When you are ready to return to on-line state, use the **O** command. If you are off line (modem is on hook) when you use an **ATO** command, the modem will go off hook and attempt to connect in answer mode.

☞ The **O** command must be the last command on the command line.

If you have established a connection at greater than 1200bps and are encountering a large number of data errors in your communications, use the **ATO1** command to go on line and force an equalizer retrain. (An equalizer retrain conditions the phone line frequencies to reduce the levels of interference and improve data transmission.)

☞ Retrains cannot overcome noise on the line.

### Options

- ATO0    Enter on-line state
- ATO1    Enter on-line state and force equalizer retrain (2400bps and higher speeds only)
- ATO2    Retrain, don't go on-line (2400bps and higher speeds only)
- ATO3    Change line speed to 4800 bps (V.32bis or V.34)
- ATO4    Change line speed to 7200 bps (V.32bis or V.34)
- ATO5    Change line speed to 9600 bps (V.32bis or V.34)
- ATO6    Change line speed to 12,000 bps (V.32bis or V.34)
- ATO7    Change line speed to 14,400 bps (V.32bis or V.34 or V.FC)
- ATO8    Change line speed to 16,800 bps (V.34 or V.FC)
- ATO9    Change line speed to 19,200 bps (V.34 or V.FC)
- ATO10   Change line speed to 21,600 bps (V.34 or V.FC)
- ATO11   Change line speed to 24,000 bps (V.34 or V.FC)
- ATO12   Change line speed to 26,400 bps (V.34 or V.FC)
- ATO13   Change line speed to 28,800 bps (V.34 or V.FC)

### Range

0-13

---

COMMAND	MEANING
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---

<b>P</b>	<b>Set Dialing to Pulse</b>
----------	-----------------------------

Your modem can use either pulse (decadic) or tone (DTMF) dialing.

The P dial modifier orders the modem to use pulse dialing.

If you are not sure which dialing is used by your phone, lift up the hand set and listen. If you hear a continuous dial tone, you probably can use tone dialing. Normally, only older telephone exchanges do not support tone dialing.

If you are still in doubt, use pulse dialing. Most exchanges supporting tone dialing also support pulse dialing, although the reverse is not always true.

Contact the supplier of your telephone line if you wish to have tone dialing accessible on your line.

☞ Pulse dialing may not be supported in New Zealand. Refer to your Installation Guide for details.

## Options

ATP    Select pulse dialing.

## See Also

T command	Set Dialing to Tone
Dial Modifiers - P	Use Pulse Dialing
Dial Modifiers - T	Use Tone Dialing

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COMMAND	MEANING
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---

<b>Q</b>	<b>Quiet (Suppress Response Codes)</b>
----------	--

Your modem has a variety of messages or response codes which it sends in response to various commands.

Examples of these codes are the OK and CONNECT messages.

The Q command allows you to switch these messages on and off.

If you switch the messages off, no response codes will be displayed on your screen — with the exception of responses from the **ATSn?** command and **AT&V** command.

- **ATQ0** Send response codes to the screen
- ATQ1** Do not send response codes to the screen
- ATQ2** Modem does not return RINGING, CONNECT or NO CARRIER messages when in answer mode.

### See Also

**Sn?** command Display S Register Value  
**V** command Verbal Response Codes  
**X** command Extended Response Codes  
**SRegister 95** Extended Response Codes

### Range

0-2

---

## COMMAND MEANING

---

### **R** Set Terminal Speed

The **R** command allows you to switch off “autobauding” and specify the terminal speed at which your modem operates.

Normally your modem uses autobauding, meaning that when you issue commands to your modem, it automatically detects the speed at which you issue the commands and changes its terminal speed to match your computers terminal speed. For example, if your computer is set to a terminal speed of 9600 bps and you change it to 19,200 bps, when you next issue an AT command to the modem, the modem detects the command was issued at 19,200 bps and changes its terminal speed (that is, the modems terminal speed) to 19,200 bps.

When autobauding is switched off, your modem does not change its terminal speed to match your computers terminal speed. For example, if you set your modem to use a fixed terminal speed of 26,400 bps, all AT commands must be issued to the modem at 26,400 bps. If you issue commands to your modem at another speed, the modem will not accept the commands.

Your modem can only autobaud at 300 bps through 9600 bps, 14,400 bps, 19,200 bps, 38,400 bps and 57,600 bps.

☞ IBM PC and compatible computers cannot support some of the high speeds provided by your modem. If you wish to use terminal speeds above 19,200 bps, we recommend you install a serial card fitted with a 16550 chip. This ensures reliable operation at high speeds when used with the correct drivers and software setup.

If you wish to set your computer terminal speed to another speed, you must issue the appropriate R command immediately prior to setting the computers terminal speed.

### Options

■ ATR0	Autobaud enabled
ATR1	1200 bps (locked terminal speed - no autobaud)
ATR2	2400 bps (locked terminal speed - no autobaud)
ATR3	300 bps (locked terminal speed - no autobaud)
ATR4	4800 bps (locked terminal speed - no autobaud)
ATR7	7200 bps (locked terminal speed - no autobaud)
ATR9	9600 bps (locked terminal speed - no autobaud)
ATR12	12,000 bps (locked terminal speed - no autobaud)
ATR14	14,400 bps (locked terminal speed - no autobaud)
ATR16	16,800 bps (locked terminal speed - no autobaud)
ATR19	19,200 bps (locked terminal speed - no autobaud)
ATR21	21,600 bps (locked terminal speed - no autobaud)
ATR24	24,000 bps (locked terminal speed - no autobaud)
ATR26	26,400 bps (locked terminal speed - no autobaud)
ATR28	28,800 bps (locked terminal speed - no autobaud)
ATR38	38,400 bps (locked terminal speed - no autobaud)
ATR57	57,600 bps (locked terminal speed - no autobaud)
ATR76	76,800 bps (locked terminal speed - no autobaud)
ATR96	96,000 bps (locked terminal speed - no autobaud)
ATR115	115,200 bps (locked terminal speed - no autobaud)
ATR230	230,400 bps (locked terminal speed - no autobaud)

### Range

0, 1, 2, 3, 4, 7, 9, 12, 14, 16, 19, 21, 24, 26, 28, 38, 57, 76, 96, 115

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COMMAND	MEANING
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---

<b>Sn?</b>	<b>Display S Register Value</b>
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---

The **Sn?** command allows you to read the value in a particular Special Register (S Register).

The command is in the form:

**ATSn?**

where **n** is the number of the S Register you want to read.

For example:

The number of times the modem will allow the phone to ring before answering an incoming call is determined by the value in S Register 0. To see the current value of this register:

- Type: `ATS0? <E>`

### Options

`ATS2?` Display the value contained in S-Register 2.

### See Also

<code>Sn=</code> command	Set S Register Value
<code>&amp;V</code> command	View Configuration Profile

---

COMMAND	MEANING
---------	---------

---

<b>Sn=</b>	<b>Set S Register Value</b>
------------	-----------------------------

---

The **Sn=** commands enables you to change the value in a Special Register (S Register).

The format for the command is:

**ATSn=x**

where **n** is the number of the S Register whose value you wish to change and **x** is the value you wish to place in the register.

For example:

The character interpreted as being a carriage return, is determined by the value in S Register 3.

The default value of this register is 13. To change this value to 15:

- Type: `ATS3=15 <E>`

It is important to alter values only in those S Registers listed for your modem. Placing a value in any other S Register can have unforeseen consequences.

Default values and the permissible range of values for each S Register are detailed in the S Register section of this guide.

### Options

ATS2=2 Set S Register 2 with a value of 2

### See Also

Sn? command    Display S Register Value

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COMMAND	MEANING
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---

<b>T</b>	<b>Set Dialing to Tone</b>
----------	----------------------------

Your modem can use either pulse (decadic) or tone (DTMF) dialing.

The T dial modifier orders the modem to use pulse dialing.

If you are not sure which dialing is used by your phone, lift up the hand set and listen. If you hear a continuous dial tone, you probably can use tone dialing. Normally, only older telephone exchanges do not support tone dialing.

If you are still in doubt, use pulse dialing. Most exchanges supporting tone dialing also support pulse dialing, although the reverse is not always true.

Contact the supplier of your telephone line if you wish to have tone dialing accessible on your line.

### Options

ATT    Select tone dialing..

### See Also

P command	Set Dialing to Pulse
Dial Modifiers - P	Use Pulse Dialing
Dial Modifiers - T	Use Tone Dialing

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COMMAND	MEANING
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V Verbal Response Codes

Your modem can display either verbal or numeric response codes in response to various commands.

The **V** command enables you to select which type of response code you want to display.

Basic response codes common to all modems are:

<i>Verbal</i>	<i>Numeric</i>	<i>Meaning</i>
OK	0	Command accepted and executed
CONNECT	1	Carrier detected and connection established
RING	2	Ringing signal detected
NO CARRIER	3	Carrier lost or not detected
ERROR	4	Error in command string or command line longer than 80 characters or S69 time out

### Options

- ATV0 Numeric response codes
- ATV1 Verbal response codes

### See Also

- X command Extended Response Codes
- Q command Quiet (Suppress Response Codes)
- \V command Error Correction Response Codes
- SRegister 95 Extended Response Codes

☞ A full description of all Response Codes is contained in Appendix A

### Range

0-1

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COMMAND	MEANING
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W Connection Speed Information

The **W** command allows you to decide whether your modem will report its line speed or terminal speed when it connects to another modem.

## Options

- ATW0 The CONNECT message reports the terminal speed
- ATW1 The CONNECT message reports the terminal speed
- ATW2 The CONNECT message reports the line speed

## Range

0-2

## See Also

- V command Verbal Response Codes
- X command Extended Response Codes
- SRegister 95 Extended Response Codes

Command Descriptions

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COMMAND	MEANING
X	Extended Response Codes

---

The X command enables you to choose which response codes will be displayed.

The basic response codes for all modems are:

Verbal	Numeric	Meaning
OK	0	Command accepted and executed
CONNECT	1	Carrier detected and connection established
RING	2	Ringing signal detected
NO CARRIER	3	Carrier lost or not detected
ERROR	4	Error in command or command line longer than 80 characters or S69 time out

Depending on the modem you are using, other extended response codes are also available.

For example:

All modems which can operate at 1200 bps or 1200/75 bps use response code 5 (CONNECT 1200), and those operating at 2400 bps use response code 10 (CONNECT 2400). You can choose to display only basic response codes or you can display sets of extended response codes, depending on the capabilities of your modem.



☞ Response Code 8 (NO ANSWER) is controlled by the Wait For Quiet Answer dial modifier. /REL Response Codes appear only if \V1, \V8, or \V9 is selected.

☞ X0, X1, X3 & X6 disables dial tone detection. This allows you to dial when there is no dial tone or the dial tone is not standard. X0, X1 & X2 disable busy detection. If a busy signal is received it is ignored. The modem will hangup after 57 seconds.

## Options

- ATX0 Display extended response codes (0-4) only
- ATX1 Display extended response codes (0-5,10-12,30-40,60-62)
- ATX2 Display extended response codes (0-6,10-12,30-40,60-62)
- ATX3 Display extended response codes (0-5,7,10-12,30-40,60-62)
- ATX4 Display extended response codes (0-7,10-12,30-40,60-62)
- ATX5 Display extended response codes (0-7,10-13,30-40,60-62)
- ATX6 Display extended response codes (0-5, 7-8, 10-13, 30-40,60-62)  
(See tables on next page)

## Range

0-6

## See Also

- Q command Quiet (Suppress Response Codes)
- V command Verbal Response Codes
- W command Connection Speed Information
- \V command Error Correction Response Codes
- %U command V.42 Response Codes
- S Register 95 Extended Response Codes

Numeric	Response	X0	X1	X2	X3	X4	X5	X6
0	OK	✓	✓	✓	✓	✓	✓	✓
1	CONNECT	✓	✓	✓	✓	✓	✓	✓
2	RING	✓	✓	✓	✓	✓	✓	✓
3	NO CARRIER	✓	✓	✓	✓	✓	✓	✓
4	ERROR	✓	✓	✓	✓	✓	✓	✓
5	CONNECT 1200		✓	✓	✓	✓	✓	✓
6	NO DIALTONE			✓		✓	✓	
7	BUSY				✓	✓	✓	✓
8	NO ANSWER	✓	✓	✓	✓	✓	✓	✓
10	CONNECT 2400		✓	✓	✓	✓	✓	✓
11	CONNECT 4800		✓	✓	✓	✓	✓	✓
12	CONNECT 9600		✓	✓	✓	✓	✓	✓
13	RINGING						✓	✓
20	CONNECT/REL	✓	✓	✓	✓	✓	✓	✓
22	CONNECT 1200/REL		✓	✓	✓	✓	✓	✓
23	CONNECT 2400/REL		✓	✓	✓	✓	✓	✓
24	CONNECT 4800/REL		✓	✓	✓	✓	✓	✓
25	CONNECT 9600/REL		✓	✓	✓	✓	✓	✓
26	CONNECT 12000/REL		✓	✓	✓	✓	✓	✓
27	CONNECT 14400/REL		✓	✓	✓	✓	✓	✓
28	CONNECT 7200/REL		✓	✓	✓	✓	✓	✓
30	CONNECT 12000		✓	✓	✓	✓	✓	✓
31	CONNECT 14400		✓	✓	✓	✓	✓	✓

Numeric	Response	X0	X1	X2	X3	X4	X5	X6
32	CONNECT 7200		✓	✓	✓	✓	✓	✓
33	CONNECT 16800		✓	✓	✓	✓	✓	✓
34	CONNECT 19200		✓	✓	✓	✓	✓	✓
35	CONNECT 21600		✓	✓	✓	✓	✓	✓
36	CONNECT 24000		✓	✓	✓	✓	✓	✓
37	CONNECT 26400		✓	✓	✓	✓	✓	✓
38	CONNECT 28800		✓	✓	✓	✓	✓	✓
39	CONNECT 57600		✓	✓	✓	✓	✓	✓
40	CONNECT 16800/REL		✓	✓	✓	✓	✓	✓
43	CONNECT 19200/REL		✓	✓	✓	✓	✓	✓
44	CONNECT 21600/REL		✓	✓	✓	✓	✓	✓
45	CONNECT 24000/REL		✓	✓	✓	✓	✓	✓
46	CONNECT 26400/REL		✓	✓	✓	✓	✓	✓
47	CONNECT 28800/REL		✓	✓	✓	✓	✓	✓
48	CONNECT 38400/REL		✓	✓	✓	✓	✓	✓
49	CONNECT 57600/REL		✓	✓	✓	✓	✓	✓
50	CONNECT 76800		✓	✓	✓	✓	✓	✓
60	CONNECT 96000		✓	✓	✓	✓	✓	✓
61	CONNECT 115200		✓	✓	✓	✓	✓	✓
62	CONNECT 76800/REL		✓	✓	✓	✓	✓	✓
63	CONNECT 230400		✓	✓	✓	✓	✓	✓
70	CONNECT 96000/REL		✓	✓	✓	✓	✓	✓
71	CONNECT 115200/REL		✓	✓	✓	✓	✓	✓
72	CONNECT 115200/REL		✓	✓	✓	✓	✓	✓
73	CONNECT 230400/REL		✓	✓	✓	✓	✓	✓

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COMMAND	MEANING
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<b>Zn</b>	<b>Restore Configuration Profile</b>
-----------	--------------------------------------

Your modem is supplied with a default operating set up. You can change this temporarily by issuing commands while you are working, or permanently by using the **&Wn** command to store profiles you've made in non-volatile memory (where n=profile 0,1,2 or 3).

The **Zn** command returns the modem to saved configuration profile n.

For example:

If you have saved a configuration into profile 2 by using **&W2**, you can restore the modem to the values contained in saved configuration 2 by:

- Type: **ATZ2 <E>**

To restore factory defaults use the **&F** command.

☞ The **Zn** command must be the last command on a line.

### Options

ATZ0	Restore active configuration from stored profile 0
ATZ1	Restore active configuration from stored profile 1
ATZ2	Restore active configuration from stored profile 2
ATZ3	Restore active configuration from stored profile 3

### See Also

<b>&amp;Wn</b> command	Write Configuration
<b>&amp;F</b> command	Restore Factory Defaults
<b>&amp;F.</b> command	Reinitialize modem
<b>&amp;V</b> command	View Active Configuration

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**COMMAND    MEANING**

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**&B                      Character Length**

The **&B** command allows the modem to use character lengths of 8, 9, 10 or 11 bits.

Bits per Character	Data Bits	Parity Bit	Start Bit	Stop Bits
8	5	odd or even	1	1+
	6	none	1	1+
9	6	odd or even	1	1+
	7	none	1	1+
10	7	odd or even	1	1+
	8	none	1	1+
11	8	odd or even	1	1+

Command Descriptions

☞ The modem will only match the speed of your computer when 10-bit or 11-bit characters are selected.

**Options**

- AT&B0            8 bit characters
- AT&B1            9 bit characters
- AT&B2            10 bit characters
- AT&B3            11 bit characters
- AT&B4            Use 10 or 11-bit format as detected by autobaud

**Range**

0-4

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<b>COMMAND</b>	<b>MEANING</b>
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<b>&amp;C</b>	<b>Controlling Data Carrier Detect (DCD)</b>
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The **&C** command enables you to control how DCD will operate. DCD is a RS-232 interface signal from the modem to a remote device, such as a terminal or a computer, indicating that the modem is receiving a carrier signal from a remote modem. This signal is switched on (asserted) when your modem is receiving a valid carrier signal from a remote modem.

The **&C3** option allows a connection that was commenced as a voice call to switch to fax or data mode without an interruption to the DCD signal (which might cause the application to think that the line has been lost).

☞ The **&C** command will only have effect when the DCD option switch is in the UP position and **%T0** is selected. (Refer to the *Dumb Mode Section* for details.)

### Options

- AT&C0      DCD signal is always asserted
- AT&C1      DCD signal responds to remote modem
- AT&C2      DCD signal always on, pulses low on disconnect
- AT&C3      DCD asserted during voice session

### Range

0-3

### See Also

- S Register 9      Carrier Detect Response Time
- S Register 10      Lost Carrier/Hang Up Delay
- %T              DCD Control Dumb Mode Switches
- %P              Connect Message Timing

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**COMMAND    MEANING**


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**&D**      Controlling Data Terminal Ready (DTR)

The DTR signal is used to indicate to the modem whether your computer is ready to communicate.

☞ The **&D** command will only take effect when the DTR option switch is in the UP position and %S0 is selected. (See the *Dumb Mode Section* for details.)

#### Options

- **AT&D0**    The modem ignores the DTR signal and acts as if it is asserted (the modem assumes the computer is ready to communicate). **AT&D1** The modem will return to on line command state if DTR is lowered during a connection.
- AT&D2**      The modem will hang up, return to local command state and disable auto-answer while DTR is low (is not asserted). To enable auto-answer, the DTR signal must be asserted. The computer must assert DTR before dialing or answering may commence.
- AT&D3**      If DTR is lowered, the modem will hang up, return to local command state and initialize itself with the values stored in the &Y profile.
- AT&D4**      The modem will hang up, return to local command state and go off-hook. It will remain off-hook while DTR is low.

☞ S Register 25 determines how long DTR must be low before the modem recognizes it as such.

☞ S Register 75 determines how long DTR must be high before the modem recognizes it as such.

#### Range

0-3

#### See Also

S 25, S75            DTR Detection Times

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COMMAND	MEANING
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<b>&amp;F.</b>	<b>Reinitialize Modem</b>
----------------	---------------------------

The **&F.** command will completely re-initialize your modem. This command will delete stored phone numbers, security, and encryption settings. We recommend you execute this command immediately after installing your modem.

All of the stored profiles in non-volatile memory will be restored to factory defaults.

- Type: AT&F.

Do not press ENTER

A message will be displayed: OK

If you do not receive this message, re-check the connection of your modem to your computer. Repeat the command. If the message still does not appear, contact your dealer.

☞ The Security Database will not be cleared by the **&F.** if the Security Lock feature is enabled.

### Options

AT&F Total reinitialization

### See Also

#S Command Security Options



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**COMMAND      MEANING**


---

**&F                      Restore Factory Defaults**

Your modem comes with factory default settings for all communications settings and S Registers.

The **&F** command enables you to restore the factory default values to the command settings and S Registers.

This command does not reset stored phone numbers, security, or encryption settings.

The **&F1** command selects non-error correction factory defaults. The defaults selected are:

X0 &K0 &D2 \N1 %C0

The **&F2** command selects synchronous mode factory defaults. The defaults selected are:

B13 E0 Q1 &M2

You *must* use the **&W** command if you wish to save the default values to non-volatile memory, and thus preserve these values when you switch the modem off.

☞ If you issue the **&F** command while the modem is off-hook, an ERROR message will be returned.

### Options

AT&F    Restore Command and S Registers to Factory Defaults

AT&F1    Select non-error correction factory defaults

AT&F2    Select synchronous mode factory defaults

### See Also

&V command    View the Active Configuration

Z command      Restore Configuration

&W command    Save Configuration

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COMMAND	MEANING
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<b>&amp;G</b>	<b>Guard Tone</b>
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The **&G** command controls the generation of guard tones.

A guard tone is a predetermined frequency generated by the modem to supervise the communications path.

The **&G** command only affects V.22 and V.22bis connections.

### Options

- **AT&G0** Do not generate guard tones
- **AT&G1** Generate guard tones of 550Hz
- **AT&G2** Generate guard tones of 1800Hz

### Range

0-2

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COMMAND	MEANING
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<b>&amp;H</b>	<b>Clock Control</b>
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The **&H** command determines when clocks will be applied to the 'RxC' RS-232 signal.

With **&H0** selected, the RxC signal will be active whenever a synchronous mode is selected.

With **&H1** selected, the clock will only be present after a connection has been established to another modem.

### Options

- **AT&H0** Clock always present in synchronous mode
- **AT&H1** Clock only appears after connection

### Range

0-1

---

**COMMAND    MEANING**


---

**&K                      Flow Control**

The **&K** command enables you to select the type of flow control used between your modem and the local computer when asynchronous mode is selected. You may want to do this to prevent possible data loss resulting from buffer overflow.

Using flow control guarantees that data buffers in your modem and computer won't overflow. Your modem and your terminal or computer must be using the same type of flow control.

☞ Flow control is only available when your modem is configured for constant speed mode or reliable or auto-reliable modes and is operating in on-line state. Flow control will be ignored when your modem is configured for variable speed mode (**AT\N1**) or is in local command state.

**WARNING**

XON/XOFF flow control *must not* be selected when you are using XModem, YModem and SEAlink file transfers. XON/XOFF flow interferes with the operation of these file transfer protocols and will cause unreliable operation.

## Options

**AT&K0** Flow control disabled

**AT&K3** RTS/CTS (hardware) flow control

The modem and computer use the CTS (Clear to Send) and RTS (Request to Send) signals on the RS-232 serial connection to control data flow.

**AT&K4** XON/XOFF (software) flow control

The modem and computer use the XON and XOFF characters (DC1 and DC3) to control the flow of data.

**AT&K5** Transparent XON/XOFF flow control

The modem and computer encode and decode XON and XOFF characters which are part of the data stream. Transparent XON/XOFF provides reliable operation when using file transfer protocols.

■ **AT&K9** Failsafe flow control

When the modem's data buffer approaches maximum capacity, the modem will lower the CTS signal. If the computer subsequently sends more than 60 (S82) characters to the modem, the modem will send an XOFF character to the computer.

When the modem is ready to accept more data from the computer it will assert CTS and, if an XOFF was sent by the modem, will send an XON character to the computer.

Failsafe flow control only affects data being transmitted from the computer to the modem. Flow control is not supported for data being transmitted by the modem to the computer.

**Range**

0, 3-5, 9

**See Also**

- \N command    Operating Mode
- \Q command    Extended Flow Control
- S Register 80 Flow Control High Water Mark
- S Register 81 Flow Control Low Water Mark
- S Register 82 Failsafe Flow Control Overrun

---

**COMMAND    MEANING**

---

**&L            Leased Line**

The **&L** command allows you to specify whether your modem will be connecting over the public switched telephone network (PSTN) or leased lines (point-to-point connection).

When the leased-line mode is selected, if the carrier from the remote modem is lost, the modem will continuously attempt to re-establish a connection.

If you select leased line operation with the **&L1** command, you must issue the **ATA** command to answer a call, and the **ATD** command to initiate a call.

If you use the **&L2** or **&L3** command to select Auto leased line operation, you do not need to issue the **ATA** or **ATD** commands; **&L2** selects Originate mode automatically and **&L3** selects Answer mode automatically.

See the section — Leased Line Operations — for a detailed explanation of the **&L** command and leased line operations.

### Options

- **AT&L0** PSTN mode
- **AT&L1** Leased-line mode
- **AT&L2** Auto leased line Originate mode
- **AT&L3** Auto leased line Answer mode

### Range

0-3

---

## COMMAND MEANING

---

### **&M** Synchronous/Asynchronous Mode

The **&M** command enables you to select either asynchronous or synchronous operation.

During asynchronous transmissions, the time between characters being sent may vary, and the characters are delimited by start and stop bits to coordinate data transfer.

During synchronous transmissions, the interval between the transmission of each character is of equal length, controlled by clock signals.

Synchronous transmission is most commonly used in communications involving mainframe computers.

### Options

- n **AT&M0** Asynchronous mode  
The modem will dial and answer in the asynchronous mode and then enter asynchronous on-line state when a connection is established.

- AT&M1** Synchronous mode with asynchronous dialing  
The modem remains in asynchronous mode while it is on-hook, dialing or answering. When a connection is established, the modem automatically switches to synchronous operation.
- AT&M2** Synchronous mode with dialing invoked by the DTR signal  
The modem remains in asynchronous mode while it is on-hook, dialing or answering. You must issue the **AT&D2** command prior to using this synchronous mode.  
When your local computer asserts the DTR (Data Terminal Ready) signal, the modem will dial stored phone number zero (see the **&Zn** command).  
When an incoming call is detected, the modem will attempt to answer it as soon as the DTR signal is asserted and the number of rings specified in S Register 0 is reached.  
As soon as a connection is established, the modem automatically switches to synchronous operation.  
If DTR is lowered at any time, the modem will hang up.

### Range

0-2, 4

### See Also

- &D** command Controlling DTR  
**&X** command Synchronous Clocks  
**&Z** command Stored Phone Number

---

**COMMAND    MEANING**


---

**&N            Abort Connection**

The **&N** command determines whether the modem will abort the attempt to make a connection if sent a character by the computer.

You can abort connection by either lowering the DTR (Data Terminal Ready) signal, or by sending a character (except a null or line feed character) to the modem.

☞ If you have used the **&N0** command and the DTR Option switch is in the down position, you will not be able to abort dialing after the **D** (Dial) command is issued.

**Options**

- AT&N0      Disable abort connection
- AT&N1    Enable abort connection

**Range**

0-1

---

**COMMAND    MEANING**


---

**&P            Pulse Ratio Selection**

The **&P** command selects the ratio make/break interval used when the modem pulse dials.

Use the setting specified by your telecommunications regulatory authority.

☞ UK Modems. Warning. Selecting the **&P0** command may invalidate the approval of your modem.

**Options**

- AT&P0      39/61 make/break ratio (United States)
- AT&P1    33/67 make/break ratio  
              (United Kingdom, New Zealand, Australia)

**Range**

0-1

---

COMMAND	MEANING
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<b>&amp;R</b>	<b>RTS/CTS Control</b>
---------------	------------------------

The **&R** command allows you to determine the relationship between the RTS (Request to Send) and CTS (Clear to Send) signals, when operating in synchronous mode.

The **&R** command is ignored whenever asynchronous mode is selected.

**%R1** overrides the **&R** command.

### Options

- **AT&R0** CTS follows RTS when the modem is on line.
- **AT&R1** CTS is always asserted.

### Range

0-1

### See Also

**%R** CTS Override

---

COMMAND	MEANING
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<b>&amp;S</b>	<b>Controlling DSR</b>
---------------	------------------------

The **&S** command allows the modem to control the state of the DSR (Data Set Ready) signal. This command will only take effect when the DSR option switch is in the UP position (see your *Dumb Mode Section* for details). **%S** overrides the **&S** command.

### Options

- **AT&S0** DSR signal will always be asserted
- **AT&S1** DSR signal asserted at the start of handshake
- **AT&S2** DSR signal asserted at end of handshake (before CONNECT message)

### Range

0-2

### See Also

**%S** command



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**COMMAND      MEANING**


---

**&T                      Self-Test**


---

Your modem is capable of performing a number of tests on itself to check its functions and the functioning of the remote modem and the telephone line.

You can terminate any test in progress by issuing an **AT&T0** command.

&T3 ,&T6 and &T7 cannot be performed when running an error correcting protocol since the protocol would be unable to run. These tests should only be performed in constant speed mode (\N0).

The number of the test in progress is saved in S Register 16.

☞ All tests are detailed in the Testing Section of this guide.

### Options

<i>Command</i>	<i>Description</i>
AT&T0	Terminate current test
AT&T1	Local Analog Loopback test
AT&T3	Local Digital Loopback test
■ AT&T4	Grant Remote Digital Loopback test
AT&T5	Deny Remote Digital Loopback test
AT&T6	Remote Digital Loopback test
AT&T7	Remote Digital Loopback with Self-test
AT&T8	Local Analog Loopback with Self-test

### Range

0-1, 3-8

### See Also

S Register 16	Test in Progress
S Register 18	Test Timer
\N command	Operating Mode

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COMMAND	MEANING
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<b>&amp;Vn</b>	<b>View Active Configuration Profile</b>
----------------	--

The **&V** command allows you to view the active configuration profile of your modem.

This shows the settings of **AT** commands and **S** Registers. Not all **AT** commands and **S** Registers will be shown. For example, the commands which relate to **V.25bis** operation will only appear when **V.25bis** mode is selected. **&V0 - &V3** displays the contents of stored profiles 0 to 3 respectively

☞ For this command **&V** is different from **&V0**

☞ The **&V** command must be the last command on the command line.

### Options

<b>AT&amp;V</b>	View active configuration profile
<b>AT&amp;V0</b>	View stored configuration profile 0
<b>AT&amp;V1</b>	View stored configuration profile 1
<b>AT&amp;V2</b>	View stored configuration profile 2
<b>AT&amp;V3</b>	View stored configuration profile 3
<b>AT&amp;V8</b>	View differences between active configuration and default settings of the <b>S</b> Registers

### See Also

S Register 96 Help Page Width  
S Register 97 Help Page Length

### Range

0-3,8

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COMMAND	MEANING
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<b>&amp;Wn</b>	<b>Write Configuration Parameters</b>
----------------	---------------------------------------

The **&Wn** command allows you to save the current configuration profile including communications settings and **S** Register values into 1 of 4 stored profiles in the modem's non-volatile memory.

The values contained in the modem's non-volatile memory specified by the **&Y** command will be loaded when the modem is next switched on.

The **&Zn** command restores the specified profile to the active configuration.

See the topics of S Register Settings and Modem Memory in the S Register section of this Guide for a description of the different types of memory in your modem and how they function.

## Options

AT&W0	Save current configuration into profile 0
AT&W1	Save current configuration into profile 1
AT&W2	Save current configuration into profile 2
AT&W3	Save current configuration into profile 3

## See Also

<b>Sn=x</b> command	Set S Register
<b>Zn</b> command	Restore active profile from stored configuration
<b>&amp;Y</b> command	Select Power-up Profile
<b>Sn=x</b> command	Set S Register
<b>Zn</b> command	Restore active profile from stored configuration
<b>&amp;Y</b> command	Select Power-up Profile

---

## COMMAND      MEANING

---

**&X**                      **Transmit Clock**

The **&X** command nominates the source of its *transmit* clock signal when operating in synchronous mode. The *receive* clock is always derived from the receive (remote) carrier signal.

## Options

- **AT&X0** Synchronous clocks generated by Modem.  
The modem generates the transmit clock and applies it to pin 15 of the RS-232 socket
- AT&X1** Clocks generated by computer - external clocking.  
The clock generated by the computer or terminal (received on pin 24 of the RS-232 socket) is directly applied to pin 15. This is known as external clocking.
- AT&X2** Clocks generated by remote system - slave clocking.  
The receive clock (derived from the incoming carrier signal) is applied to pin 15 of the RS-232 socket. This is known as slave clocking.

## See Also

**&M** command Synchronous/Asynchronous Mode

## Range

0-2

---

COMMAND	MEANING
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---

<b>&amp;Yn</b>	<b>Select Stored Profile on Power Up</b>
----------------	--

The **&Yn** command determines which stored (User) profile is selected as the Active profile when the modem is switched on and also when **&D3** is selected and DTR drops.

## Options

AT&Y0	Select stored profile 0 on power up
AT&Y1	Select stored profile 1 on power up
AT&Y2	Select stored profile 2 on power up
AT&Y3	Select stored profile 3 on power up

## See Also

**&D3** command Controlling DTR

## Range

0-3

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COMMAND	MEANING
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---

<b>&amp;Z</b>	<b>Stored Phone Number</b>
---------------	----------------------------

The **&Z** command enables you to store phone numbers in your modem's non-volatile memory. The command takes the form **&Zn=x**, where **x** is the phone number you want to store and **n** indicates which of the stored phone numbers it will be saved as. Stored numbers may contain up to 20 characters, including dial modifiers.

Do *not* include, in the stored phone number:

- an **AT**
- a **D** (Dial) command
- an **S** (Stored number) dial modifier

If you are using synchronous mode 2 , do not use the ; (return to local command state) dial modifier in the number. The stored phone numbers are displayed by the **&V** display.

### Options

**AT&Z2=12345**

Store the phone number 12345 as stored phone number two

**AT&Z4=P0,T12345**

Store the following as stored number four; first pulse dial 0, wait for two seconds to get an outside line and then tone dial 12345

### See Also

**D** command Dial (and S dial modifier)

**&M2** command

**&M4** command

**&V** command [View Active Configuration Profile](#)

### Range

0-9

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COMMAND	MEANING
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#A	<b>Universal Remote Access</b>
----	--------------------------------

This command allows a controlling modem to take control of a remote modem. All commands of the remote modem(s) are available to the controlling modem, with the exception of the Test commands. (DES keys can be changed and will take effect from the next connection made to the modem.)

To initiate remote access, the user of the controlling modem should:

- Type: \*\*\*\* (the remote access sequence)  
(with 1.0 sec guard time before and after the \*\*\*\*)

If #A2 has been set, after receiving the remote access sequence, the remote modem will send back a request to enter password. The password it is expecting is its security menu password (see #S command). If no password has been defined, remote access is disabled.

If the password you type is incorrect, the following message appears:

```
Incorrect. Please try again
```

You must re-initiate the remote access by typing the remote access sequence again before you can re-type the password.

If the password you type is correct, the following message will be displayed:

```
Remote control enabled
```

To terminate the remote control, the user of the controlling modem should, while in on-line state:

- Type: ATO <E>

Guard time can be adjusted by changing the value in S Register 66 (default 1 second). The remote access character is specified in S Register 67. The default value is 42 — the asterisk (\*) character.

☞ **AT#A2** is only available if your modem supports the security menu (#S).

## Options

- AT#A0 Prevent remote access
- AT#A1 Allow remote access
- AT#A2 Allow remote access with security password

☞ If your product does not have security features, the default is # A0

## See Also

- \*\*\*\* Remote Access Sequence
- #S command Security Menu
- S Register 66 Remote access guard time
- S Register 67 Remote access character

## Range

0-2

COMMAND	MEANING
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#B	B0 & B2 1200bps Originate Mode
----	--------------------------------

The #B command determines whether the modem will use V.23 or V.22 for its 1200 bps originate speed when B0 or B2 is selected.

By default, your modem will use V.23 as its 1200 bps connection standard with B0 selected and V.22 with B2. #B1 reverses these settings.

## Options

- AT#B0 B0 = V.23 B2 = V.22
- AT#B1 B0 = V.22 B2 = V.23

## See Also

B command Select Communications Standards

## Range

0-1

---

COMMAND	MEANING
---------	---------

---

#C	<b>V.25 Calling Tones</b>
----	---------------------------

The #C command determines whether the modem will generate V.25 calling tones when operating in originate mode.

V.25 calling tones are generated as a measure of courtesy if the telephone number you dial is answered by a person rather than a modem or other electronic device. It also allows an electronic device to select the appropriate operating mode.

V.25 tones indicate to the answerer of a call that a modem in data mode (not fax) is the originator of the call.

### Options

- AT#C0 V.25 calling tones disabled
- AT#C1 V.25 calling tones enabled

### See Also

- X command Response codes
- D command F or ^ dial modifiers

### Range

0-1

---

COMMAND	MEANING
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---

#D	<b>V.25bis Direct Calling</b>
----	-------------------------------

This command determines whether direct calling procedures (or 'DTR dialing') will be used when V.25bis mode is selected. Refer to the section titled 'Direct Dialing', which appears in the V.25bis chapter, for details of how direct dialing works.

### Options

- AT#D0 Disable direct calling procedures
- AT#D1 Enable direct calling procedures

### Range

0-1



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**COMMAND    MEANING**


---

#E                    Encryption

The #E command allows you to select DES encryption operating mode.

The #E1 command enables standard DES encryption.

DES encryption allows you to encrypt data being passed to a remote modem. The remote modem must support Cipher Feedback (or CFB) DES encryption to decrypt the data sent from your modem. You may compress the data before encryption using %C option.

The #E2 command enables the SuperSecure option.

Full details on Encryption and SuperSecure can be found in this guide in the Security Section.

**WARNING**

**Only reliable error correction modes should be used with DES. This ensures only DES connections will be established with another modem. Refer to the \N command for details of the error correction modes.**

☞ For countries other than Australia, DES encryption is only available to end users who meet the security requirements of the Australian Department of Defence. Contact your modem supplier for details of making application for a DES equipped modem to be supplied to you.

### Options

- AT#E0            DES encryption disabled
- AT#E1            DES encryption enabled
- AT#E2            SuperSecure enabled (some models only)

### Range

0-2

---

**COMMAND    MEANING**

---

**#F                    Front Panel test Switches**

After **AT#F1** is issued, the Syn switch starts an analog loopback test, the Ori switch starts a remote digital loopback test and the AA switch sends a V.54 test pattern over the telephone line. The Mode 1 LED will glow if a test pattern is received over the telephone line.

**Options**

- **AT#F0**            Disable front panel tests
- AT#F1**            Enable front panel tests

**See Also**

**&T** command    Self-Test

**Range**

0-1

---

**COMMAND    MEANING**

---

**#I                    V.22bis Lease Line**

The ITU (CCITT) specifies that in V.22 and V.22bis a different handshake should be used for leased line mode. This mode is specified by default. Some modems still use the standard PSTN handshake for leased line connections. Use **#I1** to connect to these modems in V.22bis leased line mode.

**Options**

- **AT#I0**            V.22bis leased line normal
- AT#I1**            Use non-standard PSTN V.22bis over leased line

**See Also**

**&L** command Leased Line

**Range**

0-1

Command Descriptions

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**COMMAND    MEANING**


---

**#J                    V.42 Capability Checking**

The **#J** command allows you to select whether your modem will check if the modem it is connecting to supports V.42, MNP or no error correction. This command only affects your modem when it dials another modem.

If **#J0** is selected, your modem will assume the answering modem is a V.42 modem. You should only issue the **AT#J0** command when you are certain the other modem is a V.42 modem.

When **#J1** is selected, your modem uses the 'V.42 detect phase' to test whether the answering modem supports V.42. This allows your modem to fall back to MNP or non-error corrected mode.

**WARNING**

**You will not be able to communicate with a non-V.42 modem if the AT#J0 command has been issued, regardless of the setting of the \N command.**

### Options

- |         |                          |
|---------|--------------------------|
| AT#J0   | Assume V.42 capable      |
| ■ AT#J1 | Check V.42 compatibility |

### See Also

- |               |                              |
|---------------|------------------------------|
| \N command    | Asynchronous Operating Mode  |
| S Register 62 | V.42 Detection Phase Timeout |

### Range

0-1

---

COMMAND	MEANING
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#K	MNP 10 Mode
----	-------------

MNP 10 works in conjunction with error correction and data compression to improve the performance of your modem when operating with poor or varying quality telephone lines (as sometimes found with cellular or overseas telephone connections).

MNP is the only type of error correction allowed with MNP 10 and is only available when connected to another modem that supports MNP 10. Refer to the chapter titled 'Error Correction' for details of MNP 10.

If you are using MNP 10 over bad telephone lines or cellular connections, issue the %H1 command before dialing, or use the J or L dial modifiers. This ensures an MNP 10 connection is established. Issue the AT#K2 command for cellular connections; it makes MNP 10 try harder to maintain the connection if the cellular call 'drops out'.

### Options

- AT#K0      Disable MNP 10
- AT#K1      Enable MNP 10
- AT#K2      Enable MNP 10 with cellular options

### See Also

- \N command      Asynchronous Operating Mode
- %C command      Data Compression
- %H command      MNP 10 Negotiation Speed
- M dial modifier      Initiate MNP 10 at 4800 bps
- J dial modifier      Initiate MNP 10 at 1200 bps
- K dial modifier      Initiate MNP 10 Cellular option
- Q command      MNP 10 fallback to V.22 option

---

**COMMAND    MEANING**


---

**#M                    Command Mode Selection**

The **#M** command selects AT command mode or V.25bis operating mode. See the section — V.25bis Operations — for an explanation of V.25bis.

The **#M** command doesn't take effect until the an **AT&W** and an **ATZ** command are issued.

**Options**

- **AT#M0**      AT command operation
- AT#M1**      Asynchronous V.25bis
- AT#M2**      Synchronous V.25bis (HDLC framing)
- AT#M3**      Synchronous V.25bis (Character framing — BSC mode)

**See Also**

**Z** command Reset

**&W** command Write Configuration Parameters

**Range**

0-3

---

**COMMAND    MEANING**


---

**#N                    V.25bis Character Encoding**

Use the **#N** command to select either NRZ or NRZI character encoding for V.25bis synchronous operation. This command only takes effect when a synchronous V.25bis operating mode is selected.

Before setting the **#N** command, check which character encoding method is expected by your computer.

**Options**

- **AT#N0**      NRZ Character Encoding
- AT#N1**      NRZI Character Encoding

**Range**

0-1

---

**COMMAND      MEANING**

---

**#O                      Buffer Overflow**

The **#O** command decides what happens when your modem buffers fill and can no longer accept data. This will occur if data is received faster than your computer or modem can accept it.

☞ The **#O** command is not supported when a variable speed mode connection is established.

**Options**

- **AT#O0**      Characters are ignored if the modem buffers overflow.
- AT#O1**      Modem disconnects if the terminal buffer overflows (that is, data from the computer to the modem). S Register 42 (the Disconnect Reason) is set to 10.
- AT#O2**      Modem disconnects if the line buffer overflows (that is, data from the line to the modem). S Register 42 is set to 9.
- AT#O3**      Modem disconnects if either buffer overflows. S Register 42 will be set to 9 or 10, depending upon whether the line or terminal buffer overflowed.

**See Also**

S Register 42 Disconnect Reason

**Range**

0-3

---

**COMMAND      MEANING**

---

**#Q                      V.25bis Terminal Speed**

This command allows you to specify the V.25bis terminal speed. When **AT#Q0** is issued, your modem will use the speed at which you issued the last AT command for V.25bis mode. Alternatively, you may issue one of the other **#Q** commands to select a specific V.25bis terminal speed.

**Options**

- n **#Q0**      Use last autobaud speed
- + Other options are the same as the ATR command

**Range**

0, 1, 2, 3, 4, 7, 9, 12, 14, 16, 19, 21, 24, 26, 28, 38, 57, 76, 96, 115, 230

---

**COMMAND    MEANING**

---

**#R                    Enable Remote Control**

The **#R** command allows a remote modem to control your modem.

Once a connection has been established, issuing the **#R** command will enable remote control mode.

After the command is issued, any commands the remote modem sends to your modem will be acted upon by your modem, as if commands were being issued from the computer attached to your modem.

You can terminate remote control by issuing an **ATO** command.

**Options**

AT#R            Enable remote control mode

**See Also**

O command On-Line

---

**COMMAND    MEANING**

---

**#S                    Security Menu**

The **#S** command orders the modem to enter the Security Menu mode.

When the modem is in Security Menu mode, the Security Menu will be displayed on your computer screen:

SECURITY MENU

- |                                     |                                     |
|-------------------------------------|-------------------------------------|
| 0 - Quit                            | 1 - List Users                      |
| 2 - Add or Change Users             | 3 - Delete All Users                |
| 4 - View Access Record              | 5 - Reset Access Record             |
| 6 - Security Off                    | 7 - Security On                     |
| 8 - Change Security Password        | 9 - Encryption Controls             |
| A - Stored Phone Numbers Displayed  | B - Supressed                       |
| C - Set Password Expiry Days        | E - Minimum Password Length         |
| D - Download Security file to host  | U - Upload Security file from host  |
| L - Encryption Parameters/Keys LOCK | F - FREE Encryption and Dial Enable |
| K - OutDial Disable                 | M - Dial Stored Phone Numbers Only  |

Access Security: OFF    Security Database and Security Mode: FREE  
Stored Phone Numbers: DISPLAYED    OutDial: ENABLED

Enter Security Function :

You'll find details on the Security Menu and its use in the Security Section of this guide.

### Options

**AT#S    Display Security Menu**



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**COMMAND    MEANING**


---

**#U                    V.25bis Character Set**

The **#U** command is used to select the character set to be used when V.25bis mode is selected.

ASCII characters are used by most computers; EBCDIC characters are used primarily by IBM mainframe computers.

**Options**

- **AT#U0**            ASCII character set
- AT#U1**            EBCDIC character set

**Range**

0-1

---

**COMMAND    MEANING**


---

**#V            Verifier**

The **#V** command selects whether your modem will check the validity of the commands you issue to it. Your modem can check both **AT** commands and values you write to the S Registers.

When you use the **#V0** command, no checking is performed on commands you issue. If you issue an unsupported command, the modem responds with an OK message.

With **#V1** selected, if you attempt to issue an invalid command or read or write to a reserved S Register, the modem will return an ERROR message.

☞ If you issue an AT command string containing multiple commands, and one has incorrect syntax then none of the commands in the line will be executed.

**Options**

- AT#V0**            Command and S Register verifier off
- **AT#V1**            Command and S Register verifier on

**Range**

0-1

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COMMAND	MEANING
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%C	<b>Compression Control</b>
----	----------------------------

Data compression is a technique used to reduce the size of data being transmitted without losing any of the original information.

Compressed data must be decoded at the receiving end of the communications path in order to extract the original information.

Full details on the subject of data compression can be found in the Error Correction Section of this guide.

☞ When selecting a data compression mode, error correction must also be selected. (See the \N command for details of error correction.)

### Options

AT%C0	Compression disabled
AT%C1	MNP 5 compression enabled
AT%C2	V.42bis data compression enabled
■ AT%C3	V.42bis data compression enabled with fallback to MNP 5

### See Also

\N command	Error correction
*V command	V.42bis compression table size

### Example

AT%C3\N3 Select V.42bis with auto-reliable error correction

AT%C1\N3 Select MNP5 with auto-reliable error correction

### Range

0-3

---

COMMAND	MEANING
---------	---------

---

<b>%D</b>	<b>Set Disconnect Delay</b>
-----------	-----------------------------

The **%D** command enables you to set a delay between the time the modem is told to hang up and when it actually goes on hook.

The modem will hang up whenever you issue an **ATH** command or the **DTR** (Data Terminal Ready) signal is lowered — after an **&D2** or **&D3** command is issued.

A value of 0 or 255 disables the disconnect delay.

If you have defined a disconnect delay, the modem will attempt to empty the contents of its data buffers before hanging up. If the modem's buffers are emptied before the disconnect delay expires, the modem will hang up immediately.

The modem will respond with **NO CARRIER**, rather than **OK**, if **%D** is between 1 and 255 and the modem's buffers have not been emptied when it hangs up.

### Options

- **AT%D0** No disconnect delay
- **AT%D30** Set the disconnect delay to 30 seconds

### Range

0-255

---

COMMAND	MEANING
---------	---------

---

<b>%E</b>	<b>Auto-retrain</b>
-----------	---------------------

The **%E** command allows an originating modem to automatically retrain its communications equalizers during V.22bis MNP connections, or change the speed at which it is connected to another modem. S Register 33 and S Register 45 contain EQM (*Eye Quality Monitor*) threshold values. When the quality of the connection deteriorates to this value, the modem will attempt to retrain the connection.

The **%E2** command allows an originating modem to automatically retrain to a lower speed if the line quality deteriorates. This only works between two modems, both supporting the feature.

☞ In all V.32 and V.32bis connections, Auto-Retrain is enabled.

### Options

- AT%E0 Disable automatic equalizer retrain during V.22bis MNP connections
- AT%E1 Enable automatic equalizer retrain during V.22bis MNP connections
- AT%E2 Automatic speed stepping

### See Also

S Register 33 V.32/V.32bis EQM Threshold Value

S Register 45 V.22bis EQM Threshold Value

O CommandReturn to On-line State

%Q Command Line Signal Quality

### Range

0-2

---

## COMMAND MEANING

---

**%F Front Panel Options Switches**

Front panel Option switches 1 and 2 may be used to control the DTR and DSR signals, or select V.25bis operation.

Refer to the *Dumb Mode* section for details.

Not available in all products.

### Options

- AT%F0 Select V.25bis operation
- AT%F1 Select DTR/DSR operation
- AT%F2 Switch A puts RACK CONTROLLER card into SL/IP mode

### Range

0-1

0-2 Rack Controller only

COMMAND	MEANING
%H	MNP 10 Negotiation Speed

This command allows you to determine the speed at which your modem will begin MNP 10 connections.

MNP 10 can change the speed of the connection depending upon the quality of the line. This command sets the initial connection speed only.

By initiating MNP 10 at a lower speed you can ensure that an error correcting link is established when this may not be possible at the highest speeds.

Refer to the chapter titled 'Error Correction' for details of MNP 10.

### Options

- AT%H0 Use the **B** setting for initial MNP 10 connection speed. The **B** setting is the maximum speed.
- AT%H1 Initial connection speed is made at 1200 bps (V.22). The maximum speed is defined by the **B** setting.
- AT%H2 Initial connection made at 4800 bps (V.32). The maximum speed is limited by the **B** setting.
- AT%H3 Initial connection made at 9600 bps (V.32). The maximum speed is limited by the **B** setting.

### See Also

- #K command MNP 10 mode
- J dial modifier Initiate MNP 10 at 1200 bps
- K dial modifier MNP 10 Cellular Power level
- L dial modifier Initiate MNP 10 at 4800 bps

### Range

0-3, 9

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COMMAND	MEANING
---------	---------

---

<b>%K</b>	<b>CTS During Dial and Handshake</b>
-----------	--------------------------------------

This command may be used with computers that expect the CTS signal to be raised when your modem is connected to a remote modem and is ready to send data.

This command will interfere with the Abort Connection command (&N) if your computer cannot send characters to the modem when CTS is low.

### Options

- **AT%K0** CTS operates normally
- AT%K1** CTS is lowered when an **ATD** command is issued and remains low until a connection is established

### See Also

&N command    Abort Connection

### Range

0-1

---

COMMAND	MEANING
---------	---------

---

<b>%L</b>	<b>Display Line Signal Level</b>
-----------	----------------------------------

The **%L** command allows you to display the received signal level. The value returned is a 3-digit number, for example:

009 = -9 dBm

043 = -43 dBm

### Options

**AT%L**    Display received signal level

### Examples

- Type: **AT%L <E>**

The line signal level is displayed.

---

**COMMAND    MEANING**


---

**%Ln            Transmit Level**

This command allows you to alter the transmit level of your modem.

The command is in the form:

AT%Ln

where *n* is the level you wish to select.

For example:

To set the transmit level to -15dBm:

- Type: AT%L15 <E>

**WARNING**

**Do not change the transmit level of your modem unless you have a specific reason for doing so. Changing the transmit level of your modem may adversely affect its performance.**

### Options

11-19 (13 default)            -11dB-19dB transmit level

### Range

11-19

---

**COMMAND    MEANING**


---

**%M            Mode LED Indication**

If your modem has three 'Mode' LEDs, you can use the %M command to determine whether the LEDs will indicate the line speed or the quality of the line.

The Mode LEDs provide an indication of the line speed or line quality when you are connected to another modem only.

If you have issued the %M0 command, refer to the table on the underside of your modem to determine the line speed.

If you have issued the %M1 command:

Mode 1 LED will illuminate whenever the line quality is judged to be poor, Mode 2 LED will flash whenever a V.42 or MNP error is detected

Mode 3 LED will glow whenever the modem's flow control has indicated to your computer that it is unable to send data.

### Options

- **AT%M0** Mode LEDs indicate the connection speed
- AT%M1** Mode LEDs indicate the line quality, V.42/MNP errors and flow control

### Range

0-1

---

COMMAND	MEANING
---------	---------

---

**%P**                      **CONNECT Message Timing**

This command allows you to determine whether the CONNECT message will be sent before or after the DCD signal is asserted by your modem. Some Unix computers require the CONNECT message to appear after DCD is asserted. In this case, the **AT%P1** command should be used.

### Options

- **AT%P0** CONNECT message appears before DCD is asserted
- AT%P1** CONNECT message appears after to DCD is asserted

### Range

0-1

---

COMMAND	MEANING
---------	---------

---

**%Q**                      **Line Signal Quality**

The **%Q** command allows you to display the line signal quality.

This command is not applicable to V.21, V.23 or Bell 103 connections.

A low value indicates a good quality connection. Values above 10 indicate a marginal line. Values above 30 indicate that you cannot operate at the current speed on this line and you should shift to a lower speed or use MNP10.



## Options

AT%Q Display line signal quality

## Examples

- Type: AT%Q <E>

The line signal quality is displayed.

---

## COMMAND MEANING

---

**%R** CTS Override

The %R command allows you to determine the state of the CTS signal.

This command is intended to replace the CTS switch if your modem does not have one.

This command overrides any &R setting.

☞ The %R command does not revert to the default setting after an ATZ, AT&F or modem power off is performed.

## Options

- AT%R0 &R command determines the state of CTS
- AT%R1 CTS always follows RTS (both in on-line state and local command state)
- AT%R2 V.25bis mode: CTS on when ready to accept a command

## See Also

&R Sync RTS/CTS control  
S Register 26 RTS/CTS Delay

## Range

0-2

---

COMMAND	MEANING
---------	---------

---

<b>%S</b>	<b>DSR Override</b>
-----------	---------------------

The %S command allows you to determine the state of the DSR signal.

☞ The %S command does not revert to the default setting after an ATZ, AT&F or modem power off is performed.

### Options

- AT%S0 DSR is not overridden
- AT%S1 DSR mimics the state of the DTR signal (not reset by &F)

### Range

0-1

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COMMAND	MEANING
---------	---------

---

<b>%T</b>	<b>DCD Override</b>
-----------	---------------------

The %T command allows you to determine the state of the DCD signal.

%T1 overrides any setting of &C

☞ The %T command does not revert to the default setting after an ATZ, AT&F or modem power off is performed.

### Options

- AT%T0 DCD always follows the state of the carrier from the remote modem
- AT%T1 DCD is always high

### Range

0-1

---

**COMMAND    MEANING**


---

**%U                    V.42 Response Code**

The %U command allows you to change the response codes issued by your modem when a V.42 connection is established. Compression & encryption messages will be added if active.

After the %U1 command is issued, if your modem establishes a connection with V.42 error correction, a CONNECT/LAP-M message will be sent to your computer. If an MNP connection is established, a CONNECT/REL message will be sent to your computer.

After the %U2 command is issued, a CONNECT/REL-10 or CONNECT/LAP-M message will be sent to your computer to indicate an MNP 10 or V.42 connection has been established.

☞ The %U command does not revert to the default setting after an ATZ, AT&F or modem power off is performed.

The %U command has no effect on numeric response codes issued by the modem.

### Options

- AT%U0    Standard error correction response codes
- AT%U1    V.42 response codes sent when a V.42 error corrected connection is established
- AT%U2    Append /LAP-M or /REL (2,4,10) or /MNP-5 or /V.42bis or /DES messages to the CONNECT message when established

### See Also

- \V command    Error Correction Response Codes
- X command    Extended Response Codes

### Range

02

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COMMAND	MEANING
---------	---------

---

<b>%W</b>	<b>Welcome Message</b>
-----------	------------------------

The %W command allows the answering modem to send a user specified message to the originating modem immediately after connection. This facility can be used to identify a company name, a particular service provided by this modem or simply to identify the modem itself.

The message to be sent to the remote modem is specified by using the \*W command.

If used with dial back security the original answering modem will transmit the welcome message after it has dialed back.

### Options

- AT%W0      Welcome Message disabled
- AT%W1      Welcome Message enabled

### See Also

\*W command      Welcome Message Text

### Range

0-1

---

COMMAND	MEANING
---------	---------

---

<b>\A</b>	<b>MNP Block Size</b>
-----------	-----------------------

The **\A** command allows you to select the maximum block size to be used by your modem over an MNP error-corrected connection.

### Options

AT\**A**1 128 character block size

AT\**A**2 192 character block size

■ AT\**A**3 256 character block size

### Range

0-3

---

COMMAND	MEANING
---------	---------

---

<b>\Bn</b>	<b>Generate Break</b>
------------	-----------------------

The **\Bn** command is used to send a break sequence to the remote modem of length  $n \times 100\text{mS}$ .

The length of the break sequence may be set from 0.1 seconds to 0.9 seconds. The default length of breaks generated by the modem is 0.3 seconds.

The **\K** command determines how the modem will react when a break sequence is received.

This command stores the break length into S43 in units of 20mS.

### Options

AT\**B**4      Generate a break sequence 0.4 seconds long

### See Also

**\K** command      Break Control

**S** Register 43 Break Sequence Length

### Range

1-9

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COMMAND	MEANING
---------	---------

---

<b>\J</b>	<b>Auto-Reliable Fallback</b>
-----------	-------------------------------

This command allows you to select whether your modem (when operating in auto-reliable mode) will use Constant Speed mode or Variable Speed mode.

If, with **\J0** selected, an error corrected auto-reliable connection cannot be established with another modem, the modem will fall back to Constant Speed mode.

Selecting **\J1** will cause the modem to operate in Variable Speed mode. If an error corrected auto-reliable connection cannot be established with another modem, the modem will fall back to Variable Speed mode after sending the CONNECT message to your computer. The modem will alter its terminal speed to match the connection speed to the remote modem.

### Options

- **AT\J0** Fallback Constant Speed mode
- **AT\J1** Fallback to Variable Speed mode

### Range

0-1

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COMMAND	MEANING
---------	---------

---

<b>\K</b>	<b>Break Control</b>
-----------	----------------------

The **\K** command determines how the modem will react when a break sequence is sent from your computer or received from the remote modem.

During error corrected connections the modem sending the break determines how the receiving modem will react. During non-error corrected connections, the receiving modem determines how it will react.

The default break control setting is **\K5**.

The following tables show how the modem will react when it receives a break sequence from either the remote modem or your computer.

Break sent from your computer, while in On-line state, during a Constant speed or error corrected connection.	
\K0,2,4	Enter Local Command state, do not send Break
\K1	Empty data buffers in both sending and receiving modems and immediately send Break
\K3	Immediately send Break
\K5	Send data in buffer before sending Break

\B command issued during a Constant speed or error corrected connection.	
\K0,1	Empty data buffers in both sending and receiving modems and immediately send Break
\K2,3	Immediately send Break
\K4,5	Send data in buffer before sending Break

☞ During a variable speed connection, if the \B command is issued, the modem will send the break immediately.

**See Also**

\B command      Generate Break

**Default**

\K5

**Range**

0-5

Break sent from your computer, while in On-line state, during a Variable speed connection.	
\K0,2,4	Immediately send Break and enter Local command state
\K1,3,5	Immediately send Break

Break received from the remote modem, while in On-line state, during a Constant speed connection.	
\K0,1	Empty buffers in both sending and receiving and immediately send Break to computer
\K2,3	Immediately send Break to computer
\K4,5	Send data in buffer before sending Break to computer

If a break sequence is received by the modem while it is in local command state (and is maintaining a constant speed connection), the modem will not process the break until it returns to on-line state. If the break sequence is received by the modem while it is in local command state and maintaining a variable speed connection, the break will be ignored.

Breaks received from a remote modem during an error corrected connection are handled by your modem according to the setting of the \K command in the *remote modem*.

---

**COMMAND      MEANING**

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\N                      **Asynchronous Operating Mode**

The \N command allows you to select any of your modem's four asynchronous operating modes. **AT\N0** selects *constant speed mode*, enabling the modem to use different terminal and line speeds.

Your modem supports constant terminal speeds from 300 bps to 115,200 bps. With constant speed selected the modem could connect with a remote system using V.22 (1200 bps) while communicating with your computer at 9600 bps. Selecting constant speed mode also means the modem will *not* modify its terminal speed when answering incoming calls.



☞ It is necessary to select flow control (&K command) between the modem and your computer when you use constant speed mode.

AT\N1 selects *variable speed mode*. With variable speed mode selected, the modem adjusts its terminal speed to match line speed. If the terminal speed is higher than the modem's maximum line speed, the modem will attempt to connect using its highest speed.

☞ Flow control will be ignored when your modem is configured for variable speed mode or is in local command state. Flow control is only available when the modem is configured for constant speed mode or reliable or auto-reliable modes and is operating in on-line state.

When answering, the modem automatically adjusts its terminal speed to match the standard used by the calling modem.

☞ With variable speed mode selected, your modem's terminal speed should not be changed once connected to another modem.

Changes to \N when on-line will not take effect until the next connection.

## Options

AT\N0 Constant speed mode

AT\N1 Variable speed mode

AT\N2 MNP Reliable mode

■ AT\N3 V.42/MNP auto-reliable mode

AT\N4 V.42 reliable mode

AT\N5 V.42 auto-reliable mode

AT\N6 V.42/MNP reliable mode with fallback to MNP reliable mode, disconnect if MNP not supported by remote modem.

AT\N7 MNP auto-reliable mode

## See Also

**B** command Communications Standard

**&K** command Flow Control

**\J** command MNP Fallback

**#J** command V.42 Detect Phase

## Range

0-7

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COMMAND	MEANING
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<b>\Q</b>	<b>Extended Flow Control</b>
-----------	------------------------------

The **\Q** command enables you to select flow control (*handshaking*) between your modem and computer. While performing the same function as the **&K** command, the **\Q** command provides compatibility with Microcom modems. Flow control is only available when the modem is configured for constant speed mode or reliable or auto-reliable modes, and is operating in on-line state. Flow control will be ignored when your modem is configured for variable speed mode or is in local command state.

### Options

- AT\Q0 Flow control disabled
- AT\Q1 XON/XOFF flow control  
The modem and computer use the XON and XOFF characters (DC1 and DC3) to pause the flow of data.
- AT\Q2 CTS flow control #1  
The modem uses the CTS (Clear To Send) signal to pause data flow, but will not respond if the computer changes the state of the RTS (Request To Send) signal.
- AT\Q3 CTS/RTS flow control #1  
The modem and computer use the CTS and RTS signals to control data flow (as per **&K3**).
- AT\Q4 Modem XON/XOFF flow control  
The modem uses the XON and XOFF characters (DC1 and DC3) to pause the flow of data but will not respond if the computer sends XON or XOFF characters.
- AT\Q5 CTS flow control #2  
The modem uses the CTS (Clear To Send) signal to pause data flow and keeps CTS low until a connection is established with a remote modem. The modem will not respond if the computer changes the state of the RTS (Request To Send) signal.
- AT\Q6 CTS/RTS flow control #2  
The modem and computer use the CTS and RTS signals to control data flow. CTS remains low until a connection is established with a remote modem.

### See Also

**&K** command    Flow Control

### Range

0-6

---

**COMMAND    MEANING**


---

**\S            Display Active Configuration**

The \S command allows you to display the current active configuration. The following is a sample of the \S command output:

```

&C        DCD Signal
          = 1*Asserted when carrier is valid
&D        DTR Signal goes low
          = 0*Ignored
&G        Guard Tones
          = 0*Off
&H        Sync Clock Control
          = 0*Clocks always present in sync mode
&K        Flow Control
          = 9*Auto CTS or XOFF (to DTE only)
&L        Leased Line
          = 0*Disabled (PSTN mode)
&M        Synchronous Mode
          = 0*Asynchronous
&N        Abort Dial Character
          = 1*Abort dial with any character
&P        Pulse Dial Ratio
          = 1*33/67 (Aust/NZ/UK)
&R        Sync RTS/CTS Control
          = 0*CTS follows RTS on-line, CTS high off-
          line
&S        DSR Signal
          = 1*Asserted at start of handshake

```

```

Page 002    Press Space for next page, BackSpace for
previous page, CR to end

```

## Options

AT\S    Display Active Configuration

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COMMAND	MEANING
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---

<b>\Tn</b>	<b>Inactivity Timer (Data Mode)</b>
------------	-------------------------------------

The **\Tn** command specifies the number of minutes the modem will stay on line when no activity is occurring.

The timer may be set from 1 to 42 minutes of inactivity. Selecting 0 minutes will disable the timer.

When the inactivity timer expires, the modem will hang up and return a NO CARRIER message with S42 = 12.

The inactivity timer is only available when error correction or Constant Speed mode is selected. It is ignored when variable speed mode, synchronous communications, fax or voice modes are selected.

The value specified by **\T** is connected to units of 10 seconds and stored in S30.

### Options

- **AT\T0**      Disable inactivity timer
- AT\T35**     Set inactivity timer to 35 minutes

### See Also

S Register 30 Inactivity Timer (Data Mode)

S Register 42 Modem Diagnostic

### Range

0-42

---

**COMMAND MEANING**


---

**\V Error Correction Response Codes**

The **\V** command allows you to select the error correction response codes when an error corrected connection is established. With error correction response codes enabled, the following messages are returned when a connection is established using error correction:

Num	Verbal	V.FC/V.34 Modems	V.32/V.32bis Modems	Other Modems
20	CONNECT/REL	✓	✓	✓
22	CONNECT 1200/REL	✓	✓	✓
23	CONNECT 2400/REL	✓	✓	✓
24	CONNECT 4800/REL	✓	✓	*
28	CONNECT 7200/REL	✓	✓	
25	CONNECT 9600/REL	✓	✓	*
26	CONNECT 12000/REL	✓	✓	
27	CONNECT 14400/REL	✓	✓	
43	CONNECT 16800/REL	✓		
44	CONNECT 19200/REL	✓	*	*
45	CONNECT 21600/REL	✓		
46	CONNECT 24000/REL	✓		
47	CONNECT 26400/REL	✓		
48	CONNECT 28800/REL	✓		
49	CONNECT 38400/REL	*	*	*
50	CONNECT 57600/REL	*	*	*
70	CONNECT 76800/REL	*	*	*
71	CONNECT 96000/REL	*	*	*
72	CONNECT 115200/REL	*	*	*
73	CONNECT 230400/REL	**		

\* These messages are only generated if W0 or W1 is selected (display DTE speed).

\*\* Series 6 only

If the **ATX0** command has been issued, only the **CONNECT/REL** will be generated by the modem, regardless of the connection speed, after the **\V1** command is issued.

☞ Your communications software may not expect the modem to return error correction response codes. If this is the case, disable the error correction response codes. When disabled, the modem will generate standard CONNECT messages for both error correction and normal connections.

### Options

- AT\V0 Disable error correction response codes
- AT\V1 Enable error correction response codes
- AT\V8 Enable error correction response codes plus details of the error correction and data compression negotiated with the remote modem is displayed immediately before the CONNECT message.
- AT\V9 Enable error correction response codes plus details of the error correction and data compression negotiated with the remote modem and diagnostic information displayed immediately before the CONNECT message.

### See Also

- X command      Extended Response Codes
- %U command      V.42 Response Codes

### Range

0-1, 8-9

---

COMMAND	MEANING
\X	XON\XOFF Pass Through

---

The \X command enables you to define whether XON and XOFF (software handshake) characters are allowed to pass through the modem to the remote system.

The \X command only affects XON/XOFF characters sent from your computer to your modem. It does not affect XON/XOFF characters sent from a remote system to your modem.

☞ When the modem is configured for XON/XOFF flow control, passing through XON/XOFF characters may interfere with the modem's control of data flow. It is usually best to disable pass through.

The **\X** command only takes effect when XON/XOFF flow control is enabled (**&K4**).

### Options

- **AT\X0** Remove received XON/XOFF characters from received data
- AT\X1** Pass through received XON/XOFF characters

### See Also

**&K** command                      Flow Control  
**\Q** command                      Extended Flow Control

### Range

0-1

COMMAND	MEANING
<b>*C</b>	<b>Disable V.34 (use V.FC)</b>

Although V.34 will auto connect to a V.FC modem, there may be situations where a V.FC connection is desirable. In this case use the **\*C1** command to force a V.FC connection rather than a V.34 connection. The **B** command can be used to select specific connection speeds.

### Options

- **AT\*C0** V.34 enabled
- AT\*C1** V.34 disabled

### See Also

**B** command

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COMMAND	MEANING
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---

<b>*R</b>	<b>V.13 Remote RTS Signaling</b>
-----------	----------------------------------

The **\*R** command allows your modem to simulate carrier control on a Synchronous Link by transmitting the local state of RTS to the remote modem.

☞ Not available in FSK (V.21 V.23 Bell 103) modes.

Some systems rely on RTS as an indicator of Terminal Ready to Send. When modems are inserted between the host and the terminal the status of RTS is not known since the state of RTS is not normally transmitted over the link.

The V.13 recommendation allows the state of RTS to be transmitted over the link by sending a unique stream of data. This stream of data will appear as garbage to the host (which will discard it), however the receiving modem in V.13 mode will recognize the stream and convey it to the host via the DCD (RSLD) line. DCD high indicates remote RTS high and vice versa.

The local CTS line will mimic the state of the local RTS signal on the local modem. The remote DCD line will mimic the state of the local RTS signal on the remote modem

☞ When this option is selected the modems may take a little longer to disconnect than usual since the normal function of Carrier Detect has been disabled. The modems rely on poor EQM values to confirm disconnect.

### Options

- AT\*R0 .13 mode off
- AT\*R1 .13 mode on

### See Also

**&M** command Synchronous Mode



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**COMMAND    MEANING**


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**\*S                    Change Current User Password**

The **\*S** command allows the user to change his own password. If the user is connected the modem will ask for the current password before prompting for a new password. The user will then be asked to repeat the new password for verification.

If the user is not connected he must also specify the user name whose password is to be altered.

☞ If password expiration is enabled the password age will be reset to zero days

**See Also**

#S command    Security menu

---

**COMMAND    MEANING**


---

**\*V                    Maximum V.42bis Dictionary Size**

The V.42bis dictionary size is normally negotiated during the V.42 handshake. Boca Research PRO16RM modems have enough memory to store 8,192 dictionary entries. This will allow 8:1 compression on some file types.

Some modems do not correctly negotiate the dictionary size, in these cases the user should reduce the dictionary size to 2,048 entries (4:1 compression ratio).

If the remote modem exhibits wrong negotiation the user will see corrupted data and/or sudden disconnection.

**Options**

- AT\*V0            8,192 dictionary entries
- AT\*V1            2,048 dictionary entries

**See Also**

%C command    Compression options

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COMMAND	MEANING
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<b>*W</b>	<b>Welcome Message Text</b>
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The **\*W** command allows the user to specify the message that will be sent to the originating modem immediately after CONNECT if the %W1 Welcome Message is enabled.

The message may contain any text limited only by the maximum command line size (80). The message may include new lines which are indicated by using the '| ' character.

If %W1 is enabled the text you have specified will be displayed at the end of the &V display.

### Examples

AT\*W You are connected to a Boca Research PRO16RM V.34 modem

This will send the following text to the remote modem after connection:

```
You are connected to a Boca Research PRO16RM
V.34 modem
```

### See Also

%WEnable Welcome Message

---

**COMMAND    MEANING**


---

**\*Y                    Escape Sequence Detection in Sync**

Escape Sequence Detection (i.e., +++) is normally disabled in all synchronous modes. This is because synchronous data cannot generate silences around the +++. However to diagnose line performance you need to be able to escape to command mode. To allow these diagnostics to take place the user may select the **\*Y1** option before making a synchronous connection and then attaching a asynchronous terminal to the modem. The user may then issue +++ as in asynchronous modes to return to command mode.

**Options**

- **AT\*Y0**            Escape Sequence Detection in Sync mode disabled
- AT\*Y1**            Escape Sequence Detection in Sync mode enabled

---

**COMMAND    MEANING**


---

**-Q                    MNP10 Fallback to V.22bis**

The -Q command permits the modem to fallback from a V.34, V.32bis or V.32 connection with MNP10, to a V.22bis or V.22 MNP10 connection.

MNP10 has the ability to make decisions regarding line quality and will request a change in speeds if it decides the phone line is not sufficient quality to maintain the current connection speed.

**Options**

- AT-Q0**            Disable fallback to V.22bis or V.22
- **AT-Q1**            Enable fallback to V.22bis or V.22 with MNP10

**Range**

0-1

---

COMMAND	MEANING
---------	---------

---

**:E**                      **V.32 Compromise Equalizer**

This command switches on or off the V.32 compromise equalizer.

When operating over cellular connections, it may be desirable to switch off the V.32 compromise equalizer. For dial-up lines, the equalizer should be switched on.

### Options

- AT:E0    Disable the V.32 compromise equalizer
- AT:11    Enable the V.32 compromise equalizer

### Range

0-1

---

COMMAND	MEANING
---------	---------

---

**CIC**                      **Connect Incoming Call (V.25bis)**

The **CIC** command may be issued if you decide to accept an incoming call after issuing the **DIC** command. For details, refer to the 'V.25bis Operations' section of this guide.

### Options

**CIC** Accept an incoming call after the **DIC** command has been issued

### See Also

- DIC** command    Disregard Incoming Call
- S** Register 71    Ignore Incoming Call

---

**COMMAND      MEANING**


---

**CRN              Dial      (V.25bis)**

This command allows you to dial a telephone number. The basic dialing command is: **CRN** followed by the telephone number.

For example:

To dial the number (09) 111-1234

- Type: CRN091111234 <E>

You can use hyphens, spaces or parentheses. They will be ignored by the modem, but they will make it easier to read the command line.

For example:

CRN (09) 111-1234

Dial modifiers may be included in the dial command.

### Dial Modifiers

Dial modifiers enable you to change the characteristics of dialing. (Definitions for all modifiers appear on the following pages.)

<b>Modifier</b>	<b>Meaning</b>
-----------------	----------------

- |   |                    |
|---|--------------------|
| < | pause              |
| P | use pulse dialing  |
| T | use tone dialing   |
| : | wait for dial tone |
| & | hook flash         |

### Options

CRN12345      Dial number 12345

### Dial Modifier Definitions

<    **pause      (V.25bis)**

This modifier orders the modem to pause before dialing the rest of the phone number. This is useful when using a PBX and you need to dial a number to connect to an outside line.

For example: If you must dial 0 to connect to an outside line before dialing (09) 111-1234

- Type: CRN0<091111234 <E>

The length of the pause is determined by the value in S Register 8.

☞ UK Modems. If your PBX requires more than four seconds to obtain a line, add no more than one extra < to your dial command.

**P use Pulse dialing (V.25bis)**

**T use Tone dialing (V.25bis)**

These modifiers are only active while dialing the current numbers. They do not affect the default.

Your modem can use either pulse (decadic) or tone (DTMF) dialing.

The P dial modifier orders the modem to use pulse dialing. The T dial modifier orders the modem to use tone dialing.

If you are not sure which dialing is used by your phone, lift up the handset and listen. If you hear a continuous dial tone, you probably can use tone dialing. Normally, only older telephone exchanges do not support tone dialing.

If you are still in doubt, use pulse dialing. Most exchanges supporting tone dialing also support pulse dialing, although the reverse is not always true.

Contact the supplier of your telephone line if you wish to have tone dialing accessible on your line.

☞ Pulse dialing may not be supported in New Zealand. Refer to your Installation Guide for details.

**& Hook Flash (V.25bis)**

The & dial modifier issues a hook flash signal — the modem hangs up for a short period.

Hook flashes are commonly used with PBXs to transfer calls.

For example:

To dial 0, hook flash and then dial 12345:

- Type: CRN0&12345 <E>

☞ UK Modems. Use of the hook flash is not allowed in the United Kingdom.

**: Wait for Dial Tone V.25bis**

The **:** modifier causes the modem to wait for a dial tone before dialing. If the modem does not detect a dial tone within 30 seconds, it returns a message of CFI AB, hangs up and returns to local command state.

You can change the dial tone waiting period from the default period of 30 seconds by changing the value in Register 7.

☞ When using the **:** modifier, the length of time your modem waits for a dial tone is determined by the value contained in S Register 7 (Wait for Carrier) and not the value in S Register 6 (Wait for Dial Tone).

☞ UK Modems. Setting S Register 7 with a value above 58 may invalidate the approval of your modem. S Register 7 must be set to 20 before issuing the **:** dial modifier.

For example:

To wait for a dial tone and then dial 111-0123:

- Type: CRN:1110123 <E>

See Also

<b>CRS</b> command	Dial Stored Number
S Register 6	Wait Time for Dial Tone
S Register 7	Wait Time for Carrier
S Register 8	Length of Dial Pause

---

**COMMAND      MEANING**


---

**CRS**                      **Dial Stored Number**      **(V.25bis)**

---

Your modem allows you to store phone numbers in non-volatile memory. The basic form of the **CRS** command is:

**CRS** *n*

where *n* is the stored phone number you wish to dial.

For example:

To dial stored phone number one:

- Type: CRS 1 <E>

## Options

CRS 4 Dial stored number 4

## See Also

PRN command Store Phone Number

---

COMMAND	MEANING
DIC	Disregard Incoming Call (V.25bis)

---

The DIC command is used to disregard incoming calls.

When your modem receives an incoming call, an INC message is sent to your computer. You then have the number of seconds defined by S Register 71 to disregard the call.

If you issue the **DIC** command, the call will be ignored, otherwise the modem will answer the call after the number of seconds defined by S Register 71.

## Options

DIC Disregard incoming call

## See Also

CIC Connect incoming call  
S Register 71 Ignore incoming call

---

COMMAND	MEANING
PRN	Store Phone Number (V.25bis)

---

The **PRN** command allows you to store phone numbers in your modem's non-volatile memory.

The command takes the form:

PRN*n*;*x*

where *x* is the phone number you want to store and *n* indicates which of the stored phone numbers it will be saved as.

Stored phone numbers may contain up to 20 characters, including dial modifiers.



## Options

PRN2;12345

Store the phone number 12345 as stored phone number two

PRN4;P0,T12345

Store the following as stored number four; first pulse dial 0, wait for two seconds to get an outside line and then tone dial 12345

## See Also

CRSDial a stored number

## Range

Refer to the Command Description section.

COMMAND	MEANING
<b>RST</b>	<b>Reset (V.25bis)</b>

Your modem is supplied with a default operating set up. You can change this temporarily by issuing commands while you are working, or permanently by using the **&W** command to store changes you've made in non-volatile memory.

The **RST** command returns the modem to the last saved configuration and causes it to perform a power-on self-test.

☞ When you issue the **RST** command, you must issue an **ATZ** command to select V.25bis command mode. Your modem always resets and powers up in AT command mode, regardless of the setting of the **#M** command.

## Options

**RST** Reset the modem and restore the saved configuration profile

## See Also

**&F** command Restore Factory Defaults  
**&F.** command Reinitialize modem  
**&W** command Write Configuration

## S REGISTERS

### Introduction

Your modem contains a number of registers — memory stores — which define the modem's operating characteristics. These registers are called *Special Registers* or *S Registers*.

This section of the *PRO16 Reference Guide* shows you the function and usage of each S Register, how to check the current contents of your S Registers, how to change S Register settings and how to save the settings in non-volatile memory.

### Reading and Changing S Registers

The Read Register command (**Sn?**) enables you to check the current contents of an S Register.

For example:

To check how long the modem will wait for a dial tone before starting to dial, you would check S Register 6. To do this:

- Type: `ATS6? <E>`

The modem will display the current contents of the S6 Register.

If you want to change the register setting, use the Set Register command (**Sn=x**).

For example:

To change the setting of your modem, so the modem waits five seconds for a dial tone before starting to dial:

- Type: `ATS6=5 <E>`

### S Register Settings and Modem Memory

Your modem comes configured with a set of default values for each of the special registers. Any changes you make using the **Sn=x** command will only last while the modem is switched on.

Once you switch the modem off, these changes will be lost and the next time the modem is switched on, the factory-set default values will be in effect.

To understand this, consider the following. Modems use three different types of memory chips:

1. **RAM** chips that only hold information in their memory while the modem has power supplied to it. You can easily change information in RAM. This memory is used to temporarily store any changes you make to Commands or S Registers during a communications session.
2. **ROM** chips that have their data placed into them at the factory. They retain their information when the power is switched off. You cannot make changes to information stored in ROM chips. Information such as factory default settings for S Registers is stored in your modem's ROM chips.
3. **Non-volatile** memory retains data without requiring power. You can change the data in non-volatile memory by using a special command (**&Wn**) to write the current settings to memory. This memory can be used to provide a more permanent storage of changes you make to the settings of your modem.

Any parameter stored in RAM will take precedence over any other stored in non-volatile memory or ROM. Any parameter stored in non-volatile memory will take precedence over those stored in ROM.

If you have not made any changes to your modem's settings since it was unpacked after purchase, the default parameters in ROM will control the modem.

If you have made changes and stored them as profiles in non-volatile memory — using the Write Configuration (**&Wn**) command where n = profile 0,1,2 or 3— those settings that have been changed in the active profile will take precedence over those in ROM, even after switching the modem off and on.

Temporary changes — made during a communications session — to values using any **AT** command, will be stored in RAM and will take precedence until you switch the modem off.

To use the current S Register settings with the Write Configuration command (**&Wn**):

- Type: **AT&Wn <E>**

(where n = the profile number you wish to use 0-3)

To return to the original factory default settings:

- Type: AT&F <E>

☞ Re-loading the factory default settings with **AT&F** will not save these default settings to non-volatile memory. To save factory defaults to non-volatile memory so they can be used again, after switching the modem off and on, follow the **&F** command with the Write Configuration (**&Wn**) command.

To reset and store all settings to the factory default:

- Type: AT&F.

S 0 — Rings Before Answer .....	174
S 1 — Ring Count .....	174
S 2 — Escape Sequence Character .....	175
S 3 — Carriage Return Character .....	175
S 4 — Line Feed Character .....	176
S 5 — Backspace Character .....	176
S 6 — Dial Tone Wait Time .....	177
S 7 — Wait for Carrier .....	178
S 8 — Pause Dial Modifier Delay .....	179
S 9 — Carrier Detect Response Time .....	179
S 10 — Lost Carrier/Hang Up Delay .....	180
S 11 — DTMF Tone Timing .....	180
S 12 — Escape Sequence Guard Time .....	181
S 16 — Test in Progress (read only) .....	182
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S 26 — RTS/CTS Delay .....	183
S 27 — Delay Before Dial .....	184
S 29 — Hook Flash Duration .....	184
S 30 — Inactivity Timer .....	185
S 33 — EQM Threshold Value .....	186
S 38 — Disconnect Delay .....	187
S 42 — Modem Disconnect Reason .....	188
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S 71 — Ignore Incoming Call .....	193
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S 80 — Flow Control High Water Mark .....	195
S 81 — Flow Control Low Water Mark .....	196
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S 95 — Extended Response Codes .....	198
S 96 — Help Page Width .....	199
S 97 — Help Page Length .....	199
S 105 — Voice 'Dead Man' Timer .....	200

---

S REGISTER	MEANING
0	Rings Before Answer

---

S Register 0 contains a decimal value (from 0-255) indicating the number of rings the modem will wait before answering an incoming call.

If you place a value of 0 in this S Register, auto-answer operation will be disabled.

The default value for S Register 0 is 4 — the modem will answer an incoming call after four rings.

### Examples

ATS0=0      Disable auto-answer

ATS0=4      Wait four rings before answering an incoming call

**Default**      4

**Range**          0-255

---

S REGISTER	MEANING
1	Ring Count

---

S Register 1 contains a decimal value (from 0 to 255) indicating the number of rings detected.

S Register 1 is incremented each time a ring is detected. It will be cleared if no ring occurs within 8 seconds of the last ring.

**Default**      0

**Range**          0-255

☞ This is a READ ONLY register.

S REGISTER	MEANING
2	Escape Sequence Character

S Register 2 contains the ASCII value of the characters which form the escape sequence.

The default value for this register is 43. The modem will recognize three + characters (+++) as the escape sequence.

Setting this register to a value greater than 127 disables the modem's recognition of the escape character.

### Examples

ATS2=36 Recognize three \$ (\$\$\$) characters as the escape sequence  
 ATS2=64 Recognize three @ (@@@) characters as the escape sequence

**Default** 43 (the + character)

### See Also

S Register 12 (Escape Sequence Guard Time)

**Range** 1-255

S REGISTER	MEANING
3	Carriage Return Character

S Register 3 contains the ASCII value of the character recognized by the modem as the Carriage Return character in local command state.

**Default** 13

### Example

ATS3-127 Recognize the DEL character as the carriage return

**Range** 0-127

---

S REGISTER	MEANING
4	Line Feed Character

---

S Register 4 contains the ASCII value of the character recognized by the modem as the Line Feed character in local command state.

**Default** 10

**Example**

ATS4=13 Recognize the Carriage Return character as the line feed

**Range** 0-127

---

S REGISTER	MEANING
5	Backspace Character

---

S Register 5 contains the ASCII value of the character recognized by the modem as the Backspace character in local command state.

The preferred values for this register are ASCII codes 0 to 32 or 127.

**Default** 8

**Example**

ATS5=127 Recognize the DEL character as the backspace

**Range** 0-127



---

S REGISTER	MEANING
------------	---------

---

<b>6</b>	<b>Dial Tone Wait Time</b>
----------	----------------------------

S Register 6 determines how long the modem will wait for a dial tone after going off-hook and before dialing.

This register contains a value indicating the number of seconds the modem will wait for a dial tone. This provides slow telephone exchanges the opportunity to apply a dial tone to the line before the modem attempts to dial.

If the **W** dial modifier is included in the phone number being dialed, the value in S Register 6 will be ignored, unless the **X2**, **X4**, or **X5** commands have been issued.

### Examples

ATS6 =5 Wait five seconds for a dial tone before dialing.

**Default** 4

### See Also

**D** command Dial

**W** dial modifier Wait

**X** command Extended Response Codes

**Range** 4-7

---

S REGISTER	MEANING
7	<b>Wait for Carrier</b>

---

S Register 7 contains a value, in seconds, equivalent to the length of time the modem will wait for answer tone after dialing.

If an answer tone is not detected within the time specified in this register, the modem will hang up and return a NO CARRIER message.

After an answer tone is detected the modem has another 57 seconds to complete the handshake

The answering modem has 57 seconds to complete the handshake after starting answer tone.

This register is also used by the **W** modifier to determine how long the modem will wait for a dial tone to be applied to the line before reporting a NO DIALTONE message.

☞ UK Modems. Setting S Register 7 with a value above 58 may invalidate the approval of your modem. S Register 7 must be set to 20 before issuing the **W** dial modifier. Any other change to this register will invalidate the approval of your modem.

### Examples

ATS7=20    Wait 20 seconds for a connection

**Default**    30

**Range**    1-60

---

S REGISTER	MEANING
------------	---------

---

<b>8</b>	<b>Pause Dial Modifier Delay</b>
----------	----------------------------------

S Register 8 contains the time in seconds the modem will wait when it encounters a comma (the pause dial modifier) in a dialing sequence.

☞ UK Modems. Changing S Register 8 from its default value may invalidate the approval of your modem.

### Examples

ATS8=6      Wait six seconds when a comma is encountered in the dialing sequence

**Default**      4

### See Also

D command Dial (and , modifier)

**Range**      1-7

---

S REGISTER	MEANING
------------	---------

---

<b>9</b>	<b>Carrier Detect Response Time</b>
----------	-------------------------------------

S Register 9 contains the length of time, in tenths of a second, the modem will wait before asserting the DCD (Data Carrier Detect) signal, after a carrier has been detected. The longer the time taken before asserting DCD, the less chance of line noise being mistaken by the modem as a carrier signal. If you have previously issued an **AT&C0** command or placed the DCD option switch in the DOWN position, the modem will assert the DCD signal regardless of the presence of a carrier signal from the remote system.

☞ V.21, Bell 103 and V.23 only.

### Examples

ATS9=9 Wait 0.9 seconds after detecting a carrier before connecting to the phone line (asserting DCD).

**Default**      6

### See Also

**&C** command      Controlling Data Carrier Detect

**Range**      1-255

---

S REGISTER	MEANING
<b>10</b>	<b>Lost Carrier/Hang Up Delay</b>

---

S Register 10 contains the amount of time, in tenths of a second, the modem will wait after the carrier has been lost before hanging up.

If a value of 255 is placed in this register, the modem will not hang up after the carrier is lost from the remote modem. In this case, you must use the **H** command to hang up.

### Examples

ATS10=12 Wait 1.2 seconds after losing carrier before hanging up

**Default** 18

**Range** 1-255

---

S REGISTER	MEANING
<b>11</b>	<b>DTMF Tone Dialing</b>

---

S Register 11 contains the time, in thousandths of a second, of the duration and spacing of tones when tone dialing (DTMF tones).

The value in this register does not affect pulse dialing.

☞ UK Modems. Changing S Register 11 from its default value may invalidate the approval of your modem.

### Examples

ATS11=120 Space tones at 0.120 second intervals

**Default** 95

**Range** 70-254

---

S REGISTER	MEANING
------------	---------

---

<b>12</b>	<b>Escape Sequence Guard Time</b>
-----------	-----------------------------------

The Escape Sequence Guard Time is the time delay required immediately before and after entering an escape sequence.

For your modem to distinguish the escape sequence from ordinary data, there must be a period of silence both before and after the escape sequence is entered.

If the Escape Sequence Guard Time is one second and the escape sequence character has been defined as +, for the modem to recognize an escape sequence you must maintain silence on the line for one second, then type +++ in rapid succession, and then maintain another second's silence.

The guard time is in units of 20 milliseconds (or 1/50 of a second).

☞ S Register 12 is also used to time the period between the escape sequence characters as they are typed. If the period between the first and second escape characters or second and third escape characters being entered is greater than the value in S Register 12, the modem will not recognize the escape sequence.

### Examples

ATS12=100 Maintain silence on the line for 2 seconds before and after entering the escape sequence

**Default** 50

### See Also

S Register 2 Escape Sequence Character

Range 3-255

S REGISTER	MEANING
------------	---------

<b>16</b>	<b>Test in Progress</b>
-----------	-------------------------

S Register 16 contains the number of the &T test command in progress. If no test is in progress S16 is 0.

### Examples

ATS16

**Default**      0

### See Also

&T	Self test
S Register 18	Test Timer

**Range**          0-8

S REGISTER	MEANING
------------	---------

<b>18</b>	<b>Test Timer</b>
-----------	-------------------

S Register 18 contains the length of time, in seconds, that the modem will perform tests initiated with any of the &T commands.

You can terminate any test by issuing an **AT&T0** command, or by allowing the time in the Test Timer to expire.

Placing a value of **0** in S Register 18 disables the Test Timer, forcing you to use an **AT&T0** command to terminate tests.

### Examples

ATS18=30    Terminate test after 30 seconds

**Default**      0

### See Also

&T command	Self Test
S Register 16	Test in Progress (read only)

**Range**          0-255

---

S REGISTER	MEANING
------------	---------

---

25	<b>DTR Loss Detection</b>
----	---------------------------

S Register 25 determines the time, in hundredths of a second, the DTR (Data Terminal Ready) signal must remain low before the modem will recognize a loss of DTR.

### Examples

ATS25=8     DTR must remain low for 0.08 seconds before the modem will recognize loss of DTR

**Default**     5

### See Also

&D DTR Mode

**Range**        0-255

---

S REGISTER	MEANING
------------	---------

---

26	<b>RTS/CTS Delay</b>
----	----------------------

If the RTS (Request To Send) signal is asserted when operating in synchronous mode, the modem will wait for the period defined by S Register 26 before asserting the CTS (Clear To Send) signal, when &R0 is selected.

Values in this register are in tenths of a second

### Examples

ATS26=15     Wait 1.5 seconds after RTS has been asserted before asserting CTS.

**Default**        0

### See Also

**&R**            RTS/CTS Control

**%R**           CTS Control

**Range**        0-255

S REGISTER	MEANING
------------	---------

27	Delay Before Dial
----	-------------------

S Register 27 is used to define a delay of between 0 and 255 seconds which occurs after the **D** command is issued and *before* dialing commences. This should only be used when you intend to implement callback security. Providing a delay between the dialing command and actual dialing allows the calling modem sufficient time to hang up before the modem begins to call back. A 30-second delay should be sufficient time to allow most modems to hang up. When you are not using security callback, this register should *always* contain a zero value.

☞ UK Modems. Waiting 30 seconds may not work with UK telephone exchanges. Consult the supplier of your telephone line for a solution.

### Examples

ATS27=10 Wait 10 seconds between the Dial command being issued and commencement of the dialing

**Default** 0

**Range** 0-255

S REGISTER	MEANING
------------	---------

29	Hook Flash Duration
----	---------------------

This S Register allows you to set the duration of the hook flash performed by your modem when the **!** dial modifier is executed. Some PBXs may require a different hook flash length to the standard 0.5 seconds. The value held in S Register 29 is in hundredths of a second.

### Examples

ATS29=30 Set the hook flash duration to 0.3 seconds

**Default** 50

### See Also

**!** Dial Modifier Hook Flash

**Range** 10-100



S REGISTER	MEANING
30	Inactivity Timer

### Data Mode

The value in S Register 30 indicates the number of 10 second intervals the modem may remain inactive in On-Line state before hanging up. Placing a value of **0** in S Register 30 will disable the Inactivity Timer. The Inactivity Timer is only available when constant speed, reliable or auto-reliable mode has been selected. The Inactivity Timer is ignored when variable speed mode is selected.

### Examples

ATS30=60 Hang up after 10 minutes of inactivity on the line

**Default** 0

### See Also

\T command Set Inactivity Timer

**Range** 0-255

### Voice Mode

This S Register sets how long the modem remains in voice mode, when on-hook and in non-autobauding mode, and when no characters are received from the computer, in 1 second units. If the 'Dead Man' timer expires, the modem returns to data mode. If S30 is set while in voice mode, the value is redirected to S105, the voice dead-man timer.

### Examples

ATS30=60 Set the dead-man timer to 60 seconds

ATS30=0 Disable the dead-man timer

**Default** 30

### See Also

ATS105 Voice 'Dead Man' Timer

**Range** 0-255

---

S REGISTER	MEANING
33	EQM Threshold Value

---

S Register 33 is used to define the rate of change in the EQM (Eye Quality Monitor) value the modem will tolerate before initiating an equalizer retrain sequence. This S Register applies to V.32, V.32bis, V.FC & V.34 only.

By setting this register with a low value, the modem will demand a high quality connection. Setting a high value in S33 will allow the modem to operate on degraded lines without invoking retrains.

A value of zero will also disable automatic EQM retraining for V.32, V.32bis, V.FC, & V.34.

**WARNING**

**If S33 is set to 0 the modem may not detect loss of carrier and will not hang up.**

☞ The value in this register should only be altered by people with previous EQM experience. Changing the EQM value will affect the data throughput and reliability of connections.

**Default**      3

**Example**  
ATS33=5      Set EQM change rate threshold to 5.

**Range**        0-255

---

S REGISTER	MEANING
------------	---------

---

<b>38</b>	<b>Disconnect Delay</b>
-----------	-------------------------

S Register 38 determines the number of seconds the modem will wait before hanging up after the **ATH** command is issued or the DTR signal is lowered — after the **&D2** command has been issued.

If a disconnect delay has been defined, the modem will attempt to empty the contents of its data buffers before actually going on-hook.

If the modem empties its buffers before the defined disconnect delay expires, the modem will hang up immediately.

The modem will respond with **NO CARRIER**, rather than **OK**, if S Register 38 is between 1 and 255 and the modem's buffers have not been emptied when it hangs up.

The length of the disconnect delay may be selected with the **%D** command.

### Examples

**ATS38=30** Wait 30 seconds before hanging up.

**Default** 0

### See Also

**%D** command Set Disconnect Delay

**Range** 0-255

---

**S REGISTER      MEANING**


---

**42                      Modem Disconnect Reason**

S Register 42 contains a value indicating the reason the modem last disconnected. This allows you to check for possible faults if your modem suddenly hangs up or returns to local command state without you entering an escape sequence. The modem will return one of the following values in S Register 42:

**Value      Meaning**

0	Modem reset
1	An escape sequence was entered or DTR was lowered after the <b>&amp;D1</b> command was issued
2	DTR lowered by the computer after an <b>&amp;D2</b> or <b>&amp;D3</b> command was issued
3	Carrier lost from remote modem
4	Disconnect using the TALK/DATA switch
5	Connection failed or timed out
6	No answer tone detected
7	Connected at wrong speed
8	S Register 7 time limit exceeded
9	Receive data buffer (line buffer) overflowed
10	Receive data buffer (terminal buffer) overflowed
11	Failure to negotiate MNP class 3 or 4 connection
12	Inactivity timer expired
13	Unable to establish MNP connection with reliable mode selected
14	Retrain failed
15	A break sequence received from the remote modem after the <b>Y1</b> command was issued
16	Character received while modem was attempting to establish a connection
17,18	Internal error — MNP
19	MNP or V.42 'disconnect' packet received
20	MNP disconnected after 12 attempts to send a packet
21-26	Internal protocol errors — MNP
27	Analog loopback switch asserted while on line
28	Security system rejected user
29	DES encryption could not achieve an error corrected connection
30	MNP10 rate fallback failed
31	CTS stuck (continuous retrains or data pump failure)
32	Incoming call: Access denied
42	V.42bis received an invalid token
99	Abnormal exit from on line state

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S REGISTER	MEANING
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<b>43</b>	<b>Break Sequence Length</b>
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The value in S Register 43 defines the length of a break (long space) sequence generated by the modem to your computer when constant speed, reliable or auto-reliable modes are selected.

The **\B** command determines the length of breaks to the remote modem.

Each unit is equivalent to 0.02 second.

☞ S Register 43 does *not* affect the length of the break generated by the modem when variable speed mode is selected. In variable speed mode, the **Y** command controls the length of breaks generated by the modem.

### Examples

ATS43=10    Generate a break of 0.2 seconds

**Default**    15

### See Also

**Y** command    Long Space Disconnect

**\B** command    Generate Break

**Range**        1-255

S REGISTER	MEANING
45	V.22bis EQM Threshold Value

S Register 45 is used to define the EQM (Eye Quality Monitor) value the modem will tolerate before initiating an equalizer retrain sequence. This S Register applies to V.22bis only.

By setting this register with a low value, the modem will demand a high quality connection. Setting a high value will allow the modem to operate on degraded lines without invoking retrains. A value of zero will disable automatic EQM retraining for V.22bis.

☞ The value in this register should only be altered by people with previous EQM experience. Changing the EQM value will affect the data throughput and reliability of connections.

**Default** 98

### Example

ATS45=5 Set EQM threshold to 5. If EQM level is equal to or greater than 5, the modem will retrain the connection.

**Range** 0-255

S REGISTER	MEANING
62	V.42 Detection Timer

S Register 62 allows you to set the V.42 detection timer. This specifies how long (in units of 0.01 seconds) the modem will send a V.42 detection pattern and wait for a V.42 detection pattern from the other modem. The originating modem sends the pattern then waits for a reply, the answering modem waits for the pattern then sends one in reply.

☞ Changing the value of this S Register may cause unreliable operation when attempting V.42 connections.

### Examples

ATS62=100 Set the timer to one second

**Default** 75 (0.75 seconds)

### See Also

#J command V.42 compatibility

**Range** 0-255

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S REGISTER	MEANING
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<b>66</b>	<b>Remote Access Guard Time</b>
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The Remote Access Guard Time is the time delay required immediately before and after entering a remote access sequence.

If the Remote Access Guard Time is one second and the remote access character has been defined as \* (asterisk), you must maintain silence on the line for one second, then type \*\*\*\* (four asterisks) in rapid succession, then maintain another one second's silence.

The guard time is in units of 100 milliseconds (1/10th of a second).

### Example

ATS66=20    Set the remote access guard time to two seconds.

**Default**    10

### See Also

S Register 67	Remote Access Character
#A command	Universal Remote Access
**** command	Remote Access Sequence

**Range**        1-255

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S REGISTER	MEANING
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<b>67</b>	<b>Remote Access Character</b>
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S Register 67 contains the ASCII value of the characters which form the remote access sequence.

The default value of this register is 42 (asterisk character). The modem will recognize four \* characters (\*\*\*\*) as the remote access sequence.

### Examples

ATS67=36 Recognize four \$ (\$\$\$\$) characters as the remote access sequence

**Default** 42 (the \* character)

### See Also

ATS67=36 Recognize four \$ (\$\$\$\$) characters as the remote access sequence

**Range** 1-125

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S REGISTER	MEANING
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<b>69</b>	<b>Command Line Time Out</b>
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S Register 69 determines how long you have to type a command, after typing an 'AT', expressed as seconds. If the modem times-out before you complete a command, an ERROR message will be sent by the modem. The default value of 60 allows you 60 seconds between the time you have typed 'AT' and when you press the ENTER key.

A value of 0 (zero) disables this feature.

### Examples

ATS69=120 Allow 120 seconds to type a command to the modem before timing out.

ATS69=0 Never time-out a command

**Default** 60

**Range** 0-255



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S REGISTER	MEANING
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71	<b>Ignore Incoming Call</b>
----	-----------------------------

This S Register is only applicable when your modem is operating in V.25bis mode. After an incoming call is detected, your modem will wait the number of seconds defined by S Register 71, allowing you to issue the DIC command if you do not wish to accept the call.

For more details, refer to the section titled 'Answering Calls' which appears in the 'V.25bis Operations' chapter.

### Examples

ATS71=10 Wait 10 seconds before accepting an incoming call.

**Default** 0

### See Also

CIC command	Connect Incoming Call
DIC command	Disregard Incoming Call

**Range** 0-30

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S REGISTER	MEANING
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74	<b>Disconnect Reason for Previous Call</b>
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S Register 74 contains a value indicating the reason the modem returned to local command state, for the call before last. Thus, the value in S Register 42 will be copied to S Register 74 prior to a new disconnect reason being placed in S Register 42. This register is mainly used to allow a remote modem to dial in, invoke remote access and enquire as to why the last connection failed. For details of the disconnect reasons placed in S Register 74, refer to the description of S Register 42.

☞ This is a read only S Register.

### Examples

ATS74? Read the disconnect reason for the previous call

### See Also

S Register 42 Modem Disconnect Reason

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<b>S REGISTER</b>	<b>MEANING</b>
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76,77

S76 controls the loudness of the ringing signal when an incoming phone call arrives in Digital SVD mode.

S77 controls the pitch of the ringing signal when an incoming phone call arrives in Digital SVD mode.

A ringing signal will also be generated if you have established a Digital SVD data connection and the remote user picks up his handset to initiate conversation.

### Examples

ATS77=8    Change ringing signal pitch to 800 Hz.

ATS76=40    Make ringing signal softer

### Default

S76=80

S77=10 (Units =100Hz therefore default is 1000Hz)

### See Also

-SSE command    Digital SVD control

### Range

0-255

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**S REGISTER      MEANING**


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**80                      Flow Control High Water Mark**

This S Register controls when your modem uses flow control to stop data from your computer. Data to be sent by your modem is stored in a 'buffer' (a temporary storage area) until it can be sent by your modem. If the buffer begins to fill, your modem will use flow control to stop your computer sending more data.

S Register 80 allows you to set the level at which the modem will use flow control stop your computer sending more data. Unless you have a sound reason for doing so, the high water mark should never be set higher than 75%. Using a higher water mark may cause problems with computers that are slow to respond to your modem's flow control.

Each unit is equivalent to 5% of your modem's buffer.

☞ Do not change the value of this S Register unless you are an experienced communications user. An inappropriate value may cause flow control between your computer and modem to become unreliable.

Refer to the chapter titled 'Getting Started' for details of flow control.

**Examples**

ATS80=12      Use flow control when the buffer becomes 60% full.

**Default**      15 (75% of the buffer)

**See Also**

S Register 81      Flow Control Low Water Mark

&K command      Flow Control

**Range**          1-19

S REGISTER	MEANING
<b>81</b>	<b>Flow Control Low Water Mark</b>

This S Register controls when your modem uses flow control to resume the transmission of data from your computer.

Refer to S Register 80 for a description of flow control water marks.

☞ Do not change the value of this S Register unless you are an experienced communications user. An inappropriate value may cause flow control between your computer and modem to become unreliable.

Each unit is equivalent to 5% of your modem's buffer.

Refer to the chapter titled 'Getting Started' for details of flow control.

### Examples

ATS81=2    Use flow control when the buffer becomes 10% full

**Default**    t3 (15% of the buffer)

### See Also

S Register 80    Flow Control High Water Mark  
&K command    Flow Control

**Range**    1-19

S REGISTER	MEANING
<b>82</b>	<b>Failsafe Flow Control Overrun</b>

This S Register works in conjunction with the **AT&K9** command.

If you are in &K9 mode and the modem needs to assert flow control it first drops CTS. If the host is using CTS flow control it should stop sending further characters. If the host is using XOFF flow control it will ignore the CTS signal and keep sending data. S82 determines the number of characters the modem will accept after dropping CTS before sending XOFF. If the value is too low some hosts will not respond to the CTS quickly enough. If the number is too large the buffer might overflow.

### Examples

**ATS82=20**    Accept 20 characters after CTS is dropped before sending XOFF

**Default**    50

### See Also

S Register 80    Flow Control High Water Mark  
 S Register 81    Flow Control Low Water Mark  
 &K command    Flow Control

**Range**        1-255

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**S REGISTER      MEANING**


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**95                      Extended Response Codes**

S Register 95 allows your modem to display extended response codes (or result codes). Because this S Register is a 'bit-mapped' register, values must be changed by storing the decimal number equivalent of the binary value represented by the total of the bits.

**Examples**

ATS95=46      Displays the CARRIER, PROTOCOL and COMPRESSION messages and adds the /REL to the CONNECT message (assuming S Register 95 was previously set to zero)

**See Also**

**W** command      Connection Messages Control  
**X** command      Extended Response Codes  
**Q** command      Quiet (Suppress Response Codes)

**Range**    0-255

Bit	Value	Description
0	0	CONNECT message indicates line speed
	1	CONNECT message indicate terminal speed
1	0	CONNECT message may indicate an error corrected link
	1	CONNECT/REL indicates an error corrected link
2	0	Do not display CARRIER message
	1	CARRIER message indicates the line speed
3	0	Do not display PROTOCOL message
	1	PROTOCOL message indicates the type of error correction being used
4		Reserved
5	0	Do not display COMPRESSION message
	1	COMPRESSION message indicates the type of data compression being used
6-7		Reserved

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S REGISTER	MEANING
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<b>96</b>	<b>Help Page Width</b>
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This S Register allows you to set the width of each Help page and the Configuration Profile (&V).

You may change the width of each page to suit your computer.

### Examples

ATS96=40 Set the Help page width to 40 characters

**Default** 80

### See Also

S Register 97	Help Page Length
&V command	View Active Configuration Profile
?	Interactive Help

**Range** 1-255

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S REGISTER	MEANING
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<b>97</b>	<b>Help Page Length</b>
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This S Register allows you to set the length of each Help page and the Configuration Profile (&V).

You may change the length of each page to suit your computer.

### Examples

ATS97=10 Set the Help page length to 10 lines

**Default** 24

### See Also

S Register 96	Help Page Width
&V command	View Active Configuration Profile
?	Interactive Help

**Range** 1-255

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S REGISTER	MEANING
105	Voice 'Dead Man' Timer

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This S Register sets how long the modem remains in voice mode, when on-hook and in non-autobauding mode, and when no characters are received from the computer. If the 'Dead Man' timer expires, the modem returns to data mode.

This register may also be accessed by writing to S30 when in voice mode.

### Examples

ATS105=60 Set the dead-man timer to 60 seconds

ATS105=60 Disable the dead-man timer

**Default** 30

### See Also

ATS30 'Dead Man' Timer (voice mode)

**Range** 0-255



## TROUBLESHOOTING

### Introduction

This part of the guide reviews some of the problems you might encounter and provides solutions for those problems. There is also a chart which will help you.

This section also includes some sample setups for operating in Asynchronous and Synchronous modes.

### Some Problems and Solutions

**Problem:**

No LEDs are lit when you switch on the power to the modem.

☞ On some modems, it is not appropriate for an LED to be lit. In this case, the **TR** LED will flash.

**Solution:**

- Check that the power connector is firmly in place, both at the back of the modem and at the wall socket.
- Check that the power is switched on at the wall socket.
- Check that the ON/OFF switch is in the ON position — for those modems with ON/OFF switches.

**WARNING**

**These are sample problems and solutions only. Not all modems support the same commands or have the same features. Thus, the solutions here may not be applicable to your modem. Consult your dealer if a problem persists after you have tried the solutions here.**

**Problem:**

You don't get a dial tone when you pick up your telephone handset.

**Solution:**

- Check that your telephone line is working. Disconnect the modem from the telephone line and plug the telephone handset back into the wall. Check for a dial tone again. If there is no tone, the problem is either with the telephone or the telephone line.
- It is worth checking that you can successfully dial a normal voice number using your phone line.
- If you get a dial tone without your modem connected, reconnect your modem, ensuring all connections are secure, and the switch is on.
- If you still cannot get a dial tone, contact your dealer.

**Problem:**

You type **AT** and press the **ENTER** key, but there is no response from the modem.

**Solution:**

- Check your communications software is in terminal mode, or you have performed a 'Connect Local' with.
- Check all your cable connections.
- Check that your communications software is set for appropriate serial port on your computer. If your modem is connected to COM1, make sure your communications software is set for COM1. Also make sure your communications software is set for the correct speed to communicate with your modem. (Set your communications software to 2400 bps or 9600 bps.)
- For internal modems, check the card is seated correctly in its slot and that the card is configured for the same COM port as the communications software. If your modem is configured as the same COM port as another card in your computer, you must disable the other card. You may only have one COM1, one COM2, and so forth.
- If you still have problems after adjusting the appropriate settings, exit from your communications program, switch the modem off and on, and then re-enter the communications program to reinitialize the modem.

☞ Try typing: **ATI <E>**

The modem should respond with the Product Identity number.

**Problem:**

You see garbage on the screen after your modem makes a connection. You may get a few unreadable characters in the middle of your data, or you may get data that is totally unreadable.

**Solution:**

- A few unreadable characters may occur because of subtle changes in the quality of the telephone line.
- This can often be corrected by hanging up and redialing to get a different line. If, when you pick up the telephone handset, you can hear a lot of background noise, it is likely you will have trouble with your modem connection. Try again.
- If your data is totally unreadable, there may be a mismatch between your communications parameters and those of the remote computer.

To solve this:

- Check you are using the same transmission speed as the remote modem.
- Check you are using the same parity setting as the remote computer. (Start by setting to 8 Data/No Parity/1 Stop or 7 Data/Even Parity/1 Stop)
- Check you are using the appropriate duplex setting.
- If characters are appearing doubled on your screen, turn local echo OFF.
- If you cannot see what you type, turn local echo ON.
- Check your cable connections.
- Hang up and dial again to try for a better connection. Your modem may be faulty — call your dealer.

**Problem:**

Data sent by the remote computer appears as garbage on your screen.

**Solution:**

- Check with the remote system to ensure your modem speed is compatible, or experiment with a different speed setting.
- If you are in Variable Speed mode, when the CONNECT message is sent, the terminal speed of the modem is changed to match the line speed. You will have to change this manually.

**Problem:**

Data from the remote computer is missing random characters.

**Solution:**

- You may be receiving data faster than your system can deal with it. If this is the case you will need some sort of flow control — such as RTS/CTS or XON/XOFF — if this is supported by your software.
- Some computers cannot cope with receiving data at speeds above 19200 bps. If you wish to run at high speeds, you should install a COM port that has a 16550 chip in place of your regular COM port. The 16550 chip allows your computer to accept data at very high speed.

**Problem:**

Lines of incoming data are double spaced.

**Solution:**

- This occurs when both the local and remote computers are sending linefeed characters. Turn your communication software's linefeed (sometimes called new-line) off.

**Problem:**

Incoming data writes over the same line.

**Solution:**

- Neither the remote computer nor the local computer are using linefeed characters. Turn your communication software's linefeed on.

**Problem:**

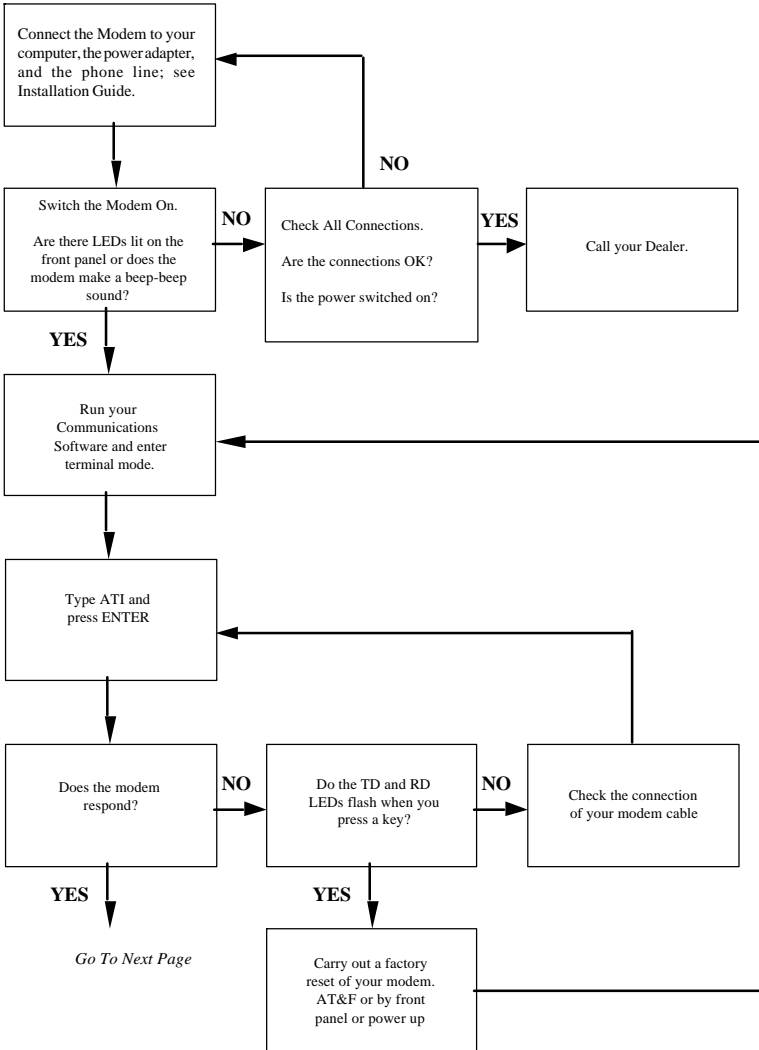
Incoming characters disappear off the right side of the screen.

**Solution:**

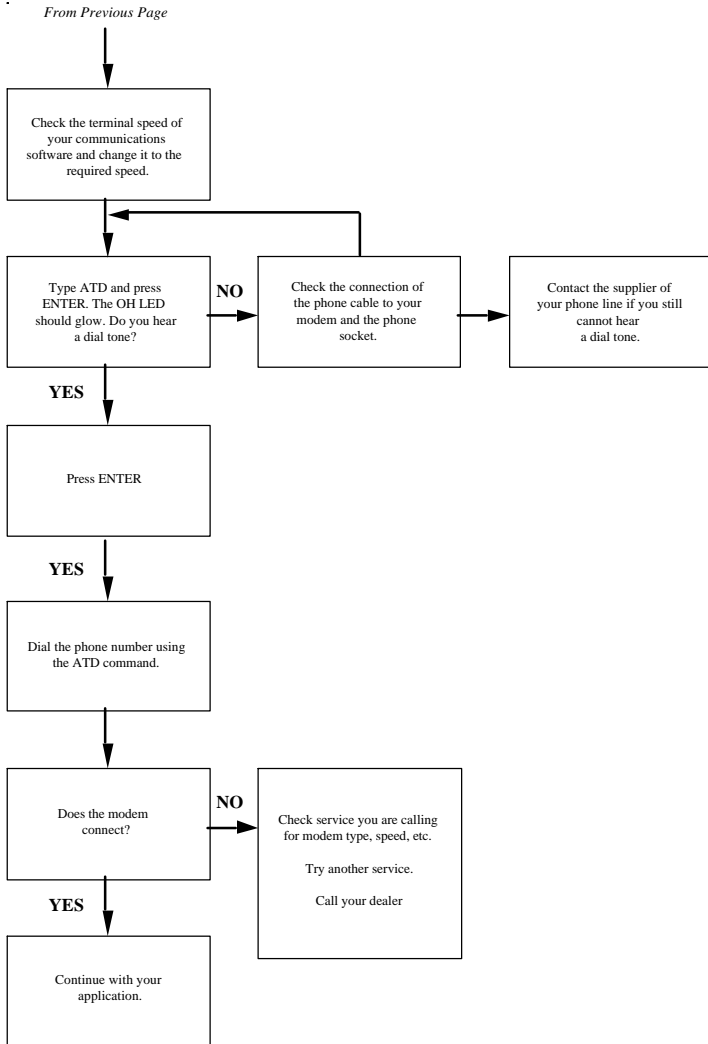
- The remote modem expects your software to provide wraparound. Turn your communications software's wraparound on.

## Troubleshooting Flow Chart

The chart on the next two pages show some common problems users face. Work through the chart. You may be able to solve your problem yourself.



Troubleshooting



## Testing Your Modem

Your modem supports a number of tests which can be initiated using the **&T** command. These tests check:

- the functioning of your modem
- the functioning of the phone line
- the functioning of the remote modem
- all the connections in between

Refer to the Testing Section of this Guide, as well as the description of the **&T** command in the Command Description section of this Guide.

## SAMPLE SETUPS

These sample setups are example of how commands can be used. Some of these commands may not be supported by your modem.

### Asynchronous Mode

#### Calling a BBS or EMail system

Terminal Software Speed: 38,400 bps, 19,200 bps, or 9600 bps

Command: `ATB0\N3%C2&K3X5\V8`

Explanation:

- B0** Selects the modem to connect at the highest possible speed supported by the remote system.
- \N3** Selects error correction. Will fallback to non-error correction mode if the other modem does not support it.
- %C2** Selects V.42bis data compression. The modem will fallback to non-compression mode the other modem does not support it. If you wish to fallback to MNP class 5 data compression (and then non-compression mode) issue the **%C3** command instead of **%C2**.
- &K3** Selects RTS/CTS flow control. Your communications software must also have RTS/CTS flow control selected. This ensures data is not lost between your modem and computer. Use **&K4** if your communications software only supports XON/XOFF flow control.
- X5** Selects extended response codes. Will report to you the speed of the connection your modem establishes with the remote modem.
- \V8** Displays connection details. This provides on-screen information about the type of error correction, data compression and other parameters negotiated between the modems. If your communications software is dialing the remote modem, issue the command **\V0** instead of **\V8**.



## Using your modem as an Auto-Answer modem

Terminal Software Speed: 38,400 bps or 19,200 bps

Command: `ATB0S0=2\N3%C2&K3X5\V8`

Explanation:

- B0** Allows the modem to auto-range, in order to connect at the highest possible speed with the remote modem.
- S0=2** Selects the modem to auto-answer incoming calls after two rings.
- \N3** Selects error correction. Will fallback to non-error correction mode if the other modem does not support it.
- %C2** Selects V.42bis data compression. The modem will fallback to non-compression mode the other modem does not support it. If you wish to fallback to MNP class 5 data compression (and then non-compression mode) issue the **%C3** command instead of **%C2**.
- &K3** Selects RTS/CTS flow control. Your communications software must also have RTS/CTS flow control selected. This ensures data is not lost between your modem and computer.
- X5** Selects extended response codes. Will report to you the speed of the connection your modem establishes with the remote modem.
- \V8** Displays connection details. This provides on-screen information about the type of error correction, data compression and other parameters negotiated between the modems. If your communications software is dialing the remote modem, issue the command **\V0** instead of **\V8**.

## Using your modem with BBS software

Terminal Software Speed: 38,400 bps or 19,200 bps

Command: ATB0S0=0&D2\N3%C2&K3X5\V0

Explanation:

- B0** Allows the modem to auto-range, in order to connect at the highest possible speed with the remote modem.
- S0=0** Disables auto-answering of incoming calls. Most BBS programs perform answering themselves.
- &D2** The modem will hang up if the BBS software lowers the DTR signal. The modem will not be able to dial until the BBS software asserts DTR.
- \N3** Selects error correction. Will fallback to non-error correction mode if the other modem does not support it.
- %C2** Selects V.42bis data compression. The modem will fallback to non-compression mode the other modem does not support it. If you wish to fallback to MNP class 5 data compression (and then non-compression mode) issue the %C3 command instead of %C2.
- &K3** Selects RTS/CTS flow control. Your BBS software must also have RTS/CTS flow control selected. This ensures data is not lost between your modem and computer.
- X5** Selects extended response codes. Will report to you the speed of the connection your modem establishes with the remote modem.
- \V0** Disables MNP response codes and connection details.

---

## Using the modem connected to a UNIX computer

Terminal Software Speed: 38,400 bps or 19,200 bps

Command: `ATB0S0=2\N3%C2&K3&C2X5\V8`

Explanation:

- B0** Allows the modem to auto-range, in order to connect at the highest possible speed with the remote modem.
- S0=2** Selects the modem to auto-answer incoming calls after two rings.
- \N3** Selects error correction. Will fallback to non-error correction mode if the other modem does not support it.
- %C2** Selects V.42bis data compression. The modem will fallback to non-compression mode the other modem does not support it. If you wish to fallback to MNP class 5 data compression (and then non-compression mode) issue the **%C3** command instead of **%C2**.
- &K3** Selects RTS/CTS flow control. Your communications software must also have RTS/CTS flow control selected. This ensures data is not lost between your modem and computer.
- &C2** This command causes the modem's DCD signal to be asserted. DCD is lowered for one second after disconnection from a remote computer. This is required by some UNIX computers which require DCD to be asserted in order to communicate with the modem.
- X5** Selects extended response codes. Will report to you the speed of the connection your modem establishes with the remote modem.
- \V8** Displays connection details. This provides on-screen information about the type of error correction, data compression and other parameters negotiated between the modems. If your communications software is dialing the remote modem, issue the command **\V0** instead of **\V8**.

## Using the modem in Leased Line mode

Terminal Software Speed: 38,400 bps or 19,200 bps

Command: ATB15!Q1&K3&L1\N4

Explanation:

- B15!** Selects the modem to connect at 14400 bps only. If this is not suitable, issue a **B** command appropriate to your application.
- Q1** Selects quiet mode. The modem does not issue response codes.
- &K3** Selects RTS/CTS (hardware) flow control. Your communications software must also have RTS/CTS flow control selected.
- &L1** Selects leased line operation. If the modem detects a loss of carrier it will attempt to re-establish the connection rather than hang up.
- \N4** Selects V.42 Reliable mode. If the modem cannot connect using V.42 error correction it will attempt to reconnect.

☞ A special phone cable is required to connect your modem to a leased line socket. Leased line cables are available from your dealer.

## Synchronous Mode

To operate the modem with a synchronous computer, the modem must first be configured with an asynchronous terminal (for example, a PC running a communication program. Issue the **AT&W** command to save the setup in the modem's non-volatile memory, then connect the modem to your synchronous computer.

### Using the modem connected to a mini or mainframe computer

Terminal Software Speed: 9600 bps or 2400 bps

Command: `AT&Z0=12345` (where 12345 is the phone number to be dialed)

Command: `ATB13!S0=2&M2&D2X0\V0E0Q1&W`

Explanation:

**B13!** Selects the modem to connect at 9600 bps only. If you are using a V.22bis modem, issue the **B8** command to connect at 2400 bps only.

**S0=2** Selects the modem to auto-answer incoming calls after two rings.

**&M2** Selects synchronous mode 2. The modem will dial stored phone number **0** if DTR is asserted by the synchronous computer when there is no incoming call. Refer to the description of the **&Z** command for details of storing phone numbers in the modem. If there is an incoming call when the synchronous modem asserts DTR, the modem will answer the call.

**&D2** Sets the modem to dial stored number **0** when DTR is raised.

**X0** Disables extended response codes.

**\V0** Disables connection details.

**E0** Disables echo from the modem to the computer.

**Q1** Disables responses from the modem to the computer.

☞ For external clocking (clocks generated by the computer or terminal) select the **&X1** for the transmit modem and **&X2** for the receive modem.

## Appendix A

## MODEM RESPONSE CODES

<b>Numeric</b>	<b>Verbal</b>	<b>Meaning</b>
0	OK	Command executed
1	CONNECT	Connection established
2	RING	Ringing signal detected
3	NO CARRIER	Carrier lost or not detected
4	ERROR	Command error, command longer than 80 characters or timeout
5	CONNECT 1200	Connection at 1200 or 1200/75 bps
6	NO DIALTONE	Dial tone not detected on line
7	BUSY	Number dialed was engaged
8	NO ANSWER	Quiet answer not detected
10	CONNECT 2400	Connection at 2400 bps
11	CONNECT 4800	Connection at 4800 bps
12	CONNECT 9600	Connection at 9600 bps
13	RINGING	Dialled number is ringing
20	CONNECT/REL	Error corrected connection at 300bps
22	CONNECT 1200/REL	Error corrected connection at 1200 bps
23	CONNECT 2400/REL	Error corrected connection at 2400 bps
24	CONNECT 4800/REL	Error corrected connection at 4800 bps
25	CONNECT 9600/REL	Error corrected connection at 9600 bps
26	CONNECT 12000/REL	Error corrected connection at 12,000 bps
27	CONNECT 14400/REL	Error corrected connection at 14,400 bps
28	CONNECT 7200/REL	Error corrected connection at 7200 bps
30	CONNECT 12000	Connection at 12,000 bps
31	CONNECT 14400	Connection at 14,400 bps
32	CONNECT 7200	Connection at 7200 bps
33	CONNECT 16800	Connection at 16,800 bps
34	CONNECT 19200	Connection at 19,200 bps
35	CONNECT 21600	Connection at 21,600 bps
36	CONNECT 24000	Connection at 24,000 bps
37	CONNECT 26400	Connection at 26,400 bps
38	CONNECT 28800	Connection at 28,800 bps
39	CONNECT 38400	Connection at 38,400 bps
40	CONNECT 57600	Connection at 57,600 bps
43	CONNECT 16800/REL	Error corrected connection at 16,800 bps
44	CONNECT 19200/REL	Error corrected connection at 19,200 bps
45	CONNECT 21600/REL	Error corrected connection at 21,600 bps
46	CONNECT 24000/REL	Error corrected connection at 24,000 bps

<b>Numeric</b>	<b>Verbal</b>	<b>Meaning</b>
47	CONNECT 26400/REL	Error corrected connection at 26,400 bps
48	CONNECT 28800/REL	Error corrected connection at 28,800 bps
49	CONNECT 38400/REL	Error corrected connection at 38,400 bps
50	CONNECT 57600/REL	Error corrected connection at 57,600 bps
60	CONNECT 76800	Connection at 76,800 bps
61	CONNECT 96000	Connection at 96,000 bps
62	CONNECT 115200	Connection at 115,200 bps
63	CONNECT 230400	Connection at 230,400 bps
70	CONNECT 76800/REL	Error corrected connection at 76,800 bps
71	CONNECT 96000/REL	Error corrected connection at 96,000 bps
72	CONNECT 115200/REL	Error corrected connection at 115,200 bps
73	CONNECT 230,400/REL	Error corrected connection at 230,400 bps
161	SECURITY LOCKOUT	Function has been prevented by Security Options selected

#### **V.25bis Indications**

CFI AB	Call failure; abort
CFI ET	Call failure; engaged
CNX	Connection
INC	Incoming call
INV	Invalid
VAL	Valid

# Appendix B

## ASCII TABLE

ASCII	DEC	HEX	CTRL	ASCII	DEC	HEX	ASCII	DEC	HEX
NUL	00	00	^@	+	43	2B	V	86	56
SOH	01	01	^A	,	44	2C	W	87	57
STX	02	02	^B	-	45	2D	X	88	58
ETX	03	03	^C	.	46	2E	Y	89	59
EOT	04	04	^D	/	47	2F	Z	90	5A
ENQ	05	05	^E	0	48	30	[	91	5B
ACK	06	06	^F	1	49	31	\	92	5C
BEL	07	07	^G	2	50	32	]	93	5D
BS	08	08	^H	3	51	33	^	94	5E
HT	09	09	^I	4	52	34	_	95	5F
LF	10	0A	^J	5	53	35	'	96	60
VT	11	0B	^K	6	54	36	a	97	61
FF	12	0C	^L	7	55	37	b	98	62
CR	13	0D	^M	8	56	38	c	99	63
SO	14	0E	^N	9	57	39	d	100	64
SI	15	0F	^O	:	58	3A	e	101	65
DLE	16	10	^P	;	59	3B	f	102	66
DC1	17	11	^Q	<	60	3C	g	103	67
DC2	18	12	^R	=	61	3D	h	104	68
DC3	19	13	^S	>	62	3E	i	105	69
DC4	20	14	^T	?	63	3F	j	106	6A
NAK	21	15	^U	@	64	40	k	107	6B
SYN	22	16	^V	A	65	41	l	108	6C
ETB	23	17	^W	B	66	42	m	109	6D
CAN	24	18	^X	C	67	43	n	110	6E
EM	25	19	^Y	D	68	44	o	111	6F
SUB	26	1A	^Z	E	69	45	p	112	70
ESC	27	1B	^[	F	70	46	q	113	71
FS	28	1C	^^	G	71	47	r	114	72
GS	29	1D	^]	H	72	48	s	115	73
RS	30	1E	^^	I	73	49	t	116	74
US	31	1F	^_	J	74	4A	u	117	75
SPACE	32	20		K	75	4B	v	118	76
!	33	21		L	76	4C	w	119	77
"	34	22		M	77	4D	x	120	78
#	35	23		N	78	4E	y	121	79
\$	36	24		O	79	4F	z	122	7A
%	37	25		P	80	50	{	123	7B
&	38	26		Q	81	51		124	7C
'	39	27		R	82	52	}	125	7D
(	40	28		S	83	53	~	126	7E
)	41	29		T	84	54	DEL	127	7F
*	42	2A		U	85	55			



## Appendix C

### RS-232 SIGNALS

This appendix describes each of the signals supported on the modem's RS-232 socket.

☞ Pin assignments are only applicable to products with a 25-pin DB-25 connector. Refer to your Product Guide for information regarding the pin assignments for your product.

#### **Transmit Data (TxD) - Pin 2**

The computer transmits data to the modem via this pin.

#### **Receive Data (RxD) - Pin 3**

The computer receives data from the modem via this pin.

#### **Request To Send (RTS) - Pin 4**

This signal indicates to the modem whether the computer is ready to begin sending data to it. When RTS/CTS flow control is enabled, the RTS signal is used by the computer to pause the transmission of data from the modem to it. If RTS/CTS flow control is not selected, the RTS signal is ignored when the modem is in asynchronous mode or local command state.

#### **Clear To Send (CTS) - Pin 5**

This signal indicates to the computer the modem is ready to begin receiving data from it. When RTS/CTS flow control is enabled, the CTS signal is used by the modem to pause the transmission of data from the computer to it. If RTS/CTS flow control is not selected CTS will always be asserted when asynchronous operation is selected. With synchronous mode selected CTS will be lowered when the modem is on line until such time as DSR and DCD are asserted. CTS will always be asserted in local command state.

#### **Data Set Ready (DSR) - Pin 6**

This signal indicates to the computer that the modem is ready to begin communications. In asynchronous mode, this signal will be asserted whenever the modem is switched on and is not performing a test. In synchronous mode, the DSR will only be asserted when the modem is off hook. The &S command lets you control the state of the DSR signal.

#### **Signal Ground (SG) - Pin 7**

Ground for all signals on the RS-232 socket.

**Data Carrier Detect (DCD) - Pin 8**

This signal indicates the presence of a compatible carrier signal. In asynchronous mode, the modem may be configured to assert DCD at all times, ignoring the presence of an incoming carrier signal. The **&C** command allows control over the state of the DCD signal.

**Transmit Clock (TxC) - Pin 15**

This signal only affects the operation of the modem when synchronous mode is selected. This signal may be used to clock transmit data from the host computer. The clock pulse may be derived from the computer connected to the modem (via the XCLK pin), the remote modem (via the receive carrier signal) or the modem's internal clock. The source of the transmit clock is determined by the **&X** command.

**Receive Clock (RxC) - Pin 17**

This signal only affects the operation of the modem when synchronous mode is selected. This signal is used by your computer to synchronize incoming data. The receive data clock is always derived from the receive carrier signal.

**Data Terminal Ready (DTR) - Pin 20**

This signal indicates to the modem whether the computer is ready to begin communications. When asynchronous mode is selected the **&D** command allows you to determine what the modem will do if the DTR signal is lowered while the mode is in on-line state. When synchronous mode 2 is selected, dialing and answering can be initiated by the DTR signal and the modem will hang up and return to local command state if the DTR signal is lowered. The **&D** command lets you control the DTR signal.

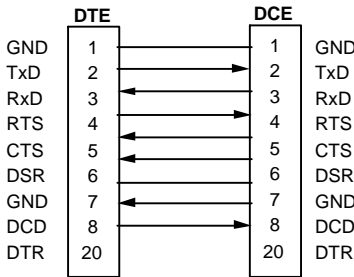
**Ring Indicator (RI) - Pin 22**

This signal will be asserted whenever an incoming call is detected.

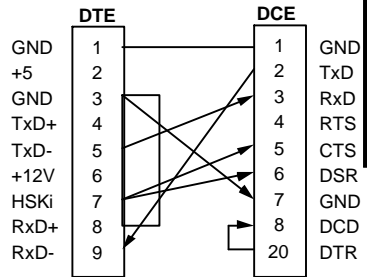
**External Clock (XCLK) - Pin 24**

This signal is only used when a synchronous mode is asserted. The modem may be configured to use this signal for data transmission timing. The **&X1** command allows external clocking to be used during synchronous connections.

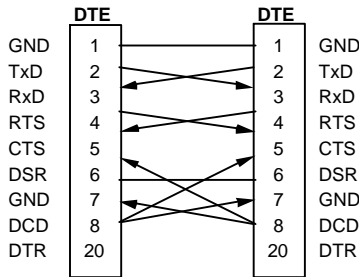
DB-25 to Modem



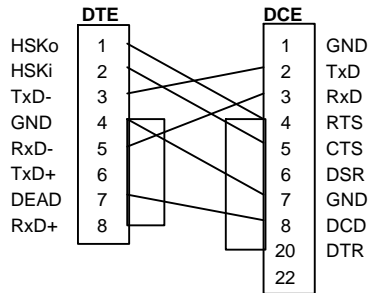
Mac DB-9 to Modem



Null Modem Cable



Mac DIN-8 to PC DB-25



**Cable Pin Labels and Descriptions**

DESCRIPTION	CCITT	EIA	PC	PC DB-9	PC DB-25	MAC	MAC DIN-8	MAC DB-9
Protective frame ground	101	AA	GND	1	1	N.A.		1
Transmit Data	103	BA	TxD	5	2	TxD-	3	5
Receive Data	104	BB	RxD	9	3	RxD-	5	9
Request to Send	105	CA	RTS		4	N.A.		
Clear to Send	106	CB	CTS	7	5	HSKi	2	7
Data Set Ready	107	CC	DSR		6	N.A.		
Reference signal ground	102	AB	GND	3	7	GND	4	3
Data Carrier Detect	109	CF	DCD		8	N.A.		
Data Terminal Ready	108	CD	DTR		20	HSK0	1	
Ring Indicator	125	CE	RI	9		N.A.		9

**Standard RS-232 Examples**

## GLOSSARY

## A

**ACK (Acknowledge)**

Control Character transmitted by a receiving device as an affirmation to a sending device.

**Alphanumeric**

Roman Letters (alphabetic) and Arabic numbers (numeric).

**Amplitude**

The height of a waveform measured in volts.

**Amplitude Modulation (AM)**

Transmission of information by varying the amplitude of a carrier signal.

**Analog Data**

Data in the form of continuously variable physical qualities. Compare with Digital data.

**Analog signal**

A signal such as voice or music that varies in a continuous manner (smooth transitions to different levels).

**ANSI**

American National Standards Institute, primary standards development body in the USA.

**ASCII**

American Standard Code for Information Interchange. Pronounced *as-kee*. A code by which alphanumeric, punctuation and control characters, commonly found on computer keyboards, are each assigned a unique value between 0-127 (decimal).

**Asynchronous**

A data transmission in which the time between characters may vary. Characters are delimited by start and stop bits.

**Attenuation**

The loss of power through transmission equipment, lines or other communication devices.

**Auto answer**

A modem capability that allows automatic pick-up — by the modem — when the phone answers.

**Auto dial**

The ability to make a connection with another modem automatically. (To dial a number automatically, usually using a stored number.)

**Auto range**

The ability of a modem to range over several modem standards to determine the standard of the calling modem.

**B****Bandwidth**

The range of signal frequencies that are accepted or passed by a circuit or network. (The normal bandwidth on a telephone line is 3100Hz.)

**Baseband**

The frequency band occupied by a signal in its original or unmodulated form.

**Baud**

This term represents the number of signal elements per second. Because a signal element can represent more than one bit, this term is not equivalent to BPS (bits per second), although it is often used in this way. Compare with bit rate.

**Baud Rate**

Number of discrete signalling events per second; not necessarily the same as bits per second. For example, a V22bis, 2400 bps modem uses a 600 baud by 4-bit encoding scheme.

**Baudot Code**

Code for transmitting data using five bits to represent a single character.

**BBS**

An acronym for Bulletin Board System. See Bulletin Board.

**Binary**

A number system with a base of two, using the digits 0 and 1. Commonly used in computers since the values 0 and 1 can easily be represented as OFF and ON in electrical circuits.

**Binary Synchronous Communications (BSC or BiSync)**

A communications protocol developed by IBM which has become an industry standard. It uses a defined set of control character sequences for synchronized transmission of data.

**Bit**

The smallest piece of information in a binary number system. The word stands for Binary digIT.

**Bit rate**

The speed at which bits are transmitted, usually expressed as bits per second (BPS).

**Block**

Group of characters treated as a unit for the purpose of data transmission.

**BPS**

An acronym for Bits Per Second. Transmission rate of binary numbers. Compare with Baud.

**Break**

A special, non-data signal used by computer equipment to interrupt some processes.

**Buffer**

Temporary storage area used to compensate for a difference in the rate of data flow into and out of a device.

**Bulletin Board**

A generic term covering a wide variety of on line information services. Many bulletin boards are open to the public, run at no cost to users and provide the ability to download public domain software and exchange electronic mail.

**Byte**

A grouping of bits to specify a single character usually consisting of eight consecutive bits. See also Bit.

**C**

**Carrier signal**

An analog signal of known specifications, such as level and frequency, which is modulated by another signal containing information to be transmitted. This is the high-pitched sound you can hear when you first connect to a remote system.

**Carrier Detect**

An RS-232 interface signal from the modem to a terminal or personal computer indicating that the modem is receiving a signal from a remote modem. See also DCD.

**CCITT**

International Telegraph and Telephone Consultative Committee. An international committee which establishes recommended communications standards.

**CCITT Vxx**

International standards in communications concerned with modem interfaces, speeds and transmission modes.

**CCITT X25**

International standard defining the protocol used in accessing a packet switching network.

**Channel**

An electronic communications path. A voice grade channel generally ranges from 300 to 4000 Hz.

**Character**

A letter, number or other symbol contained in a message or used in a control function. See Byte.

**Character Set**

The characters that can be coded or used by a particular machine.

**Clear to Send (CTS)**

An RS-232 control signal sent by the DCE to indicate that the DTE may begin a transmission.

**Clock**

Source of timing signals used in synchronous transmission.

**Code**

A predefined set of rules specifying the way data is to be represented by the transmitting and receiving device.

**Common Carrier**

Telephone company that furnishes communications services to the general public.

**Conditioning**

The addition of equipment to a leased voice-grade line to improve the transmission characteristics of the line.

**Conferencing**

A form of bulletin board that allows real-time communication between multiple users. In the U.S.A., conferencing systems have been established to allow large numbers of individuals to simultaneously discuss a wide range of specialized topics and interests.

**Connector**

A physical devices, such as a plug, socket or jack, used to connect one hardware component of a system to another. A connector may also be called a port.

**Connect Time**

The amount of time spent on line with an information service.

**Console**

Part of a computer system, usually a video display terminal, used by the operator to communicate with the computer.

**Contention**

Condition arising when two or more devices try to transmit at the same time using the same channel.

**Control Character**

Any character assigned as ASCII numeric code less than the SPACE character. These characters are used to initiate a control function on the receiving device. Also a symbol you can create by pressing one of your computer's keys while holding down the Control key. These symbols are not usually printed, and are generally used to control screen formatting and cursor positioning.

## **CPU**

Central Processing Unit. The computer hardware which processes software instructions to control the computer system and its peripherals.

## **CRT**

Cathode Ray Tube. This term is commonly used to stand for the video display terminal.

## **CTS**

An acronym for Clear To Send. This signal is generated by a modem in response to RTS to indicate that a communications channel has been established and that data can be sent.

## **Cyclic Redundancy Check**

An error-detection technique in which a data validation value is mathematically derived from a block of data and transmitted at the end of the block. The receiving end recomputes the value and if it matches the value sent, the data is assumed to be valid (error-free). If not, the receiver notifies the transmitter that an error has occurred and the block is retransmitted.

## **D**

### **Data**

Any type of information, such as numbers, letters and symbols, that can be processed by a computer.

### **Database**

A source or collection of information. In the context of communications, a dial-up service from which users can exchange or retrieve information.

### **Data Bits**

The actual characters being transmitted between two computers when asynchronous communications is being used. Usually 7 or 8 data bits are used.

### **Data Communications**

A broad term covering any exchange of information between computers or similar systems over telephone lines.

### **Data Communications Equipment**

Equipment that is used to access a communications network. The DCE provides all the functions required to establish, maintain and terminate a connection, and provides the signal conversion required for communications between the Data Terminal Equipment (DTE) and the telephone network. With RS-232 connections, the modem is generally the DCE device while the computer or terminal connected to a modem is generally the DTE device. See also Data Terminal Equipment.



**Data Compression**

An encoding technique which provides for the transmission of fewer data bits without the loss of information. The receiving end expands the data received to its original form.

**Data Set**

See Data Communications Equipment and Modem.

**Data Set Ready (DSR)**

An RS-232 control signal used to indicate the readiness of the DCE (Usually a modem) to accept data from the DTE (usually a terminal or computer).

**Data Terminal Equipment (DTE)**

The equipment which provides the data source and/or receiving end of a data transmission link. The DTE may be a CRT or teletype terminal, a personal computer, a printer, a front-end processor to a large mainframe computer or any other device which can transmit or receive data. With RS-232 connections the designation of DTE or DCE determines which device is responsible for generating certain control signals. See also Data Communications Equipment.

**Data Terminal Ready (DTR)**

An RS-232 control signal used to indicate the readiness of the DTE for data transmission.

**DCD**

An acronym for Data Carrier Detect. See also Carrier Detect.

**DCE**

An acronym of Data Communications Equipment. See Data Communications Equipment.

**Decibel (dB)**

Unit of measure indicating the logarithmic ratio of output signal power to input signal power.

**Dedicated Line**

A communications line which is not dialed. Also known as a leased or private line.

**Default**

A value, action or setting that is automatically used by a computer system when no other explicit information has been given.

**Demodulate**

To recover the information being transmitted by a modulated signal. For example, a conventional radio receiver demodulates an incoming broadcast signal to convert it into sound emitted by a speaker. See also Modulate and Modem.

**Device**

A piece of equipment connected to a computer — maybe a Fax Card or Modem.

**Dial-up**

Establishing a temporary connection to a remote system or computer via the public switched telephone network.

**Dial Tone**

A call progress signal returned by a telephone switching machine to indicate that it is ready to accept a telephone number.

**Dibit**

A grouping of two bits.

**Digital Signal**

A signal composed of discrete signal levels as opposed to the continuous signal levels of an analog signal.

**Direct Keying**

In videotex terminology direct keying refers to accessing a page by specifying its page number rather than using index pages.

**Distortion**

Undesired change in a signal's original waveform resulting from the characteristics of the transmission circuits or other external influences.

**Downloading**

See Software Downloading.

**DTE**

An acronym of Data Terminal Equipment. See Data Terminal Equipment.

**Double-Digit Keying**

Pressing two number keys in rapid succession to access a page in a videotex system. The first number accesses an intermediate index (see Intermediate Page) which in turn accesses the page. See also Single-Digit Keying.

**Dumb Terminal**

Terminals that do not contain an intelligent microprocessor and usually send data one character at a time.

**Duplex Transmission**

Independent, simultaneous, two-way transmission.

**E**

**EBCDIC**

Extended Binary Coded Decimal Interchange Code. An eight bit code used primarily by IBM equipment.

**Echo**

The re-transmission of characters received by either the modem or remote system back to the DTE.

**Echoplex**

Method of verification of transmitted data by echoing the characters transmitted back to the source device for verification. Echoplex is sometimes called remote echo and, erroneously, half-duplex.

**EEPROM**

Electrically Erasable Programmable Read Only Memory.

**EIA**

Electronic Industries Association. Organization in the USA that sets standards for the functional characteristics of electronic interfaces.

**Electronic Mail**

A means by which users of a particular bulletin board or videotex system can send messages to other users of that system. Some dial-up services deal exclusively with providing electronic mail facilities.

**E-MAIL**

See Electronic Mail.

**ENQ**

Control character used to enquire as to the identification or status of a remote device.

**Even Parity**

Even parity refers to the addition of a 0 value or 1 value bit to the data bits which form a character to cause an even number of 1 value data bits to be sent. See also Parity.

**ETX**

Control character which indicates the End of Text in a transmitted message.

**F****Firmware**

Computer program stored permanently in Read Only Memory.

**Forward Error Correction (FEC)**

Technique of transmitting additional information with the original data so that if small errors are detected the correct information can be recreated by the receiving end without requiring a re-transmission.

**Frame**

See Block.

**Frequency Modulation (FM)**

A method of transmitting information by varying the carrier frequency.

**Frequency Shift Keying**

A form of frequency modulation in which the frequency of the carrier is shifted between two frequencies to represent digital data.

**Front-end Processor**

Computer equipment designed primarily for communications control associated with a large mainframe.

**Full Duplex**

Data transmission which allows data to flow in two directions at the same time.

**G**

**Gateway**

An electronic connection of some type, generally transparent to the user, by which multiple computers can be connected together.

**Graphics**

Information in the form of pictures or images. Also, the display of pictures or images on a computer's display screen.

**Guard Band**

Narrow frequency band left unused between adjacent channels to minimize interference.

**H**

**Half Duplex**

Data transmission in which data may flow in either direction at one time, but not both directions simultaneously. Transmission direction is alternatively switched to allow two way flow of data.

**Handshake**

A predetermined interchange of signals between two devices to establish conditions for a transfer of data.

**Hardware**

The electronic or electro-mechanical devices in a computer system as opposed to the programs or software.

**Hardware Handshaking**

The use of special RS-232 signals to halt or commence the flow of data between two computers or terminals, between computers and modems or between facsimile machines. See also Software Handshaking, RTS and CTS.

**Harmonics**

Frequencies which are integer multiples of some fundamental frequency.

**Harmonic Distortion**

A line impairment caused by equipment which distorts the original signal at multiples of the same fundamental frequency.

**Hexadecimal Numbers**

A number system with a base of 16. The first ten digits are represented by 0-9 while the last six digits are represented by A-F. Hexadecimal numbers can be easily translated from binary numbers and are easier for humans to understand and read than are binary numbers.

**HDLC**

High Level Data Link Control. Communications protocol developed by the International Standards Organization.

**Header**

In communications protocols, this is the control information that precedes the message or text portion of a block of data.

**Hertz (Hz)**

Unit of frequency, one cycle per second.

**Horizontal Redundancy Checking (HRC)**

Technique in which redundant information is included with a block of data for validating the transmitted data at the receiving end.

**Host Computer**

A computer that manages information for many terminals. A host computer may be mainframe, minicomputer or a microcomputer.

**I****ID Name**

See ID Number.

**ID Number**

A security code, used mainly with remote systems that either charge a subscription fee, allow the purchasing of goods and services on line or both. The code is known only to the user and protects the user from unauthorized access to her/his account. See also Password.

**Input**

Information transferred into a computer from some external source, such as the keyboard, a disk drive, a modem or a scanner. Also, the act or process of transferring such information.

### **Input/Output Device**

A device that transfers information into or out of a computer.

### **Interface**

A physical point of interconnection between two devices where electrical signal levels, timing, handshaking and pin numbers are defined. The devices, rules or convention by which one component of a system communicates with another.

### **Interference**

Undesirable disturbances or distortions in a data transmission signal.

### **Intermediate Page**

An index page which, when used with another index page, allows users to perform double-digit keying.

### **I/O**

Input/Output. The transfer of information into and out of a computer.

### **ISO**

International Standards Organization.

## **J**

### **Jack**

A socket used for telephone line or other electrical connections.

## **K**

### **Kermit**

Kermit is a file transfer protocol developed for operating systems which could not support the XModem protocol. Kermit was developed at Columbia University in 1981.

### **Keying**

Videotex systems only. Refers to pressing of numeric keys to access an item from an index.

## **L**

### **Leased Line**

A telephone line permanently connecting two or more locations. It does not have any switching equipment associated with it and runs between specific, fixed locations. Also known as a private line.

### **LED**

Acronym for light emitting diode. See Light Emitting Diode.

**Light Emitting Diode**

A diode which glows when a current flows through it. Often used as an indicator light.

**Link**

A circuit or transmission path, including all equipment, between a sender and a receiver.

**Local Echo**

A method of communication in which your modem or software displays data locally on your screen, without relying on the host computer to echo the characters back.

**Log on**

To connect to or access a bulletin board or videotex system.

**Log Off**

To disconnect from a bulletin board or videotex system.

**Longitudinal Redundancy Check**

Error detection technique that consists of a byte where each bit is calculated on the basis of the parity of all bits in the block in the same position.

**Loopback**

Directing signals back toward the source at some point in the communications path.

## M

**Mailbox**

A term used to describe the holding, by a bulletin board, videotex or electronic mail system, of electronic messages (mail) for a user. Usually, the system will announce if the user has any unread mail when she/he logs on.

**Mainframe**

Large scale computer system composed of a large number of peripherals and comprehensive software.

**Mark**

One of the two possible states of a binary data element. The closed circuit and idle condition in a teleprinter circuit. Also see Space.

**Modem**

Modulator/Demodulator. A device to convert data from a computer or terminal into a form suitable for transmission across a telephone system.

**Modem Eliminator**

A usually passive device which takes the place of a modem between a local terminal which requires a modem and a computer.

### **Modulate**

To modify or alter a signal so as to transmit information. For example, conventional broadcast radio transmits sound by modulating the amplitude (Amplitude Modulation, or AM) or the frequency (Frequency Modulation, or FM) or a carrier signal. See also Demodulate and Modem.

### **Monitor**

A program or device used to observe an operation without interfering with the operation.

### **Multidrop Line**

Single communications circuit interconnecting many stations (nodes) each containing terminal devices.

### **Multiplex**

To interleave or simultaneously transmit two or more messages on a single channel.

## **N**

### **NAK**

Negative Acknowledgement. This control character indicates that the last block transmitted was in error and that the receiver is expecting a re-transmission.

### **Node**

A point of interconnection on a circuit.

### **Noise**

Random electrical signals introduced by components of the circuit or natural disturbances which can produce errors in transmission.

### **Null Modem**

See Modem Eliminator.

## **O**

### **Odd Parity**

Odd parity refers to the appending of a 0 or 1 value bit to the data bits of a character to ensure that an odd number of 1 value bits are sent. See also Even Parity and Parity.

### **Off line**

Describes equipment and activities connected to, but not currently accessible by, a computer.

### **On line**

Describes activities and equipment currently connected to an accessible by a computer.



## P

### **PBX**

Private Branch Exchange. An automatic switchboard for handling large concentrations of telephones (extensions).

### **Packet**

Group of bits including data and control elements that are transmitted as a whole.

### **Packet Switched Network**

System where messages are transmitted in packets, each individually addressed and routed through the network.

### **Packetized Ensemble Protocol (PEP)**

A patented data transmission technique used by the TrailBlazer modem to transmit data at up 18000 bps on the switched telephone network.

### **Parity**

A simple method of error checking by which the number of data bits received are added together to ensure that the correct number have been received. Most bulletin boards do not use any parity checking.

### **Password**

A second-level security device, generally being a set number of characters. The length and types of passwords used with bulletin boards varies from one system to another. On most videotex systems a four character password is used. See also ID Number.

### **PBX**

See PBX.

### **PEP**

See Packetized Ensemble Protocol.

### **Peripheral**

(Or peripheral device). A device, such as a video monitor, disk drive, printer or modem, used in conjunction with a computer. Often (but not necessarily) physically separate from the computer and connected to it by wires, cables or some other form of interface.

### **Phase Modulation (PM)**

A method of modulating the carrier wave based on the data by varying the phase relationship of the signal elements.

### **Point-to-point**

A connection between two points as opposed to a multipoint or multidrop line.

### **Port**

The point of connection, usually a physical connector, between a computer and a peripheral device, another computer or a network.

### **Private Line**

See Leased Line.

### **PROM**

Programmable Read Only Memory.

### **Propagation Delay**

The time required for a signal to travel from one end of a circuit to another.

### **Protocol**

A set of conventions controlling the timing and format of data communications between two pieces of communications equipment.

### **Protocol Converter**

Device that converts from one protocol to another.

### **Public Domain Software**

Software from which its author has relinquished copyrights. This software is free of charge and may be distributed for non-commercial purposes. Many bulletin boards and videotex systems carry public domain software for users to download. See also Shareware.

### **Public Switched Network**

Telephone system providing circuit switching to many customers.

### **Pulse**

An abrupt and relatively short change in voltage, either positive or negative, resulting in the conveyance of data in a circuit.

## **Q**

### **Quadrature Amplitude Modulation (QAM)**

A modulation technique which employs both amplitude and phase modulation to encode multiple bits in a single element.

## **R**

### **RAM**

Random Access Memory.

### **Received Line Signal Detector**

See Carrier Detect.

**Redundancy Check**

Technique of error detection involving the transmission of additional data related to the message so that the receiving device can determine if the data transmitted is valid (error-free).

**Remote System**

Usually a bulletin board or videotex system that registered users or the public can dial up and communicate with via modem.

**Request to Send**

RS-232 control signal by the DTE to inform the DCE that it is ready to transmit data. When used for flow control between the DTE and the modem, this signal indicates to the modem that the DTE is ready to accept data.

**Ring Indicator**

RS-232 control signal used by the DCE to inform the DTE that it is receiving a ringing signal.

**ROM**

Read Only Memory.

**RS-232C**

Frequently shortened to RS-232. A standard which defines the physical and electrical interface between Data Communications Equipment and Data Terminal Equipment. The most commonly used interface between modems and computers. Also known as CCITT V24.

**RTS**

An acronym for Request To Send. This signal is generated by the terminal or computer indicating that it requires to send data to the modem. Used mainly in half-duplex communications.

**S****SDLC**

The standard Synchronous Data Link Control protocol used by IBM for products which conform to its System Network Architecture.

**Serial Data**

Data transmission in which each bit of information is sent sequentially through a single data path.

**Shareware**

An extension of public domain software. Individuals can obtain copies of software for free from bulletin boards or other computer users. If the software is useful to them, they are encouraged to send a small fee to the program's author, usually for a printed manual, registration and any software updates that are available. See also Public Domain Software.

## **SIG**

An acronym for Special Interest Group. Groups of user's who share an interest in a particular topic. Often SIGs set up bulletin boards, available only to SIG members.

## **Simplex**

Data communications in one direction only.

## **Single-Digit Keying**

Refers to videotex systems where you only need to press one numeric key from an index. See also Double-Digit Keying.

## **Software**

Computer program or set of computer programs held in storage, and loaded into RAM for execution.

## **Software Downloading**

Known as software downloading or teleloading on videotex systems and downloading on some bulletin boards. Refers to the transferring of software from a remote system to your computer.

## **Software Handshaking**

A method of controlling the flow of data between two computers or terminals. Special control characters are sent from one terminal to the other in order to halt or re-commence the flow of data. See also Hardware Handshaking.

## **SOH**

Start Of Header used in synchronous transmissions indicating the start of a header block.

## **Space**

One of the two possible states of a binary data element. The open circuit condition in a teleprinter circuit. Also see Mark.

## **Special Interest Group**

See SIG.

## **Start Bit**

When a character is transmitted asynchronously to another computer, a start bit always precedes the actual data. Seven or eight data bits, an optional parity bit and a stop bit will follow.

## **Stop Bit**

The last bit or element transmitted in asynchronous transmission of a character to return the circuit to an idle state. One or two stop bits are sent at the end of each character of data.

## **STX**

Start Of Text control character used in synchronous transmission which precedes the text portion of the data block.

## **SYN**

Synchronous Idle control character transmitted when the line is idle in synchronous transmissions.

**Synchronous**

A data transmission in which the time between characters is fixed by synchronizing the transmitting and receiving communications equipment. The clock signal is typically derived from the data stream in order to maintain synchronization.

**Sysop**

System Operator. This is the person or organization who controls and maintains a videotex or bulletin board system. Most bulletin board systems display the name of their individual sysops when you first log on.

**T****Telecommunications**

The transmission of information across long distances, such as over telephone lines.

**Tele-downloading**

See Software Downloading.

**Teleload**

See Software Downloading.

**Teletext**

A non-interactive information system that was the predecessor to videotex systems. Teletext terminals consist of a specially modified television set and keypad to provide 24 lines of 40 column color text and graphics. Connection is made to teletext systems by specially assigned television broadcast channels, hence the need to use a television set. Videotex terminals cannot access the information contained in a teletext system.

**Terminal**

An input/output device consisting of a typewriter-like keyboard and a display device, used for communicating with a large computer. Any device capable of sending and/or receiving data over a communications channel.

**Terminal Emulation**

Refers to the type of ASCII terminal your software will imitate (the control characters used to perform certain screen and cursor movement tasks vary from one terminal to another).

**Text**

The message portion of a data block in synchronous data transmissions.

**Turnaround Time**

The time required to reverse the direction of transmission when operating in half duplex mode.

## U

### Upload

Refers to sending files or text from the user's computer to another user, a bulletin board or videotex system. (Many bulletin boards that offer public domain software encourage users to upload their own programs so that other users can download them).

## V

### Vertical Redundancy Check (VRC)

A method of character parity checking.

### Videotex

An interactive information system which is also known as Videotext or Viewdata. Videotex systems usually operate over switched telephone lines and allow 40 columns by 24 lines of color text and graphics to be displayed on the screen.

Information is arranged in pages, each page having a unique page number. Well known videotex systems include Prestel (Britain), Discovery 40 (Australia), and Minitel (France). See also Teletext.

### Videotext

See Videotex.

### Voice Grade Line

Channel with a frequency range of 300 to 3400 Hz suitable for the transmission of speech or data in analog form.

## X

### XModem

A communications protocol developed in the late '70s by Ward Christensen to perform error checking on data being sent between two computers.

### XON/XOFF

Special control characters used to control the flow of data between your computer and a remote system. See Software Handshaking.







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