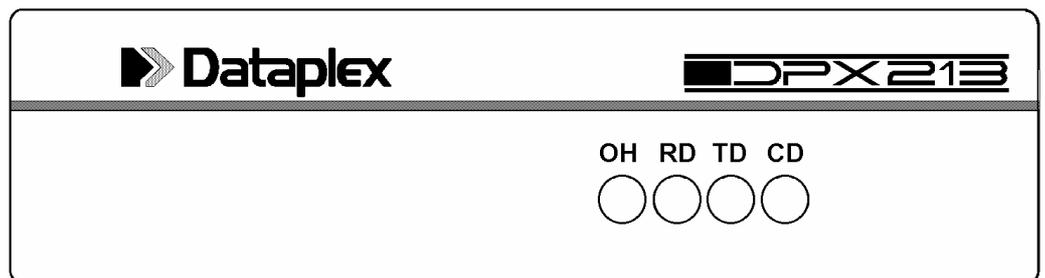




DPX-213

LOW POWER DATA MODEM

USER MANUAL



2400/1200/300bps MNP-5 Data
Leased Line & Dial Network Modem

WARNING

When operating the *DPX213* from a DC supply ensure that any devices that are connected to the *DPX213* have a common **NEGATIVE** ground or are powered from an isolated source. It is recommended that the supply be connected via a disconnection device or an over-current protection device.

SAFETY

The 48V free standing unit is fitted with a 2m power supply cable with bare wire ends. This power supply cable must be connected to the power source via a disconnection device or an over-current protection device. A circuit breaker rated 1A, 100 VDC will satisfy both requirements. Observe correct polarity:

- Red wire to positive;
- Black wire to negative.

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1.0 INTRODUCTION

Welcome to the Dataplex *DPX-213*. Whether you are familiar with dial network modems or not, you will find the *DPX-213* simple to operate. The modem offers advanced features only found in quality high-end products and opens the door to a new world of data communications. Congratulations on your purchase of the *DPX-213*.

1.1 Features of the DPX-213

This low power dial network and leased line data modem is designed for advanced business and professional applications. A wide range of useful features allow many different types of networks to be configured with the one compact unit. MNP 4 error correction and MNP 5 data compression permit error free transmission of data at up to four times the throughput of basic 2400 bps modems.

The *DPX-213* supports five international speed standards for both synchronous and asynchronous communications.

1.2 Requirements

To operate the *DPX-213*, it is assumed that the user is reasonably familiar with data communications concepts and personal computers. If you are unfamiliar with data communications or personal computers, please refer to the relevant texts or user manuals. Before you can operate the modem, ensure you have the following equipment:

1. An asynchronous terminal. This can be a personal computer with an RS-232 serial port or a dumb asynchronous terminal. Once configured, synchronous devices may be used.
2. Data communications software.
3. A DTE (Data Terminating Equipment) cable.

1.3 About the Manual

The manual is organised to explain increasingly more advanced operations. Novice users should read all sections, in particular, Section 3 on modem basics and Section 7 on Applications. The manual is divided into 12 sections as follows:

- Section 1** **Introduction** describes the *DPX-213* features and explains how to use this manual.
- Section 2** **Installation** explains the purpose of each indicator, switch and connector plus how to connect your modem to the computer and telephone line.
- Section 3** **Before You Start** covers the command method, dialling, answering, matching dissimilar speeds, leased line and dial network operation.
- Section 4** **Command Set** is probably the most important Section. It explains in detail the function of each AT command for both fax and normal modem operation.
- Section 5** **Applications** offers some quick start information on a range of common uses including password security, synchronous support, leased line operation, extended character set support and remote configuration.
- Section 6** **Data Transfer** describes advanced features such as error correction, data compression, flow control and speed matching. This Section also gives some warnings on set-up conflicts to be avoided.
- Section 7** **Testing and Diagnostics** covers the loopbacks and test patterns available to help isolate any problem in your cable, modem or phone line.
- Section 8** **S-Registers** covers the software registers used to store the *DPX-213* configuration options. Instructions are given to enable reading and altering the S-Register values.
- Section 9** **Technical Specifications** gives the performance specifications of the *DPX-213* and lists the other models available.
- Section 10** **Warranty and Repair** allows you to record the installation configuration. Also included is warranty information and a field service request form.
- Appendices** The appendices contain a problem report sheet, interface signal leads/connections information, an ASCII code table (in decimal, binary and hex), an S-registers summary table and the AT Command Set Summary.

1.4 The DPX-213 Modem

The *DPX-213* is designed and built in Australia and offers:

- Low Power: Standby current < 100uA.
Operating current < 100mA
- Wake up on DTE RxD, Ring or Raise of DTR.
- Led operation link selectable.
- DTR wake-up link selectable.
- Alarm/Dialback function.
- Password security/dialback.
- Remote configuration.
- Async/Sync link selectable.
- Power from DB25, IDC or Power Connector.
- Small size.
- MNP error correction & data compression.
- Constant speed interface from 300 to 9,600 bps.
- Automatic terminal speed detection from 300 to 9,600 bps.
- Data operation at 300, 1200, and 2400 bps.
- Auto-ranging on originate and answer at 300, 1200 and 2400 bps.
- CCITT standards V.21, V.22, and V.22bis.
- Bell 103 and Bell 212 support.
- A rugged plastic case.
- Front panel indicators.
- Stored number dialling for up to ten numbers.
- DTR raise and AT command dialling.
- Help screens for configuration, S-registers and AT prompts.
- Manufactured to ISO-9002/AS-3902 quality standards.
- Austel approved.
- RFI compliant to AS-3458 and CISPR-22 class A.

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2.0 INSTALLATION

Read this Section in order to correctly install your modem. It includes information on connector pinouts, front and rear panel details and a simple test of your setup.

Before operation is possible, the modem must be setup, either to the factory defaults or with special S-register values to suit your own configuration.

Most communications software packages issue a default command string to set up the modem. Before altering this default setup, check the software operations manual and Section 4, Command Set.

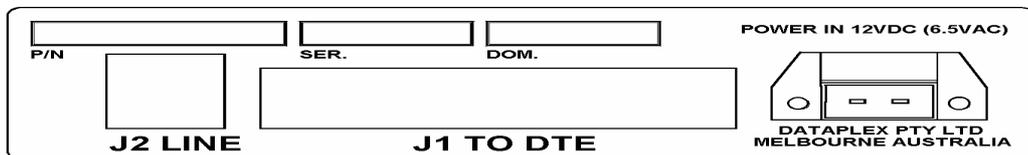


Figure 2.1 Rear Panel Layout

The rear panel of the *DPX-213* has a single RJ-11 connector for line, together with a 25 Pin V.24/28 DCE connector. The supplied line cord connects from the RJ-11 of the *DPX-213* to the telephone wall socket. A description of the RJ-11 connectors is given in Appendix D.

2.1 Setting the Internal Jumpers

The *DPX-213* contains a number of internal jumpers which have to be set before operation. The figure over page shows the location of the various jumpers.

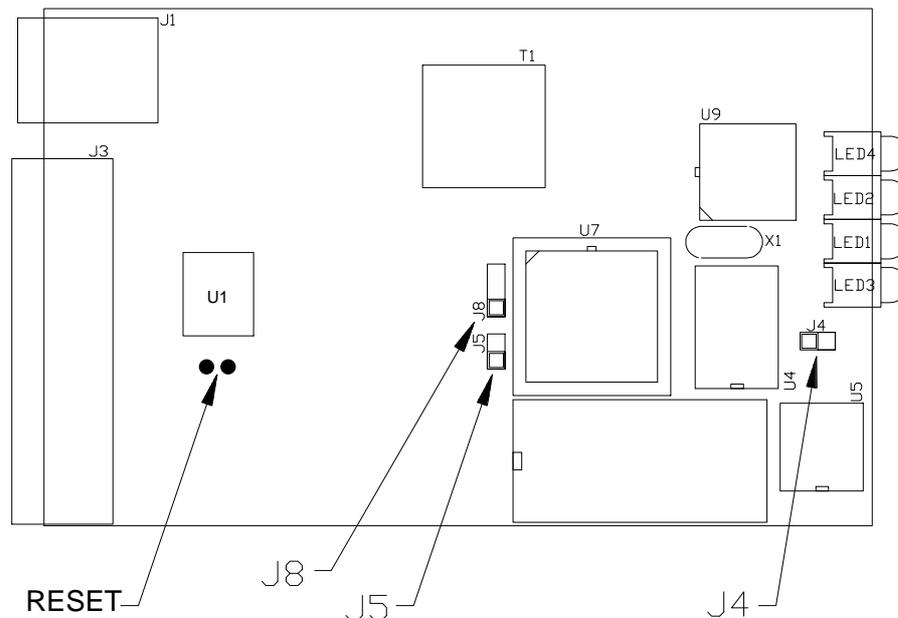


Figure 2.2 DPX-213 Jumper Locations

- J4:** Removing this jumper reduces current consumption by disabling the front panel LEDs.
- J5:** Removing this jumper stops the V.24 DTR input which controls the standby mode of the **DPX-213**. Without this jumper set, the unit will not wake up on raise of DTR and will not be held active by the DTR when the unit is placed in standby mode.
- J8:** This jumper enables the sync clocks on the V24 interface. When Pins 1 and 2 are shorted no sync clocks will be present at the interface. When Pins 2 and 3 are selected, both Rx and Tx sync clocks will be placed on Pins 17 and 15 of the DB25 connector.

2.2 Connecting the DPX-213 to the Telephone Line

Remove your telephone from its wall socket (you may need a flat bladed screwdriver for this) and plug one end of the supplied cable into the socket labelled "J2 LINE" on the rear of the **DPX-213** and plug the other end into the wall socket. The terminal prompts will give call progress indication.

NOTE: 1. *Dataplex does NOT recommend the use of double adaptors to connect your telephone in parallel with the DPX-213. Should the handset be lifted when the modem is online, noise and errors will be injected into the data stream.*

2. *If the handset draws power from the telephone line (for example, to keep stored numbers intact or to run a clock display) the battery charging current can be a source of noise and errors in the data during long modem sessions. A long data call may cause the telephone memory battery to discharge and lose the stored numbers.*

2.3 Connecting a Terminal or Computer to the DPX-213

The **DPX-213** uses the industry standard 25 Pin "D" connector as its data interface, with the signals defined in the CCITT V.24, V.28 and EIA RS-232C for modems. The **DPX-213** operates as Data Circuit-terminating Equipment (DCE).

If you wish to connect the **DPX-213** to a terminal or computer with a serial port configured as Data Terminal Equipment (DTE), then a "straight through" cable connecting corresponding pins of the serial ports should work. If the computer serial port is configured as a DCE, then you must use a "cross over" or "null modem" cable. Most personal computers and terminals have their serial interface configured for DTE operation. The connections needed for dumb terminals, PC's and asynchronous operation are described in Appendix D.

NOTE: *When connecting the RS-232 cable to the PC, DO NOT connect the cable to the DB25 female connector on the rear of the PC. This is the parallel port and connection may cause damage to your PC. At the PC end, the cable should be connected to a male connector (serial port) for correct operation.*

The terminal cable to the modem should be less than 15 meters in length and restrained with screw locks at both ends to avoid placing too much strain on the cable. Round cable is recommended. Ribbon cables **MUST** be kept as short as possible to minimise clock and data interference in the ribbon.

2.4 Front Panel Indicators

The front panel of the **DPX-213** contains 4 LED's (Light Emitting Diodes), which are used to indicate modem and line status.

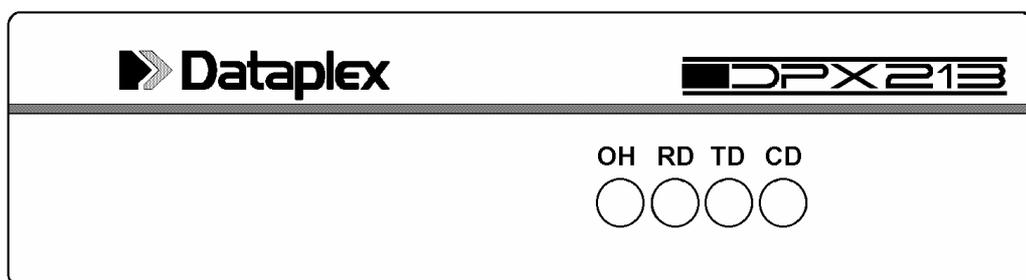


Figure 2.3 Front Panel Layout

Table 2.1 Front Panel Indicator Names and Functions.

Name	Function	Colour	Status
TD	Transmit Data	Yellow	Off for mark, On for space, flickering for data
RD	Receive Data	Yellow	Off for mark, On for space, flickering for data
CD	Carrier Detect	Green	On when CD active, Off when CD inactive. (See <i>AT&C</i> command)
OH	Off Hook	Red	On when modem is on line (Off hook). Off when modem is off line (On-hook). When the modem is in Loop modes this LED flashes.

2.5 Testing Your Connections

With your terminal or computer connected and operating, the DTR LED should light. You can now perform a quick test to determine if you have setup the *DPX-213* correctly.

After connecting your terminal or PC to the modem, power the system up and start your communications or terminal emulation package. To check that keyboard characters are reaching the *DPX-213*, the TD LED must flash with every keystroke.

Press the  key. Each time you press the key, the TD LED should flash briefly. If no data is reaching the *DPX-213*, check that:

1. The correct COM port is being used on your PC;
2. The terminal is in the ON-LINE state and not the LOCAL Mode state, or,
3. The correct cable is being used and the cable pinouts are correct.

2.6 Setting Your PC for Speed and Character Format

The *DPX-213* uses the attention request ('AT' prefix) to automatically detect terminal speeds at all standard baud rates up to 9,600 baud.

For initial configuration, the terminal used must be a ten bit ASCII device operating at one of the standard speeds, for example, 300, 1200, 2400, 4800, 9600 or 19,200 bps. The AT command processor and Constant Speed Interface accept character formats of 10 bits in total.

For example:

Table 2.2 Valid Character Formats

Start Bit	Data Bits	Parity	Stop Bits	Total Bits
1	7	Mark	1	10
1	7	Even	1	10
1	7	Odd	1	10
1	7	Space	1	10
1	8	None	1	10

2.7 Making a Connection

Make sure the cable and terminal software are correct, then type `A T Enter`. This allows the modem to sense the terminal speed and calculate the parity being used. After this has been successfully decoded, the *DPX-213* will reply with:

"OK"

NOTE: *If the modem fails to issue the "OK" response, and you are certain the cable, terminal speed and parity are all correct, refer to the Section on Testing and Diagnostics.*

The *DPX-213* comes with a default configuration suitable for many applications. As a "soft" configured product, it is possible to make errors by loading a conflicting configuration, causing unpredictable operation. If you suspect this has happened, turn the power off, wait about ten seconds, and then turn the power back on. Force the modem back to the factory default setup by typing `A T & F Enter`.

Otherwise, type `A T H 1 Enter` to force the modem to go Off Hook (equivalent to lifting the handset). Typing the command line `A T H Enter` or `A T H 0 Enter` will terminate the call.

Dial a number by typing the command line: `A T D 1 2 3 4 5 6 7 Enter`.
(*Fictitious Number Only*)

The above command tells the modem to dial (ATD) the number 1234567. Where non-standard dial tones are used, such as with some PABX's, the modem may not be able to detect dial tone. In this case select the appropriate pulse or tone dialling method with the *ATDP* or *ATDT* commands respectively and ensure the modem "blind dials" by using the *ATX0* or the *ATX2* command.

When dialling a number, you should see various prompts on your terminal.

2.8 Closing a Connection

There are several ways to abort a call. If the call has been answered by a modem and both are on-line, typing any key will now send that character to the attached modem. Aborting the call in this case must be done from the on-line interactive state which is entered by typing the escape sequence of 'pause' `[+][+][+]` 'pause' followed by `[A][T][H][Enter]`.

The abort timer (S-Register 7) will also abort the call if the originating modem has not established a call before S7 times out. This is normally 45 seconds but can be between 1 and 255 seconds.

Basically, a call can be terminated in several ways :

- Hitting any key on the terminal;
- Detection of busy tone by the *DPX-213*;
- Time-out of the modem (S-Register 7);
- Loss of carrier;
- Typing the escape sequence ('pause' `[+][+][+]` 'pause') then `[A][T][H][O][Enter]`.

Additionally, a call will be terminated when either Busy tone (engaged) is detected or loss of power is applied to the modem by switching off or removing the power cord.

NOTE: *If data is present, then one of the Dumb modes should be used (AT*D2).*

2.9 Call Establishment Sequence

The modem placing the call is termed the *originating modem* and the modem at the other end is termed the *answering modem*. When instructed to place a call, the originating modem will go off-hook and the OH LED will illuminate. Typically, the originating modem listens briefly for dial tone before dialling, places the call, and then listens for answer tone from the answering modem. If no tone is received within a preset time (stored in S-Register 7), the call is aborted.

The originating modem is usually silent during this initial call set-up phase, but a calling tone can be enabled (via the *AT*G* command) which transmits an interrupted tone so the called party can distinguish a data call from a voice call and activate the modem if required.

At the answering end, the modem detects the incoming ring, counts up to the preset number of rings (stored in S-Register 0) and then goes off-hook. It transmits an answer tone to the calling modem. Once this tone is detected by the calling modem the training sequences begins. Therefore, it usually takes a few seconds before data transfer actually begins.

The called modem will turn on the ring indicator with each incoming ring (Pin 22). It will usually output the word "RING" to the terminal with each incoming ring unless this feature has been disabled with the *ATQ* or *ATV* commands.

The *DPX-213* can be configured so it will:

- Answer at a particular ring count (typically, the answering modem will be set to answer on the first or second ring;
- Never answer;
- Answer if the data terminal ready lead (Pin 20) is asserted.

2.10 Trouble Shooting

If you are sure you have the correct cables, terminal speed and ASCII character format, but are unable to get the OK response from typing *AT*, the *DPX-213* may have an invalid set-up string stored in the NVRAM.

A Master Reset should eliminate this problem. A Master Reset will erase all stored numbers, passwords and configuration information. To initiate the Master Reset, turn the *DPX-213* power off, remove the lid and short the reset pads on the PCB while turning the power back on. Wait a few seconds before removing the short

Now type as before. If you still experience problems, consult Section 7 on Testing and Diagnostics or call your modem supplier for assistance. Details of the Warranty and Service contacts are given in Section 10.

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3.0 BEFORE YOU START

The *DPX-213* is a combined soft-strapped and link selectable modem. There are number of internal links which can be used to select Async/Sync operation, DTR wakeup and LED operation. All other parameters are set by software commands from an attached asynchronous terminal and then stored in Non Volatile Random Access Memory (NVRAM). These setups or configurations are stored in 'S-registers'.

3.1 Command Structure

In general, commands entered into the modem are prefixed with 'AT' and end with a carriage return (). The modem automatically determines the terminal speed and parity from the *AT* characters, loads the command into a buffer as you type it, and executes the command when you hit the carriage return.

The factory defaults assume you are going to use the modem for asynchronous operation on the dial network at the fastest speed the line or modem can accommodate. The character format is assumed to be 10 bit ASCII, consisting of 1 start bit, 8 data bits and 1 or more stop bits. For 8 to 11 bit configurations, read Section 5 on Applications and Section 8 on S-Registers.

3.2 Communications Software

The software used to configure the *DPX-213* can range from simple dumb terminal emulators to advanced communications systems. The *DPX-213* is compatible with virtually all communications software packages. If using a smart communications package, ensure it supports the AT command set. Most packages also send an initialisation string. This should be checked for correctness before using the modem.

3.3 Manual and Automatic Calling

Calls can be initiated by raising DTR from the terminal and typing an AT command string. Calls can be answered by the same methods.

3.4 Dial-up Line and Leased Line Support

The **DPX-213** cannot share the same line as your normal telephone. It can only be used in isolation.

NOTE: *Telephones with Mode 3 connectors should not be used with this equipment. Contact Telecom if you are trying to use the modem on a small business key system such as a Commander, as these hand sets often signal to the PABX electronics with non standard tones and voltages. Damage to either the PABX or the modem could result from incorrect connection. A direct line from the local exchange may be needed in these situations.*

Leased lines are special services providing a dedicated link between two sites. No switching is involved and hand sets are rarely provided. The **DPX-213** can be configured to operate on two wire leased lines in synchronous or asynchronous modes. Special care has been taken with the design to ensure reliable operation in leased line mode, particularly with line changes caused by circuit re-routing. Section 5, Applications, details the recommended set-up strings for this use. Leased line also requires modifications to the line connector as shown in Appendix D.

3.5 Speed Matching

There are several forms of speed matching used in the **DPX-213**. The *autobaud* feature automatically senses the terminal speed from the typed AT commands and sets the modem interface speed to match the terminal. The *autoranging* feature automatically senses the line speed of the remote modem and adjusts to it in both originate and answer modes.

Additionally, there is a Constant Speed Interface (CSI) on the **DPX-213** modem which allows your terminal to remain at the same speed, say 9,600 bps, for all 300, 1200 or 2400 bps full duplex calls. This simplifies operation with mini-computer systems provided you support flow control and avoids data loss if there is a speed mismatch in the system.

3.6 Flow Control

Flow control is needed whenever one device in the system runs faster or slower than another, or there are delays in transmission while errors are corrected. Flow control can be In-band using Xon and Xoff characters or Out-of-band using Request To Send (RTS) and Clear To Send (CTS). These are also referred to as software handshaking or hardware handshaking. It is legitimate to have different flow control techniques at each end of the link. The Xon and Xoff characters are user programmable in the **DPX-213** and are stored in S-Registers 32 and 33 respectively.

3.7 Escape Sequence

While off-line, the *DPX-213* is in the Command State and all characters typed at your keyboard are scanned by the command interpreter awaiting AT commands. Once on-line, whatever is typed is sent to the remote modem. In order to get back in touch with the local command interpreter, perhaps to hang up or to change parameters, an escape sequence must be sent.

The industry standard "+++
" escape sequence does not hang up the line or interfere with other settings and is entered by pausing for a few seconds, typing `[+][+][+]`, and then pausing again. Do not press `[Enter]` (Carriage Return or Enter). Typing the escape sequence returns you to the On-line Interactive State where the AT commands are active. For example, typing `[A][T][H][Enter]` will hang up the call.

3.8 Advanced Features

The *DPX-213* has MNP-4 error correction and MNP-5 data compression software. These are disabled in the factory defaults and must be specifically enabled if required. The Constant Speed Interface is active by default and allows terminal speeds from 300 to 9,600 bps to be automatically supported. The modem will normally attempt to establish all calls at 2,400 bps unless commanded otherwise or the remote modem cannot support this speed.

The modem automatically adjusts the transmit or receive speed to match the modem at the other end of the link. The line speed of the connection is displayed as the modem goes on-line.

The Constant Speed Interface facility, error correction and data compression are powerful features, but can result in problems if your terminal does not support flow control. If you are obtaining errors, or characters are garbled or missing whenever these features are invoked, it is likely there is a flow control problem. Check your communications software manual, the flow control sections (see Index) and the relevant AT commands of this manual.

To reduce the risk of unauthorised entry to your system, the *DPX-213* features password verification. A password may be stored in the *DPX-213* permanently and only those calls meeting the incoming password challenge are allowed access to the host.

The *DPX-213* also contains an alarm feature that will dial a remote modem when an external device indicates that an event has occurred. The modem will connect with the remote modem and attempt to send a previously stored string.

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4.0 AT COMMAND SET

This Section contains some useful information about entering commands into the *DPX-213*, the 'AT' command syntax and the different operating states. The Section also contains a complete alphabetical listing of all commands.

4.1 Command Line and Command Entry

The *DPX-213* uses the common *AT* command set which Dataplex has extended to cover additional features. The attention code, the letters 'AT', must precede all command lines to the *DPX-213*. This code may be in either upper or lower case. The modem uses the AT characters to detect the baud rate and character format of the incoming data. In this way, each command line can be at a different baud rate if desired. Once the AT sequence has been entered, the baud rate and character format are fixed for the remainder of that command line.

Typing *AT* while off-line will alert the internal control processor, but while on-line, the 'pause' 'pause' escape sequence must be entered.

Some AT commands act on S-Registers. These are storage locations where various operating parameters are stored. These parameters control various modem features, such as the number of rings to count before answering an incoming call, the delay after dialling and before carrier detect, and so on. Refer to Section 8 for a full description of the S-Registers used in the *DPX-213*.

A command line to the *DPX-213* consists of an attention code, one or more commands, and a carriage return (). A command line may contain up to 129 characters (including the attention code and the carriage return). Should you enter more than 129 characters, the *DPX-213* will abort the command and return an ERROR code. Re-enter the command sequence in two smaller command lines.

Commands may be concatenated to save time. For example causes the *DPX-213* to recall the factory configuration, set S0=5 (answer telephone on 5th ring) and then dial 1234567. Do not type *AT* more than once on any line or the *AT* character will be interpreted as command and not Attention.

For example you can enter commands separately:

1. Entering will cause the modem to blind dial (not wait for dial tone).
2. Entering will cause the modem to answer on the fourth ring.

3. Entering `A T S 7 = 6 0` `Enter` will cause the modem to wait 60 seconds for carrier from the answering modem.
4. Entering `A T D N 5` `Enter` will cause the modem to dial the number stored in location 5.

Or type one concatenated string:

`A T X 3 S 0 = 4 S 7 = 6 0 D N 5` `Enter` which has the same effect (spaces between commands are ignored and are optional).

The above command descriptions have numeric modifiers to allow selection from one of several command options. These are usually shown as parameters 0 to 9. Where a numeric selection is omitted, the command processor assumes a zero (0) has been entered. For example `AT*W` is interpreted as `AT*W0`.

Commands take a variable time to execute, depending on the length of the command line and the type of command. The *DPX-213* also takes a short period (750 microseconds) after the end of one command (the transmission of the result code) before it is ready to accept the next command. During this time the *DPX-213* is resetting its internal registers in preparation for the next command. If communications equipment sends an 'AT' sequence during this 750 microsecond period, the 'AT' and subsequent command will be ignored.

4.2 Attention Code Syntax

It is possible to disable the `AT` command sequence by using the `AT*DI` (Dumb Mode) command. In this mode, the unit will not respond to any `AT` sequence. The only way to reset the unit from this state is to carry out a power up reset (if not stored in NVRAM).

A description of the syntax for entry of `AT` commands follows:

Carriage Return

Command lines end with the carriage return character `Enter`. The value of this character is stored in Status register S3, and may be changed if desired. The default value of the carriage return is ASCII code 13 {0D HEX}.

Backspace

If an incorrect entry is made in a command line before `Enter` is depressed, the backspace key (`←`) can be used to erase the mistake. The backspace key will erase all characters up to, but not including the attention code (`AT`). The backspace character is stored in Status register S5. The default value is ASCII code 8.

Repeat Command

When the *DPX-213* is in Local Command State (waiting for an attention code), entering the characters **A** **/** will cause the *DPX-213* to repeat the last command line. The 'A' character can be in either upper or lower case. If an **A** **/** is entered directly after turning on the power, the modem will return an ERROR code.

Command Parameters

Most commands to the *DPX-213* have several parameters. These parameters select the various options for each command. Should the parameter be missing for a particular command, the modem will substitute the value 0. Should a parameter be outside the defined range, the modem will return an ERROR code.

Result Codes

After the *DPX-213* has executed each command line, it returns a result code to show the status of the command. The result is in the form of digits (0 to 233) or text. Results displayed in digit format are often used when the modem is being controlled by a computer. Results displayed in the text format are suited to terminal control. Result codes can be disabled by setting Quiet Mode (*ATQ1*).

Status Registers

Configurations are stored in the Status Registers, called 'S-registers'. The *DPX-213* has 24 Status Registers (of which, some are reserved for future expansion or used to maintain compatibility with the *DPX-224*). Most commands in the *DPX-213* alter values in the status registers.

4.3 DPX-213 Operating States

There are four distinct operating states for the *DPX-213*:

1. Idle State
2. Command State
3. Data State
4. On-line command State

A description of each operating states follows.

1. Idle State

This state is entered shortly after power is applied to the modem and the power-up self test has been passed. It can also be entered after the modem has executed a non-dialling command line. In this state, the modem is waiting to autobaud an *AT* sequence from the DTE or awaiting a ringing signal from the telephone line. If a valid 'AT' entry is detected, the modem enters the Command State.

If a valid ringing signal is detected the modem will send a RING message to the DTE at the last autobaud speed. If set to answer (S-Register 0 not set to 0) the modem will go off-hook and enter the Data State after a predetermined number of rings (S0).

2. Command State

During the Command State, the modem buffers command characters from the DTE until a carriage return () character is received. The modem will buffer up to 48 characters not including the initial 'AT' characters. If more than 48 characters are received the modem will insert a carriage return character and return an ERROR message signifying buffer overflow. If no overflow is detected and a carriage return character is received the modem will start to sequentially execute commands in the buffer until one of the following:

1. Carriage Return Detected

If this is part of a dial command, the *DPX-213* will execute the following sequence: go off-hook, look for dial tone (unless set to blind dial) and then proceed to place the call.

2. Illegal Command Encountered

The modem will execute the following sequence: send an ERROR message to DTE, empty the command buffer and return to idle state.

3. Answer (*ATA*) or On-line (*ATO*) Command Received

The modem will enter the Data State.

3. Data State

After an *ATA* (Answer) or *ATO* (Originate) command, the modem enters the Data State. The modem will attempt to handshake with the remote modem or if already connected will enter begin to exchange data.

The normal Data State is transparent and all characters issued by the DTE are passed to the remote end. Sometimes you may need to abort the operation and regain control of the local modem instead of the remote DTE. This is possible in the On-line Command State and is selected with the escape sequence.

Several other interface or line events that will cause the modem to drop out of transparent data transmission (Data State) to local control (On-line Command State) are described as follows:

1. Escape Sequence Detected ('pause' 'pause')
The modem will leave the data state and execute the following sequence: send an "OK" message to the DTE, clamp transmit data to mark, disable receive data to DTE and enter the On-line Command State.
2. Loss of Carrier Detected (provided S10 is not set to 255)
The modem will execute the following sequence: send a "NO CARRIER" message to the DTE, go on-hook and returns to Idle State.
3. DTR Dropped (provided DTR is not forced on and *AT&Dn* is set)
The modem will execute the following sequence: send a "NO CARRIER" message to the DTE, go on-hook and return to Idle State.
4. DTR Dropped (provided DTR is not forced on and *AT&D2* or *AT&D3* is set)
The modem will execute the following sequence: send a 'NO CARRIER' message to the DTE, go on-hook and return to Idle State.

4. On-line Command State

This state is entered after a 'pause'  'pause' escape sequence has been detected. The modem link is preserved and the user communicates with the local modem and not the remote *DPX-213*. All data sent by the remote modem is ignored but carrier is still monitored and the message "NO CARRIER" will be issued if loss of carrier is detected. Additionally, some RTS, DTR, or make busy control changes are acted upon. Any normal command that can be issued in command state can now be issued in the On-line Command State while a call is active. However, some commands have no meaning such as *ATA*, and will return ERROR. The most common use of the On-line Command State is to issue the *ATH* command to hang up the call. Other options to exit the On-line Command State are:

1. *ATH* Command Received

The modem will execute the following sequence: send an "OK" message to the DTE, go on-hook (hang-up) and return to Idle State.

2. *ATZ* Command Received

The modem will execute the following sequence: reset the configuration to the customer stored value, go on-hook (hang-up), send an "OK" message to the DTE and return to Idle State.

3. *ATO* Command Received

The modem will execute the following sequence: send a "CONNECT" message, unclamp received and transmitted data, and returns to the Data State.

4.4 AT Command Set

The remainder of this Section contains an alphabetical listing of all commands, including full syntax and details of use. For each command, parameters, default settings (or *AT&F*) and the Status Register (S-register) bits that store the present command setting are provided. If the value in a status register effects the operation of a command, the register with its default value is shown. For example: S7 (45 seconds).

A/ Repeat Last Command**Parameters** : None**Default** : None

A/ is the only command that must not be preceded by an "AT" or terminated with a carriage return (). This command will repeat the preceding command string. This is useful for redialling a previously engaged phone number.

ATA ANSWER**Parameters** : None**Default** : None

Causes the modem to answer an incoming call (go off-hook), try to train on the incoming signal and then go on-line. There will be a 2.1 second delay to pass STD beeps, billing meter pulses and the modem's answer tone. If the modem fails to detect carrier within the time stored in register S7 (45 seconds), the modem will go on-hook and return to Local Command State. The modem ignores all commands in a command line following the Answer command.

ATB BELL/CCITT Select**Parameters** : 0 or 1**Default** : 0 (CCITT Modulation)

This command selects CCITT or BELL modulation format for signaling to line. In conjunction with the *ATFn* command, the user can force the line speed and modulation to a predetermined format instead of relying on the autoranging capabilities of the *DPX-213*. The command is useful when placing international calls to Bell modems. Refer to the *ATF* command description for full details on autoranging and other settings. The Bell 103 Mode is only available when the Constant Speed Interface is disabled via the *AT&I0* command.

Table 4.1 CCITT and Bell Selection

SPEED	300	1200/75	1200	2400	
	<i>ATF1</i>	<i>ATF3</i>	<i>ATF4</i>	<i>ATF5</i>	
<i>ATB0</i>	V.21	V.23	V.22	V.22bis	CCITT
<i>ATB1</i>	Bell 103	V.23	Bell 212	V.22bis	Bell

ATD DIAL**Parameters** : Dial String**Default** : None

Causes the modem to go off hook and originate a telephone call. After dialling, the modem will wait for an answer tone from the remote modem, try to train on the incoming signal, and go online. If the modem fails to detect an answer tone after the time in register S7 (45 seconds), the modem will return to the Local Command State and send the "NO ANSWER" message.

The modem will dial all 10 pulse digits or 12 standard tone pairs. These digits may be separated by spaces. Certain modifiers will effect the way the number is dialled and are listed below. The dial string consists of telephone number digits and dial modifiers. Acceptable dial digits are the numbers 0-9 (zero through to nine) and the symbols * # (for tone dialling only). Acceptable dial modifiers are Nn P T and , (*comma*).

The *DPX-213* ignores any other characters in the dial command. These can be freely used to improve readability. `A T D 1 2 3 4 5 6 7 Enter` is equivalent to:

`A T D (0 3) 1 2 3 - 4 5 6 7 Enter`.

Entering the dial string with no parameters causes the modem to try to establish a connection without dialling any digits. This can be used in leased line Mode in conjunction with the Answer command to make a connection.

Dial Modifiers

Dial modifiers are used with the dial command to instruct the modem to perform different dialling features. They can be placed anywhere in the dial string.

- Nn** Dial stored number where n = 0 to 9.
- P** Set pulse dialling.
- T** Set tone dialling.
- ,** Pause for time in status register S8 (Default = 2).

Nn - Dial Stored Number

The *ATDN* command, followed by a number from 0 to 9 instructs the modem to dial the number stored in that memory location. The numbers are stored into the memory locations by the *AT&Z* command. *AT&N* will display all 10 stored numbers. If n = 0 or no number is given, the modem dials the number in location N1.

P - Set Pulse Dialling

Normally the *DPX-213* will automatically sense whether to use tone or pulse dialling. Using this modifier causes any further digits in the dial string and if *ATX3* is set, dial commands, to be dialled with decadic pulses. Thus, pulse and tone dialling may be mixed in the same telephone number. The default setting is for check for tone dialling. If *ATX4* (check for dial tone) is set, the *DPX-213* will dial the first digit of a dial string in tone mode and recheck for dial tone. If dial tone is still present, the entire number will be dialled in pulse mode, otherwise, the rest of the number will be dialled in tone mode.

T - Set Tone Dialling

Causes any further digits in the dial string (provided *ATX3* is set) or dial commands to be dialled with DTMF tones. Pulse and tone dialling may be mixed in the same telephone number. If *ATX4* (check for dial tone) is set, the *DPX-213* will dial the first digit of a dial string in tone mode and recheck for dial tone. If dial tone is still present, the entire number will be dialled in pulse mode, otherwise the rest of the number will be dialled in tone mode. A 'T' or 'P' command in a dial string will override the automatic tone/pulse selection.

, (comma) - Pause

Causes the modem to wait for the time in register S8 (2 seconds) before continuing. Sometimes used after dialling the STD codes before dialling the rest of the telephone number. For example:

A	T	D	0	3	,	1	2	3	4	5	6	7	Enter
---	---	---	---	---	---	---	---	---	---	---	---	---	-------

.

ATDn DIAL Stored Number

Parameters : 0 to 9

Default : 0 (act on Number in location zero)

The ATDn command causes the *DPX-213* to go off-hook and dial the number stored in location n. It is equivalent to typing *ATD* followed by the valid dialling characters stored in location n.

ATE Command ECHO

Parameters : 0 or 1

Default : 1 (Echo Enabled)

The *ATE* command controls the echoing of characters from the DTE in local command state.

ATE0 - Disable Local Echo.

ATE1 - Enable Local Echo. The modem echoes all characters from the local DTE.

ATF FORCE Line Speed**Parameters** : 0 to 6**Default** : 0 (Auto Speed)

This command lets you select the transmission speed and modulation format independent of the DTE interface speed. Use this command in conjunction with the *ATB* command. This allows you to go on-line at 300, 1200 or 2400 bps but keep your terminal speed fixed at some other speed.

ATF0 - Modem autoranges for both originate and answer. The Constant Speed Interface operates from 300 to 9,600 bps. The *DPX-213* will accept incoming calls at 300,1200 or 2400 bps.

ATF1 - Selects 300 bps. CCITT or Bell selected by *ATB*.

ATF2 - Not used. Responds with ERROR.

ATF3 - Not used. Responds with ERROR.

ATF4 - Selects V.22 or Bell 212A 1200. Speed fixed at 1200 bps.

ATF5 - Selects V.22bis. Speed fixed at 2400 bps.

ATF6 - Similar to *ATF0* except that once a connection is established, forces DTE speed to line.

The *DPX-213* will autorange on both answer or originate. Set *ATF0* at the answering modem and it will adjust speed automatically to accommodate the incoming call. If the Constant Speed Interface (*AT&I1*) is set, the DTE speed will be the last autobaud speed (except when *ATF6* is used).

ATH HOOK Control**Parameters** : 0 or 1**Default** : 0 (modem On-hook)

Controls the hook relay, connecting and disconnecting the modem from the telephone line. *ATH* with no numeric suffix is interpreted as *ATH0* and causes the modem to hang up (go on-hook) and return to the Idle State.

ATH0 - Forces the modem to go on-hook and return to Idle State.

ATH1 - Forces the modem to go off-hook (on-line).

ATI IDENTIFICATION**Parameters** : 0 to 3**Default** : 0 (Display "DPX-213")

Returns the modem identification codes to your terminal.

ATI0 - Return modem product code. The *DPX-213* sends "DPX-213".

ATI1 - Return ROM checksum.

ATI2 - Return result of checksum verification. The *DPX-213* sends "OK" if the checksum verifies.

ATI3 - Return software revision number.

ATNn&Z Store String in NVRAM

Parameters : 0 to 9

Default : None

This command allows up to 44 characters to be stored in each of the ten NVRAM locations for later recall.

NOTE: *Location zero and location one are the ONLY locations that can be dialled on the rise of DTR.*

Locations may hold Alarm Mode text strings (2,3,4), Passwords (5,6,7,8,9), numbers to dial on the raise of DTR (0,1) and number to dial with the *ATDNn* command for security callback after a password match (any location). For example:

LOCATION	CONTENTS
0	DTR / n0 Dial Number.
1	Alternate DTR / n1 Dial Number
2	Alarm Mode Connect String / n2 Dial Number
3	DTR Raised String / n3 Dial Number
4	Keyboard Activity Alarm String / n4 Dial Number
5	Password Storage / n5 Dial Number
6	Password Storage / n6 Dial Number
7	Password Storage / n7 Dial Number
8	Password Storage / n8 Dial Number
9	Password String / n9 Dial Number

When a stored number is recalled via the *ATDNn* command, the command processor effectively enters *ATD*, fetches location n and then dials the digits in the order it finds them.

ATO On-line, ORIGINATE and Retrain

Parameters : 0

Default : 0

If the modem is already online, this command causes the modem to return to the Data Transfer State. If the modem is not online, the modem will attempt to originate a call (go off hook and wait for answer tone). The modem ignores all commands in a command line following the Originate command.

AT00 - Return to On-line State or originate a call.

ATP Set PULSE Dialling**Parameters** : None**Default** : None

If *ATX3* (do not listen for dial tone) is set, *ATP* causes the *DPX-213* to dial any further dial commands with decadic pulses. If *ATX4* (check for dial tone) is set, then regardless of the state of the *ATP* command, the *DPX-213* will dial the first digit of a dial string in tone mode and recheck for dial tone. If dial tone is still present, the entire number will be dialled in pulse mode, otherwise the rest of the number will be dialled in tone mode.

ATQ QUIET Mode**Parameters** : 0 or 1**Default** : 0 (Enable dialling messages)

This command controls whether or not the modem sends messages and result codes (such as "OK") to the DTE as it executes commands (some software packages may not recognise call progress messages); the AT command itself will still be echoed (unless *ATE0* is active).

ATQ0 - Enables command and call progress messages to be sent to the DTE.

ATQ1 - Enables Quiet Mode and ensures no messages are passed during call placement.

When *ATQ1* is in use, sufficient time must be allowed for each command issued to be executed or closely spaced commands may be misinterpreted by the modem.

ATSr? Read STATUS Register Contents**Parameters** : r = 0 to 53**Default** : 0 (Display Register 0)

This command will return a three digit decimal value of the selected S register, r. The display is always in decimal, even for bit mapped registers.

ATSr=n Set STATUS Register Contents

Parameters : r = 0 to 53, n = 0 to 255.

Default : r = 0, n = 0

The *ATSr=n* command allows the user to change the modem configuration parameters by altering the values stored in the S registers. You must first convert a binary bit mapped register into decimal before attempting to set it. Use the S register descriptions and Appendix B to get the correct bit number. This command should be used with care, as loading incorrect results into the S registers can produce unpredictable results. Type **A T & F Enter** to reload the factory default settings if the S registers become corrupted.

ATT Set TONE Dialling

Parameters : None

Default : None

This command enters the tone dial mode and awaits the next *ATDnnnn* command. Typing **A T T Enter** is a valid entry. Additionally, typing 'T' within a dial string such as the following command string: **A T D T 1 2 3 4 5 6 7 Enter** is acceptable. This command overrides the automatic tone/pulse dialling selection only when used as a dial modifier.

ATV Set VERBOSE Response Codes

Parameters : 0 or 1

Default : 1 (Verbose Mode)

Determines whether the *DPX-213* returns result codes from commands to the DTE in text format or digit/numerical format (Verbose or Terse). Most communications programs use digit responses to determine command status.

ATV0 - Selects digit (terse) responses; digit code is followed by a carriage return.

ATV1 - Selects verbose or text responses; word code is preceded and followed by a carriage return character (S-register 3) and a line feed character (S-register 4).

ATX Call Progress Control

Parameters : 0 to 3

Default : 3

The *ATX* command controls the level of call progress detection when originating or answering a telephone call. The table on the following page shows the result codes returned.

ATX0 - Enables response codes 0-4, 8, 12-14 modem will blind dial.

ATX1 - Enables response codes 0-4, 6-8, 12-14 modem needs dial tone.

ATX2 - Enables response codes 0-5, 8-10, 12-21 modem needs dial tone.

ATX3 - Enables response codes 0-10, 12-21 modem will blind dial.

The term 'blind dialling' refers dialing without trying to detect a dial tone. This is useful when the dial tone is a low level or non-standard dial tone as found with some PABX's. The auto tone or pulse dial detection feature of the *DPX-213* is only enabled when the modem is not blind dialling and when it is configured to detect dial tone.

The available response codes that are selected by the *ATXn* command are shown below.

Table 4.2 Response Codes

Digit	Code	Description
0	OK	Command executed without error.
1	CONNECT	Modem connected at any speed if <i>ATX0</i> enabled.
2	RING	Incoming call detected.
3	NO CARRIER	Carrier not detected after <i>S7</i> timeout or carrier lost.
4	ERROR	Illegal command or buffer overflow.
5	CONNECT 1200	Modem connected at 1200 bps.
6	NO DIAL TONE	Dial tone not detected.
7	BUSY	Busy signal detected, call aborted.
8	NO ANSWER	Remote did not answer.
10	CONNECT 2400	Modem connected at 2400 bps.
11		Reserved
12	LOOP GRANTED	Local or remote modem in loop.
13	RDL DENIED	Remote modem has refused RDL request.
14	RDL ACCEPTED	Local modem has accepted RDL request.
16	CONNECT 1200/REL	Modem connected at 1200 MNP 2-5.
17	CONNECT 2400/REL	Modem connected at 2400 MNP 2-5.
18	LOOP GRANTED/REL	Local or remote modem in loop with MNP.
19	CONNECT 1200/REL	Modem connected at 1200 MNP 2-4.
20	CONNECT 2400/REL	Modem connected at 2400 MNP 2-4.
21	ABORTED	Connection attempt aborted by operator.

ATZ Modem Reset**Parameters** : 0,1**Default** : None

Entering *ATZ0* resets the modem and copies the user stored NVRAM configuration to the active RAM. It restores all user controlled settings to previously stored values. If the NVRAM contains an invalid configuration, typing *ATZ* will merely copy the bad data from NVRAM to active RAM. You must use *AT&F* (load factory configuration from ROM to RAM) followed by *AT&W* (write RAM configuration to NVRAM) to recover from this.

If the modem is in the On-line Command State this command will terminate the call and the modem will return to the Idle State after the command is processed. See also the *AT&F* command which copies the factory defaults from ROM into the active RAM.

If *ATZ1* is entered, the unit will be placed in the very low power standby mode (depending upon DTR level and setting of jumper J5). The modem may be woken from this state by either raising the DTR, activity on DTE Txd, Ring detection or power cycle. When the modem is in standby mode the unit is effectively switched off. If a unit is on line the connection will be lost.

AT&C CARRIER Detect Control**Parameters** : 0 or 1**Default** : 0 (CD Pin 8 always High)

This command controls the status of both the CD lead (Pin 8) in the V.24/RS-232 interface and the front panel CD LED.

AT&C0 - V.24 Pin 8 CD and LED always forced on.

AT&C1 - V.24 Pin 8 CD and LED follows phone line data carrier.

AT&D DTR Control**Parameters** : 0 to 3**Default** : 0 (DTR Always On)

This command controls events on the fall of DTR (Data Terminal Ready). See the *AT&M* command for interactions on the rise of DTR. When this command is enabled, the DTR lead must be high for the modem to operate correctly.

AT&D0 - DTR input ignored.

AT&D1 - Modem set to Command State when DTR drops (as for escape sequence).

AT&D2 - Modem set to on-hook and returns to Command State when DTR drops
(*ATH*).

AT&D3 - Modem initializes (executes *ATZ*) when DTR falls.

AT&E ERROR Correction**Parameters** : 0 or 1**Default** : 0 (MNP disabled)

AT&En enables or disables error correction and data compression in the **DPX-213**. When used with the *AT&II* Constant Speed Interface command, the terminal can operate at 4800 bps to 9,600 bps to take full advantage of data compression. Error control or data compression is not supported at V.21 (300 bps) speeds and in one of the two leased line modes.

AT&E0 - Error control/data compression disabled.

AT&E1 - MNP-2 to MNP-4 error correction enabled. The highest level automatically negotiated by modems. If no remote MNP is found, the modem will fall back to Constant Speed Interface mode or disconnect if *AT&IO* is set.

When MNP modems connect, one of the modems must send a request packet (MNP) to initiate the negotiation. By convention, this is normally the originating modem. If the modem is connected to a non MNP modem this request will appear as corrupt characters to the DTE on the non MNP modem. Therefore, the default setting is MNP off.

NOTE: *If MNP is to be used, both modems must support it and at least one modem must request it.*

AT&F Load FACTORY Configuration**Parameters** : None**Default** : None

This command copies the factory defaults from fixed EPROM into working RAM. This is useful for restoring the modem to a preset configuration. To use the factory defaults in normal operation, type `A T & F Enter` then make them permanent by typing `A T & W Enter`.

AT&G GUARD Tone Control**Parameters** : 0 or 1**Default** : 0 (no Guard Tone)

Guard tone is typically used to disable echo cancellers within the U.K. It is only active in 1200 bps and 2400 bps operation. The modem sends guard tone to line to disable echo suppressors. Echo suppressors are desirable for voice lines where one party talks and the other listens, but undesirable for full duplex data lines where both ends are transmitting simultaneously. Echo suppressors are rarely used in Australia. Guard tones are only active when operating in V.22bis mode, and only on the answering modem.

AT&G0 - No Guard Tone.

AT&G1 - 1800Hz or 550Hz Guard Tone (depends on Bell setting, *ATB0* enables 1800Hz).

AT&H HELP

Parameters : 0 to 4

Default : None

This command displays several levels of help screens to reduce the need for a handbook to enter field changes.

AT&H0 - General help Summary.

AT&H1 - Extended help Summary.

AT&H2 - Help on Dial Modifiers.

AT&H3 - Help on Test Commands.

AT&H4 - Help on S-Registers.

AT&I Constant Speed INTERFACE

Parameters : 0 or 1

Default : 1 (enable Constant Speed Interface)

The *AT&I* command allows the data rate of the DTE to be at a uniform rate, regardless of the rate determined by the communication format (specified by *ATFn*). This is useful if the DTE can only operate at a single speed and when error correction is enabled. It can also control whether a connection will be established or rejected if the MNP negotiations fail.

AT&I0 - Disable Constant Speed Interface. The modem will autobaud on the DTE rate before the call, but will change the interface speed to that of the actual line connection as soon as the call is established. For example, if your terminal is set for 2400 bps and the *DPX-213* can only establish a link at 1200 bps, the message "CONNECT 1200" will be displayed at the 2400 bps autobaud rate and then the interface will change to 1200 bps. Therefore, the terminal speed must be changed to continue without errors. Some communications packages read the "CONNECT XXXX" message and can be instructed to change your DTE speed automatically. Also, the 'pause' 'pause' escape sequence will need to be sent at 1200 bps to be recognised.

AT&I1 - Enable Constant Speed Interface. The data to and from the terminal will be at the last autobaud speed regardless of the actual connection speed. DTE speeds above 2400 bps (or faster than the actual on-line rate) can cause data to enter the modem faster than it can be sent to line. Therefore, unless the *AT&K* and *AT&U* flow control commands are set, data may be lost in buffer overflows.

The *AT&I1* command in conjunction with *AT&E1* or *AT&E2* (MNP-4 or MNP-5) ensures a dial link will be established regardless of whether or not the remote modem can support MNP.

AT&K DTE Flow Control**Parameters** : 0 to 3**Default** : 1 (Select Xon/Xoff Flow Control)

This command selects the method of handshaking between the DTE and the modem during error correction, data compression or whenever the Constant Speed Interface is set at a different rate to the line speed.

NOTE: *Xon/Xoff flow control should NOT be used when passing binary, command or executable files since they may contain Xoff characters without matching Xon characters. The modem may appear to 'lock up' and Xoff characters may be introduced or lost, thus corrupting the file. Use hardware flow control (RTS/CTS) for binary file transfers.*

AT&K0 - Disable flow control. The DTE must be careful not to overflow the buffers or data will be lost.

AT&K1 - Xon/Xoff (###**Q** / ###**S**) enabled. The modem can control the flow of data by issuing an Xoff to the DTE. The Xon and Xoff characters can be altered from their defaults and are stored in locations S33 and S32 respectively. Both the modem and the DTE must halt whenever they receive an Xoff character and not restart until they receive an Xon character.

AT&K2 - Enables RTS/CTS hardware flow control. When set, the modem drops Clear To Send (CTS) whenever the buffers are almost full. The DTE may also flow control the modem by dropping RTS.

AT&K3 - Enables both RTS/CTS and Xon/Xoff flow control. This is equivalent to issuing the commands **AT&K1** and **AT&K2**. Be sure to terminate RTS and CTS correctly when using this command.

NOTE: *Whenever AT&K2 or 3 are invoked, the RTS and CTS leads must be correctly driven and not left floating in the interface cable.*

AT&L LEASED Line Select

Parameters : 0 or 1

Default : 0 (Dial Network)

The CCITT V.22bis recommendation is primarily concerned with dial network operation. Leased line operation with different manufacturers products may not be entirely successful. The **DPX-213** supports leased line operation at 1200 and 2400 bps in both *AT&L0* and *AT&L1* modes. Data transfer at 300 bps is only supported in *AT&L1* mode and data transfer at 1200/75 V.23 is not supported in either leased line mode.

AT&L0 - Dial Network Mode.

AT&L1 - Enable speeds 300, 1200 and 2400 bps only. MNP/V42 and the Constant Speed Interface are disabled in this Mode. Synchronous or Asynchronous Mode is selected via the *AT&Mn* commands. The *AT&D0* (ignore DTR) effectively overrides the DTR Pin on the interface. Setting *AT&D0* with *AT&L1* forces the **DPX-213** on-line immediately regardless of the DTR status. This is the recommended mode for interworking with the *DPX-224* or *TEL-424* modems.

Configure the modem for leased line operation as follows:

1. Set *AT&D1* mode.
2. Issue the *AT&L1* command to select Leased Line Mode.
3. Set register *S0=0* at one end to force Originate Mode.
4. Set register *S0=1* at the other end to force Answer Mode.
5. Enter *AT&M1* mode.
6. Raise DTR at both ends to establish the link.

Once connected the escape sequence 'pause'  'pause' is entered, control may be regained and allow entering the *ATH* command if needed. Alternatively, the DTR may be dropped to return to Command Mode. In synchronous (*AT&M2* or *AT&M1*) Mode, dropping DTR will terminate the call. In asynchronous (*AT&M3*) Mode, dropping DTR will follow the *AT&Dn* command.

All keystrokes are ignored during leased line call establishment phase.

NOTE: *The line interface cable must be modified as shown in Appendix D for correct operation in leased line modes.*

AT&M Synchronous/Asynchronous MODE Selection

Parameters : 0 to 3

Default : 0 (Async)

The *AT&M* command selects asynchronous or synchronous terminal modes of operation. This command also provides for the manual and automatic dialling of a stored number under DTR control. See the *AT&D* command for actions taken on the fall of DTR.

AT&M0 - **Asynchronous Mode 0**. Type *ATDnnn* to dial.

AT&M1 - **Synchronous Mode 1**. DTR dial asynchronous. Enabling this Mode will cause the modem to dial the number in location zero on raise of DTR. *AT&Dn* must be correct.

AT&M2 - **Synchronous Mode 2** (with asynchronous terminal dialling). Use an asynchronous terminal to place the call and then change to Synchronous Mode once the call is placed.

AT&M3 - **Synchronous Mode 3**. DTR dial synchronous. Enabling this mode will cause the modem to dial the number stored in location zero on raise of DTR.

AT&N Display/Clear Dialling Directory

Parameters : None or 99

Default : None

AT&N will display the 10 telephone number storage locations with their contents. Any numbers which require alteration can be updated individually with the *ATNn&Z* command. The *AT&N99* command erases all 10 locations.

AT&P PULSE Dial Make/Break Ratio

Parameters : 0,1

Default : 1 (CCITT Make/Break Ratio)

This command allows the user to select the pulse dialling make to break ratio.

AT&P0 - Bell Make/Break Ratio (US setting).

AT&P1 - CCITT Make/Break Ratio (Australian setting).

AT&T TEST Modes

Parameters : 0 to 6

Default : 0 (No Tests in Progress)

This command enables and disables several local and remote loopback tests, and tests with the internal test pattern generator.

AT&T0 - Terminate test in progress.

AT&T1 - Initiate Local Analog Loopback.

AT&T4 - Enable Remote Digital Loopback response.

AT&T5 - Disable Remote Digital Loopback response.

AT&T6 - Initiate Remote Digital Loopback

AT&U USER Flow Control

Parameters : 0 to 3

Default : 0 (Flow Control off)

This command affects flow control in the modem. *AT&Un* is only active while MNP /V42 is disabled and while the Constant Speed Interface is enabled. If MNP/V42 is enabled then *AT&U* can remain at the defaults. Refer to the Data Transfer Section (Section 6) for more details. The commands *AT&En*, *AT&Kn*, *AT&In* and *AT&Un* all influence flow control and must be correctly set for your application.

Whenever *AT&Un* is invoked, Xon/Xoff characters may be inserted in the data stream and corrupt a binary file transfer. Alternately, an Xoff character encountered in a binary file transfer will halt the modem. Select *AT&U0* (off) for binary file transfers.

AT&U0 - Pass through off, line flow control off.

AT&U1 - Pass through enabled, line flow control off.

If Xon/Xoff flow control is active (*AT&K1* or *AT&K3*), Xon/Xoff characters through from the DTE to the line side buffers of the modem - after being acted upon.

AT&U2 - Pass through off, line flow control on.

This selection is only valid if RTS/CTS handshaking (*AT&K2*) is selected. In this mode, any flow control characters detected in the data received from line will be acted upon by the line buffer but not passed to the DTE buffer.

AT&U3 - pass through on, line flow control on.

This selection is usually used with DTE flow control set to RTS/CTS, *AT&K2*. Flow control characters received at the line buffer will be acted upon and then passed to the DTE via the DTE buffer. The DTE will be operating in a mode that enables it to respond to both RTS/CTS and Xon/off flow control. In this way both the local modem and the remote DTE may flow control the far modem and DTE.

Pass through means that, if Xon/Xoff flow control is enabled, the controlling character detected will be acted upon by any buffer it encounters, and then passed through to the next buffer in the link. Disabling pass through means that any Xoff character received by a buffer will be obeyed but the Xoff character will then be discarded. If line flow control is enabled, the receiving modem line buffers will be susceptible to flow control characters in the received data stream.

AT&W WRITE Active Configuration to NVRAM

Parameters : None

Default : None

Whenever power is applied to the *DPX-213*, or the modem is reset (*ATZ*), the status registers are loaded with values saved in the non volatile RAM. *AT&W* allows a particular configuration to be saved in the non volatile RAM and then reloaded the next time power is applied to the modem or the reset (*ATZ*) command is issued. The interface speed is also saved and becomes the default speed for the subsequent incoming calls (and after power cycling).

AT&Z Store Telephone Number

Parameters : Dial String

Default : N/A

This command stores a dial string in non volatile RAM for dialling later with the *ATDNn* command. Any valid dial string (see the *ATD* command) can be stored and up to a maximum length of 36 characters. Any characters after this will be ignored. The storage location to be overwritten by the *AT&Z* command is set by the *ATN* command.

To invoke the dial string type with no other characters. Dialling by pulse or tone dial will be by the default or the last used method. The more general storage/access command is *ATNn&Z*, which gives access to all 10 storage locations.

AT*A Alarm/Alert Mode

Parameters : 0 to 3

Default : 0 (Alarm off)

This command enables the Alarm function on the *DPX-213*.

*AT*A0* - Alarm function disabled.

*AT*A1* - Enabling this command will cause the modem to dial the number stored in location 0 upon "wake up". When connected, the modem will send the string stored in location 1. If the modem is woken by DTR, it will send the string stored in location 2; if woken by TxD, it will send the string stored in location 2 and if woken by Ring, the modem will ignore ring and then dial and send strings in locations 1 and 4 respectively.

*AT*A2* - The modem will "wake up" on any Ring, raise of DTR or TxD from DTE. By invoking the *AT&M* command, the unit will dial the number stored in location 0 on rise of DTR and send the relevant alarm string on connection. Otherwise, the modem will wait for an *AT* command or Answer when the ring limit is reached. If the *AT* command originates the call then the alarm string is sent on call connection, however, if the modem has answered the call then no alarm string is sent.

*AT*A3* - Reserved for future use.

See applications section for full description of this function.

AT*C Configuration Status

Parameters : None

Default : None

The *AT*C* command will display the active modem configuration. The table below shows the default (*AT&F*) configuration.

CONFIGURATION	STATUS	CONFIGURATION	STATUS
B Bell/CCITT	0	&M Sync/Async	0
E Echo	1	&P Pulse Ratio	1
F Format	0	&T RDLB Enable	0
T/P Tone or Pulse	0	&U DCE Flow Control	0
X Result Code	3	*A Alarm Mode	0
&C DCD Option	0	*D Dumb Mode	0
&D DTR Option	0	*E Compression	0
&E Error Control	0	*G Calling Tone	0
&G Guard Tone	0	*P Password	0
&I Constant Speed	1	*R Remote configuration	0
&K DTE Flow Control	1	*Y Break Handling	0
&L Leased Line	0		

AT*D DUMB Mode**Parameters** : 0 to 3**Default** : 0 (Disabled)

To prevent modem "lock up", it is advised that the escape sequence 'pause'  'pause' be disabled when using the Dumb Mode (see Register S2 description for more details).

*AT*D0* - Allows the *DPX-213* to respond to normal *AT* command and attention sequences.

*AT*D1* - Disables *AT* command acceptance and echo. Once the modem is configured, *AT* commands can no longer gain control of the *DPX-213*. The modem will still abort connect sequence if a key is pressed during the training sequence.

*AT*D2* - Disables call placement abort on DTE activity. If characters are sent to the modem during call connect sequence the modem will ignore them.

*AT*D3* - Equivalent to activating both *AT*D1* and *AT*D2*.

AT*E Data Compression**Parameters** : 0 or 1**Default** : 0 (Data compression disabled)

*AT*E* controls the data compression feature of the modem during error corrected connections. The *AT*E* command must be used in conjunction with the *AT&E* command.

*AT*E0* - MNP 2-5 data compression disabled.

*AT*E1* - MNP 2-5 error correction and data compression enabled. The highest level is determined by modem negotiation. The modem will fall back to CSI or disconnect if no remote MNP is detected.

AT*G Calling Tone**Parameters** : 0 or 1**Default** : 0 (Disabled)

*AT*G* enables the CCITT recommended V.25 calling tone. This is an intermittent 1300Hz tone generated by the originating modem during the connection phase of a call.

*AT*G0* - Causes the *DPX-213* to be silent when calling.

*AT*G1* - Enables an interrupted 1300 Hz tone to be sent by the calling *DPX-213* after dialling and before the remote modem carrier is detected.

AT*P Password Security

Parameters : 0 to 2

Default : 0 (Password Disabled)

The *AT*Pn* command enables several levels of password and dial back security in the *DPX-213*. Refer to Section 5, Applications, for more information.

*AT*P0* - Disable password checking.

*AT*P1* - Enable password checking. Password prompt can be programmed by placing the required string in location 9. If no password prompt is specified, the *DPX-213* issues a "PASSWORD ? : " prompt for incoming caller. Passwords can be placed in locations 5 to 8. If no passwords are present, the unit will not connect. If a passwords are specified, the call originator has 20 seconds per attempt to enter

the correct string. Once 3 attempts have been made, the modem will disconnect.

*AT*P2* - Password will dialback.

NOTE: *Password security is not available in non CSI/MNP modes (AT&I0 and AT&E0)*

AT*R Remote Configuration

Parameters : 0 or 1

Default : 0 (Disabled)

This command enables and disables the remote configuration option. When remote configuration is enabled a remote user can modify the configuration on the *DPX-213* using the 'pause' 'pause' escape sequence or view configuration/setups of the remote modem. Any AT command which does not hang up the modem can be issued in remote configuration Mode.

*AT*R0* - Disable remote configuration.

*AT*R1* - Enable remote configuration.

NOTE: *While in Remote Configuration, the user will be prompted with an ROK> every 20 seconds by the remote modem if no commands are issued.*

AT*Y Break Mode Control

Parameters : 0 or 1

Default : 0

The *AT*Y* command controls the processing of break characters from the DTE when the modem is on-line. Refer to the break handling in non-MNP/V42 and non-CSI operation.

*AT*Y0* - Pass break immediately to the other end. Leave data in modem buffers at each end intact. Expedited Non-destructive Break Handling.

*AT*Y1* - Pass break immediately to other end but flush all data buffer. Expedited /Destructive Break Handling.

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5.0 APPLICATIONS

This Section describes some essential information about configuring the *DPX-213* to operate under various applications.

5.1 Resetting the Modem

Remove the lid from the box and short reset pads while switching the power on. This executes a MASTER RESET which totally clears all stored numbers, stored commands, passwords and S-registers from NVRAM and then loads the factory defaults from EPROM.

5.2 Operating Modes

There are 4 operating modes on the *DPX-213*. The first two are asynchronous only and the remaining two are synchronous operating modes.

NOTE: *There is some interaction between the Data Terminal Ready (DTR) AT&Dn commands and the AT&Mn operating Mode commands (as shown in the AT&Mn command description tables).*

The *DPX-213* supports synchronous operation at 1200 bps in both CCITT and Bell Modes, and 2400 bps in CCITT V.22bis Mode (to disable synchronous clocks, short J8 Pin 1 and 2). Before synchronous operation can be established, the correct AT commands must be loaded with using an asynchronous terminal and the subsequent configuration stored in NVRAM (EEPROM). The *DPX-213* does not support V.25bis dialling methods. To enable synchronous clocks, place a jumper across Pins 2 and 3.

Some special conditions exist for the two synchronous modes, *AT&M2* and *AT&M3*. If *AT&D1* to *AT&D3* is set, answering takes place when both the ring count and the DTR high condition is reached. If the DTR lead is raised before the count stored in register S0, the modem will go on-line in Originate Mode. If DTR is raised after S0 is reached (but before the 8 second reset period stored in S0) the modem will go on-line in Answer Mode. For all Synchronous Modes, the suggested starting values and sequences are: *AT&F*, *AT&C1*, *AT&D2*, *AT&M2* or *AT&M3*

5.3 Asynchronous Modes

Mode 0 Asynchronous

This is the standard default Asynchronous Operating Mode. Enter *ATDnnnnnn* to dial and go on-line. DTR modes refer only to actions performed on the falling edge. Dialling is performed exclusively by AT dial commands. If *AT&D0* is set, answering a call takes place as soon as the ring count in *S0* is reached. If DTR is left high, the modem will answer on the number of rings stored in *S0*, or, as determined by the *AT&D1-3* modes.

ASYNC MODE	DTR RISE	DTR FALL	DTR LOW
<i>AT&M0&D0</i>	Ignore DTR.	Ignore DTR.	Ignore DTR.
<i>AT&M0&D1</i>	Ignore DTR.	On-line Command State.	Do not answer.
<i>AT&M0&D2</i>	Ignore DTR.	Hangup and go to Command State.	Do not answer.
<i>AT&M0&D3</i>	Ignore DTR.	Execute <i>ATZ</i> & hang up.	Do not answer.

Table 5.1 Mode 0 Asynchronous

Mode 1 Asynchronous

This mode allows the *DPX-213* to dial the number stored in location zero on the rise of DTR. If no dialling is desired, the user should ensure location zero is empty for the originating modem or have R stored (for reverse mode) in location zero at the answering end. After a call has been placed by the rise of DTR, the remote modem may disconnect and the local modem may then be in the DTR high, but in the Off-line State. If this is the case, the modem will answer after *S0* rings.

If DTR is low and the phone is ringing, the "RING" message will be output to the DTE. If DTR is raised while the phone is ringing, the modem will go on-line in Originate Mode (provided the *S0* count has not been reached), or alternatively, go on-line in Answer Mode if the *S0* value has been passed.

ASYNC MODE	DTR RISE	DTR FALL	DTR LOW
<i>AT&M1&D0</i>	Ignore DTR.	Ignore DTR.	Ignore DTR (answer on <i>S0</i>).
<i>AT&M1&D1</i>	Dial number.	On-line Command State.	Do not answer.
<i>AT&M1&D2</i>	Dial number.	Hang up and go to Command State.	Do not answer.
<i>AT&M1&D3</i>	Dial number.	Execute <i>ATZ</i> and hang up.	Do not answer.

Table 5.2 Mode 1 Asynchronous

5.4 Synchronous Modes

Mode 2 Synchronous

This is useful for setting up a synchronous auto-answer system or setting up a synchronous link with an asynchronous terminal and then switching over to a synchronous DTE with an A/B switch once the call is established.

With *AT&M2* set, the *DPX-213* allows asynchronous dialling (for example *ATDPI234567*). After call establishment (the modem issues the "CONNECT" message), the modem enters Synchronous Mode and turns on the clocks. It then waits the period stored in Register S25 before examining the DTR line. This allows time to switch over to a synchronous DTE. If DTR is high (ON) when S25 expires, the *DPX-213* continues in Synchronous Mode with clocks at the speed of the connection. If DTR is low (OFF), then the modem takes the action specified by the *AT&D* setting.

After a call has been placed by the rise of DTR, the remote modem may disconnect and the local modem may then be in the DTR high but off-line state. If this is the case, it will answer after S0 rings. If DTR is low and incoming ring is detected, the "RING" message will be output to the DTE. If DTR is raised while the phone is ringing, the modem will go on-line in Originate Mode (provided the S0 count has not been reached), or go on-line in Answer Mode if the S0 value has been passed.

In all other synchronous modes, the *AT&D* command is ignored and if DTR is on, the modem is on-line. If DTR is off, the modem will not answer. To allow for auto answer with DTR down, use the *AT&D0* command (Ignore DTR). The modem will then answer after S0 rings. To allow manual answer on the rise of DTR or answer with DTR high, use *AT&D2* (hang up on fall of DTR). The modem will then answer after S0 rings if DTR is up, or when DTR rises, provided it is down.

ASYNC/SYNC MODE	DTR RISE	DTR FALL	DTR LOW
<i>ATM2&D0</i>	Ignore DTR.	Ignore DTR.	Ignore DTR.
<i>AM2&D1</i>	Ignore DTR.	On-line Command State.	Do not answer.
<i>AT&M2&D2</i>	Ignore DTR.	Hang up and go to Command State.	Do not answer.
<i>AT&M2&D3</i>	Ignore DTR.	Execute <i>ATZ</i> and hang up.	Do not answer.

Table 5.3 Mode 2 Synchronous

Mode 3 Synchronous

This mode is the as the *AT&M2* mode (as detailed above) except that when the modem connects it will switch to slave synchronous mode. In this mode, the Tx clock is internally connected (slaved) to the Rx clock.

5.5 Leased Line Operation

The *DPX-213* supports leased line operation. This mode (*AT&L1*) follows the CCITT recommendations for V.22 and V.22bis and is useful for sync and async applications with many manufacturers products. The *AT&L1* command does not support Constant Speed Interface or MNP operation. The *AT&L1* mode provides a controlled carrier mode based on the RTS interface lead (*AT&K1*) which can be made permanent carrier with the *AT&D0* command. V.22bis modems have long equalisation and training times (2+ seconds) and are not suitable for multi-drop operation or fast polling.

This leased line configuration is fully compatible with the CCITT V.22 and V.22bis recommendations for both synchronous and asynchronous leased line operation. The modem gains synchronisation on the data stream without requiring a full V.22bis retrain sequence, making this mode compatible with other V.22bis modems such as the TEL-424.

V.22bis, V.22 and V.21 recommendations are supported in Asynchronous Leased Line Mode with synchronous operation available at 1200 and 2400 bps. The following set-up string is provided as a guide (spaces included for clarity):

```
AT&F F5 &M1 &L1 S0=0 &E &I &W
```

where

COMMAND	DESCRIPTION
<i>AT&F</i>	Factory default to define start values.
<i>F5</i>	Force 2400 bps speed.
<i>&M1</i>	Select Synchronous Mode.
<i>&L1</i>	Leased Line mode.
<i>S0=0</i>	Make this end originate.
<i>&E</i>	No MNP/V42.
<i>&I</i>	No CSI.
<i>&W</i>	Write configuration.

The originate end must have *S0=0* and the answer end must have *S0* set to any value except zero (typically *S0=1* at the answer end). To set the speed of operation enter the above set-up with the terminal set to 2400 bps. For synchronous operation, use *AT&M1* or *AT&M3*.

Once on-line, the unit may be returned to Command Mode by issuing an asynchronous 'pause' 'pause' escape sequence. When in Command Mode, the leased line configuration can be deleted by an *AT&F&W* or via a Master Rest.

5.6 Extended Character Formats

Both MNP and AT protocols specify ten bit characters made up of one start bit, eight data bits and one stop bit. The data bits may be seven data bits and one parity bit or eight data bits with no parity bit. The V.22bis standard allows for character lengths from eight to eleven bits including start and stop bits. The **DPX-213** supports 8 to 11 bit characters through the use of register S30. The Constant Speed Interface (CSI) and MNP /V42 features only support ten bit characters. Whenever eight, nine or eleven bit character support is required, MNP and CSI must be turned off.

To operate with character lengths other than ten bits, the **DPX-213** must be initially configured with a 10 bit ASCII terminal, S30 needs to be set for the appropriate character length, and then the modem will switch to the extended character format at the time a connection is made. The 'pause'  'pause' escape sequence must also be entered in ten bit format.

The following command string is an example of the use of this facility.

```
AT&M1 S30=182 N0 &Z 1234567.
```

This sets the modem up to dial 1234567 when DTR is raised and then pass eleven bit characters once the connection is established.

NOTE: See S30 settings in Appendix B to ensure that other bits are not corrupted unnecessarily (MNP/CSI is disabled by setting S30 bits 0,1,2 to 0).

5.7 PABX Operating Problems

The modem needs only two wires connected to the exchange to operate, tip and ring. These are connected to Pins 2 and 6 of the Telecom 605 plug as shown in Figure 5.1. Business PABX and other handsets such as Telecom Commander systems often have extra facilities on the handsets and non-standard wiring.

Using a modem on these circuits could cause unexpected results and possibly damage. PABX makers follow their own design and wiring practices and it is unlikely one universal cable will ever suit all applications. If any troubles are experienced with obtaining dial tone, dialling out or receiving calls with the **DPX-213**, remove all extra wires from the cable, leaving only Pins 2 and 6 active, and try again. If problems still persist contact your PABX supplier for connection information.

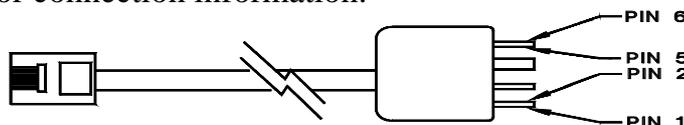


Figure 5.1 Telecom 604 Plug

5.8 Low Power/Standby Mode

The DPX-213 has a low power feature that allows the unit to be placed in a state where it will draw no current.

There are 2 methods of entering this state, namely:

- Using the *ATZI* command, or,
- Placing a value other than 0 in the inactivity timer registers S36/37, and allowing the unit to sit in offline Idle Mode until the inactivity timeout is reached.

To enter standby mode in both instances, the DTR must be disabled or held inactive. The modem will wake up on rise of DTR (if DTR is enabled), ring detection, activity on the DTE Tx/D input, or power cycle.

5.9 Alarm Mode

Alternate number dialling. In alarm mode, when an alarm call is made, the unit will dial the number in location 0. If the call is unsuccessful the unit will attempt to dial the number contained in location 1. If this does not exist, the modem will revert to location 0. For every attempt (or pair of attempts if location 1 contains a number) the modem checks if the redial count (S50) has been reached and gives up if this occurs.

Alarm detection while on line. If the DTR is raised while on line or during disconnection the modem will detect the raised DTR and generate another alarm.

5.10 Password Mode

On answering a call the unit will respond with a password prompt (location 9 string) or *PASSWORD ?* if location 9 is not programmed. The modem will then wait for 20 seconds and allow 3 attempts to enter a correct password. If a correct password is seen the unit will connect (*AT*PI*) or disconnect and attempt to dial-back the user. If the unit is in dial back mode and a correct password is entered which does not have a dial back number, the caller will not gain access even though the modem indicates a correct password entry. Storage locations 5-8 may be used for password storage.

Passwords are stored in the following format. For example:

```
\password,password\number  
\fred\t2225555\jim\sid\t5554444  
\ian,sigmund,kylie\t4365879\terry\
```

5.11 Remote Configuration

In remote configuration mode, any valid *AT* command which does not drop the line can be issued (but without the *AT* prefix) to reconfigure a remote modem. Typically the command is left disabled and is temporarily enabled at the remote site by entering the escape sequence ('pause' 'pause') then *AT*RI* if on-line, or simply *AT*RI* if off-line. Holding down the LOOP button at the instant power is applied will also temporarily enable remote configuration.

The central site can then call in and examine S-registers with the *AT*C* command or reconfigure the *DPX-213*. The central site should execute *AT*R0* before it hangs up or the remote modem should be turned off and back on again to disable the remote configuration option. Password protection (*AT*P*) is recommended to guard against malicious reconfiguration.

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6.0 DATA TRANSFER

6.1 Error Control

In synchronous applications, typically with mainframe computers, communications software running in the front end processor and terminal is responsible for error control. In asynchronous communications with mini, micro, and personal computers, there is usually no link level error control and users occasionally experience corrupted data in keyboard interactive sessions. For file transfers, most async communications packages support an error correcting protocol such as Xmodem. This protocol, and others such as Ymodem, Zmodem and Sealink offer error correction only during the file transfer phase. Problems will still be experienced on noisy lines during the set-up phase if the link is not error protected.

MNP (Micro Networking Protocol) provides continuous error control during keyboard interactive sessions and file transfers. When these error corrected protocols are active, ASCII file transfers are sufficient and invoking the additional error protection of Xmodem is often unnecessary and only serves to slow down file transfer.

Error Control is achieved by building packets of characters from the sending terminal, then calculating and appending a Cyclic Redundancy Check (CRC) character. This information is transmitted over the communications channel which will often have noise (electrical interference). This noise will corrupt the data and produce errors. At the receiving terminal, the packet is analysed by the same CRC algorithm and the CRC is locally computed. If the two CRCs do not match then an error has occurred and a Negative Acknowledgment (NAK) is sent and the block is requested again. If the CRCs match, a Positive Acknowledgment (ACK) is sent and the next block is sent. Retransmission takes place repeatedly until the block is received error free. Once the block is received error free, the next block is sent.

In simpler block-at-a-time protocols, such as Xmodem, a block is sent and then the sender pauses until an ACK or NAK is received. On satellite or long delay links this seriously reduces throughput and therefore go-back-n or sliding window protocols are preferred. Such protocols number each block and send blocks repetitively until either the preset maximum is reached or an ACK or NAK is received from the remote modem. An ACK signal contains the number of the last successfully received block. In the event of an error, all blocks that followed the block in error are retransmitted. In very sophisticated systems, Selective Block Retransmission sends only the block in error and the receiving device resequences the data stream before releasing it to the terminal.

The *DPX-213* features extended MNP allowing selective retransmission when connected to another *DPX-213* modem for higher throughput.

6.2 Flow Control

Flow Control refers to the method used to stop data flow whenever the terminal or the modem needs time to retransmit blocks in error or prevent a buffer overflow. The **DPX-213** supports both RTS/CTS (Hardware or Out-of-Band) and Xon/Xoff (Software or In-Band) flow control. Flow control is needed whenever the terminal and line speeds are different, or whenever MNP/V42 is active.

When file transfer is taking place, data flows into the **DPX-213** and is sent to line in packets. When a line error occurs, the block is retransmitted. This takes a small amount of time and during this time, more data is received from the terminal and must be buffered in the modem RAM. If the line errors are substantial, or the data is continuous or faster than the line can accommodate, the modem RAM will eventually fill and either CTS is dropped, or Xoff is issued at 85% memory capacity to indicate to the terminal to stop sending while the backlog of characters in the modem are cleared. When the buffers fall to 30% full, CTS is asserted or the Xon character is sent allowing normal transfer of data to resume.

Any "error free" modem link can lose data if the terminal does not respond to Xoff quickly and over-runs the buffer, or if the modem is interrupted or loses power at either end before the data in RAM is transferred. The **DPX-213** uses DC1 (11/91 HEX or ###[Q]) as Xon and DC3 (13/93 HEX or ###[S]) as Xoff. Flow control (*AT&Kn* and *AT&Un*) and error control (*AT&En*) are separate tasks and need to be individually set within the **DPX-213** according to your application needs.

6.3 Flow Control Buffers

There are eight modem buffers plus the buffers residing in your computer and terminal which must all be correctly driven or data may be lost in some conditions.

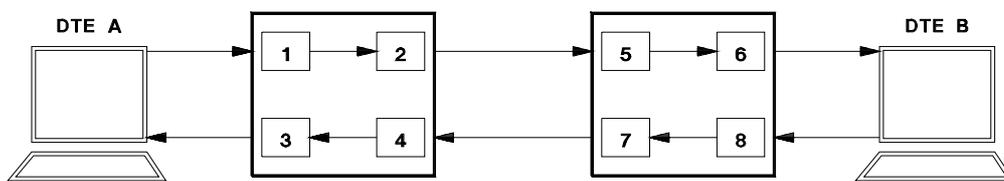


Figure 6.1 Flow Control Buffers

Referring to the figure above, buffers 1, 3, 6 and 8 are the DTE buffers controlled by the *AT&K* command. Buffers 2, 4, 5 and 7 are the modem (or line side) buffers controlled by the *AT&U* command. If MNP/V42 is enabled and both terminals can accommodate the full data rate without issuing Xoff to the modem then flow control issues are handled for you and no data will be lost.

There may be instances when the Constant Speed Interface is used without MNP/V42 and where the DTE issues Xoff (or drops RTS) to the modem. In this case, data may be lost unless *AT&U* is enabled.

For example, assume that the modems have Constant Speed Interface enabled (*AT&I1*) and MNP/V42 disabled (*AT&E0*), the local terminal is set for 9600 bps with Xon/Xoff flow control and the remote terminal is set for 1200 bps with RTS/CTS flow control. In this case, *AT&U2* or *AT&U3* must be used. Binary files cannot be transmitted unless Zmodem or a similar protocol is used.

Data from the local terminal (DTE A) flows into the local modem (Modem A) faster than it can be sent to line and buffer 1 will soon need to stop DTE A or data will be lost. Buffer 1 issues Xoff to DTE A by placing the Xoff character in the outbound data stream of buffer 3 and the terminal stops with no loss of data.

The data is now moved down the line from buffer 2 to buffer 5. It arrives at buffer 5 faster than buffer 6 can take it since the output speed to the terminal is only 1200 bps. Buffer 6 is in danger of an overrun and so issues Xoff to buffer 5.

Buffer 5 may now overrun and so it places an Xoff in the output stream of buffer 7 to halt the flow from the sending modem. The Xoff is received at buffer 4 and passed across to buffer 2 to halt the data flow. If *AT&U3* is enabled (pass through), the Xoff character is output to buffer 3 and the DTE A. If *AT&U2* is enabled (no pass through) the Xoff character is passed to buffer 2 but not output via buffer 3.

Consider another example, where both terminals operate at 4800 bps and the line speed is 2400 bps. Xon/off at the local end and RTS/CTS at the remote. The remote DTE in this example is slow and frequently drops RTS to keep up. If *AT&U0* (default) is invoked in this example, data will be lost.

In this case data flows into buffer 1 until an Xoff stops it. Data is passed to buffer 2 then to 3 and finally flows to buffer 6. The DTE has RTS low quite often and eventually buffer 6 fills. Dropping RTS at the remote end suspends output from buffer 8 causing buffers 5 and 2 to eventually overrun and lose data.

6.4 Microcom Networking Protocol

MNP (Microcom Networking Protocol) is a suite of sophisticated sliding window block retransmission error control and data compression protocols. The *DPX-213* has MNP to level 5 with enhanced throughput from selective block retransmission in the event of an error. This protocol offers excellent error control and achieves data throughput up to 4800 bps on good lines and 2400 bps with zero errors on noisy lines. An internal 8k buffer handles short term data overruns and either RTS/CTS or Xon/Xoff flow control ensures no data is lost.

The MNP protocol starts with a short negotiation sequence at the beginning of transmission where both modems decide on the highest level of error correction they both support. This negotiation can take several seconds (approximately 5 seconds) therefore, if your modem appears to hang after raising the CD signal, and before sending the CONNECT message, it may be attempting to negotiate an error corrected link with the remote modem. If no MNP support is found, the *DPX-213* either hangs up or enters the transparent data mode where data is transparently passed with no error correction or compression enabled.

When a 2400 bps phone line rate connection is established at MNP, the *DPX-213* issues the message "CONNECT 2400/REL".

If one end of the link has MNP turned off (or does not support it) and the other does, the non MNP end will receive the MNP negotiation packets and display them as garbage on the screen. These packets, or patterns, may in some circumstances, lock up the answering device and make the link appear inoperative.

When using a *DPX-213* at both ends of the link, it is recommended you set your asynchronous terminal to 9600 bps and invoke Constant Speed Interface (*AT&I1*, *AT&E1*, and *AT*E1*). Since there is the possibility of re-transmissions taking place to correct line errors, you must enable some form of flow control, either RTS/CTS or Xon/Xoff (default) flow control. Either RTS/CTS or Xon/Xoff flow control may be activated by the software you are using.

A minimal error protection file transfer method should be used when uploading (sending) or downloading (receiving) files. With MNP enabled, the modem link is error protected and overlaying another error control mechanism can only add delay and reduce throughput.

6.5 Error Free or Not at All

In some applications you may need to be sure you connect with error control invoked. It may be desirable not to connect at all if you cannot establish a reliable link. Setting *AT&E1* and *AT&I0* achieves this. If the remote modem cannot support MNP, the *DPX-213* will terminate the call immediately after the MNP negotiation sequence.

If *AT&E1* and *AT&I1* are set, the *DPX-213* will negotiate with the remote modem for the highest level of MNP that both support and if no MNP support is found, the modem will enter the Transparent Data Mode and remain on-line.

6.6 Constant Speed Interface

A Constant Speed Interface on the *DPX-213* can be invoked to ensure your terminal always functions at the same speed, regardless of the line speed the modem connects at.

If you want the interface speed to change with each different line speed, use the *AT&I0* command. For example, with *AT&I0* set, if you have your terminal set at 4800 bps then call a 1200 bps modem, the *DPX-213* will issue the message "CONNECT 1200" at the initial bit rate of 4800 bps and then immediately switch to 1200 bps for the remainder of the call. To make any sense of the data you must quickly change your terminal speed to 1200 bps.

Some software packages, such as Telix, can read the CONNECT (speed) message and automatically adjust the PC com ports while in other packages you must manually reset the PC com port speed. If the interface constant speed rate is set at 4800 bps for example, the "CONNECT 2400" message could incorrectly instruct your software into changing the terminal speed to 2400 bps when the correct speed is 4800 bps. We recommend the use of the Constant Speed Interface provided your terminal can employ either hardware or software flow control.

6.7 File Transfer Restrictions

File transfer restrictions exist when using Xon/Xoff flow control. For example, when transferring pure binary files, where the data bytes in the file may be any combination of 8 bits, there is a possibility there will be some stray Xon or Xoff characters. If Xon/off flow control (*AT&K1*) or *AT&U1,2* or 3 is enabled, any stray Xoff characters will command the *DPX-213* to stop sending data.

For such applications, the *DPX-213* should be set to RTS/CTS flow control with the *AT&K2* command. This command will work for text or binary files provided your communications software correctly drives RTS and respond to CTS. MNP still works with binary files and ignore any embedded Xon/Xoff characters. Alternatively, a file transfer program such as Zmodem (that removes the Xon/Xoff characters at the sending end and adds them back at the receiving end) is required.

The ZMODEM or Ymodem-G protocol is ideal for all types of file transfer over an error protected channel. ZMODEM is a "sliding window" protocol that allows for long path delays such as through multiplexer channels, packet switched networks or ARQ modems. ZMODEM searches for control characters such as Xon and Xoff which may be embedded in the file. Such characters are converted to an escape sequence which will not confuse the MNP flow control. ZMODEM with either RTS/CTS or Xon/Xoff flow control allows *.EXE, *.BIN, *.COM and all other files to be sent over the **DPX-213** while retaining the benefits of error correction. ZMODEM is error protected so there is a small additional overhead, but it is a very efficient protocol compared to XMODEM.

6.8 Software Compatibility

The **DPX-213** modem operation is compatible with most popular communication programs that use the *AT* dialling protocol. When the modem is using MNP, there are some software restrictions described above which must be understood. Zmodem or Ymodem-G is recommended for file transfers whenever MNP or V42 is active. The use of small block, half duplex protocols such as Xmodem will slow down file transfers considerably and not take full advantage of the in built error control.

The **DPX-213** modem is compatible with all communications programs that use the 'AT' dialling protocol. Listed below is an incomplete list of the software tested with the **DPX-213**. Consult Dataplex for more specific details.

- Smartcom Version 2.1;
- Magicsoft MTEZ;
- Crosstalk XVI Version 3.6;
- Procomm Version 3.2;
- Supercomm Version 2 & 3;
- PCTalk;
- Telex (Versions 2 & 3);
- Dataplex FleetCom, and,
- Mirror II.

7.0 TESTING AND DIAGNOSTICS

Dataplex have designed the **DPX-213** to provide years of trouble free service. However, abuse, component failure or external high voltages will damage the unit. All Dataplex products are subjected to 72 hour burn-in and extensive testing before leaving the factory to ensure professional quality and reliability.

The **DPX-213** uses professional grade components and includes the minimum number of mechanical components which can degrade with age. There are no customer maintainable components in the **DPX-213**.

In the event of a confirmed hardware failure the purchaser must return the modem to a Dataplex authorised service center, after first obtaining a Return to Manufacturer Authorisation (RMA) number.

The **DPX-213** has facilities for enabling remote and local loops for modem and line testing.

NOTE: *If bit error rate tests are performed with MNP enabled, line errors will be corrected but a false bit error rate reading will be given. The Constant Speed Interface allows test equipment to run faster or slower than the line can accommodate and either data will be lost or flow control characters may appear as errors during a bit error rate test. Always ensure MNP is disabled and the test equipment is running at the true line rate when performing any tests.*

7.1 Operator Initiated Tests

Operator initiated tests cover local and remote loopback tests. Testing a remote modem assumes that the local modem is fully CCITT V.22bis compliant or is another **DPX-213**.

Whenever a local or remote test is in progress, the OH LED will be flashing. Tests initiated with the *AT&Tn* commands are:

AT&T0 - Terminate test in progress.

AT&T1 - Initiate Local Analogue Loopback (LALB).

AT&T4 - Enable Remote Digital Loopback (RDLB) response.

AT&T5 - Disable Remote Digital Loopback (RDLB) response.

AT&T6 - Initiate Remote Digital Loopback (RDLB).

Tests *AT&T1* and *AT&T6* execute until the user enters the *AT&T0* command or the power is disconnected.

7.2 Local Analog Loopback (ALB)

Local Analog Loopback will test the analog and digital performance of the *DPX-213* modem up to the line interface hybrid. Analog Loopback is controlled with the *AT&T1* command.

If the *DPX-213* is configured for switched network operation, the modem must be off-line for this test to work properly. If you are on-line the modem will not go into loop but will issue "CONNECT 2400" and revert to the On-line Data Mode (equivalent to typing *ATO*).

To enter the Analog Loopback, type the command string `A T & T 1 Enter`.

In synchronous or asynchronous operation, the modem will respond with an asynchronous "LOOP GRANTED" message. All characters from your keyboard will be echoed back to you. To disable the messages in synchronous Mode, use the *ATQ1* command. Exit the test by typing the 'pause' `+ + +` 'pause' escape sequence then *AT&T0*.

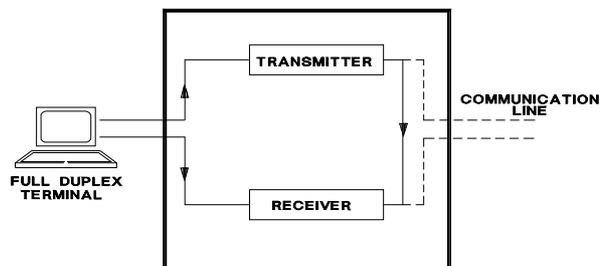


Figure 7.1 Local Analog Loopback

7.3 Remote Loopback Response

When power is applied, Remote Loopback is disabled. Therefore, your modem cannot be put into loop from the remote end nor can the command *AT&T6* be issued locally.

To enable Remote Loopback, type the command string `A T & T 4 Enter`.

AT&T5 or *AT&F* disables Remote Loopback.

7.4 Remote Digital Loopback (RDLB)

This test will verify the receive and transmit sections of both *DPX-213* modems and the phone line in both switched network and leased line operation.

The Remote Digital Loopback test is initiated by typing the escape sequence followed by the command `AT&T6` Enter.

In asynchronous modes, you will now get one of two messages on your screen: "LOOP GRANTED" if the remote modem is able to support loopback testing or "RDL DENIED" if the remote modem either cannot support RDLB or has previously issued the *AT&T5* command.

The *DPX-213* modem which is in RDL mode will display "RDL ACCEPTED" if an RDL request has been received or one or more "RDL DENIED" messages if an RDL request was received but *AT&T5* was set.

During loops, the OH LED will flash. Once the loop is established, all data sent by the local *DPX-213* will be echoed by remote modem and appear on your terminal.

Exit the test by issuing `+++` escape sequence then entering `AT&T0` Enter. Return to the data state with the *ATO* command.

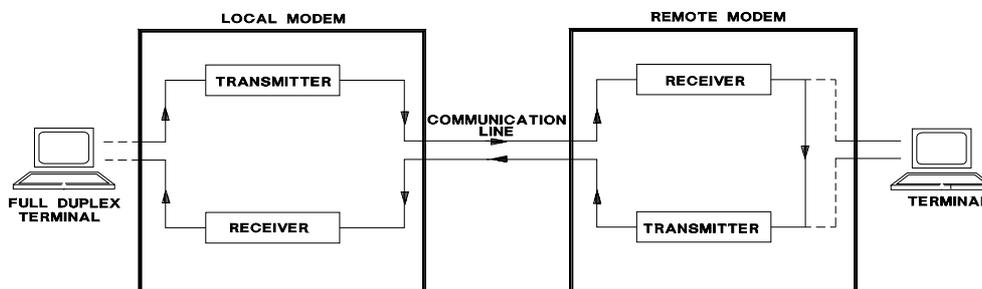


Figure 7.2 Remote Digital Loopback

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8.0 S REGISTERS

The "S" registers, or status registers store the modem configuration parameters. The S registers (particularly the bit mapped registers) are usually only altered using the AT commands, but in exceptional circumstances may require alteration via the *ATSr=n* command. S registers should be altered with care, as it is possible to configure the modem with conflicting parameters producing unpredictable results. Should altering the S registers produce erratic operation, reload the factory default settings using the *AT&F* command. The *DPX-213* uses 24 "S" registers.

This Section contains information on the bit mapped registers used in the *DPX-213*. These registers are set and reset by the various AT commands.

To change the contents of a bit-mapped register, you must change the appropriate bits, recalculate the decimal value to reflect those changes and then set to the new value to initiate the changes. Changing a bit-mapped S-Register involves the following steps:

1. The binary notation system is used in the following example. A simple system for converting 8 bit binary representations into their decimal equivalents is given here. In order to perform the following steps, you will need a copy of the table given below.

BIT:	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	
Current Setting :									
New Setting :									TOTAL
Decimal Equivalent Underline for bits set to '1'	128	64	32	16	8	4	2	1	

Table 8.1 Table for Converting 8 Bit Binary to Decimals

2. Use the *ATSr?* command to display the particular S-register value you wish to change (where r equals the S-reg value you wish to display between 0 and 34).
3. From the display, determine the corresponding 8 bit representation. Insert the bit values in the row 'Current Setting' using the table given above.
4. Determine those bits you need to change by changing the bit values as appropriate. To achieve this, you will need to refer to the appropriate S-register description. Insert the new bit values in the row 'New Setting' using the table given above. The new binary number should include those bit values which have not changed.

5. Wherever a '1' appears in the 'New Setting' row, perform the conversion by underlining the decimal equivalent for that particular bit value and then ADDING together the underlined decimal numbers. Place this result in the TOTAL cell.
6. You can now change the contents of the S-register by assigning the derived TOTAL decimal value to the S-register. This is performed by the $ATSr=n$ command, where r equals the S-reg value you have changed (between 0 and 50) and n equals the new decimal value (between 0 and 255).

For example, to change the value of Register S30 such that MNP 2-4 error control and MNP 2-5 data compression is enabled and the Constant Speed Interface is disabled, you would do the following:

1. Display the current setting of the bit register by entering **A T S 3 0 ? Enter**.

2. In the factory default condition, the contents of S30 will read 10111100 in binary format and 243 in decimal format {BC HEX}. Refer to the appropriate page of this Section for a description of each bit value for S30. To enable Error Control and Data Compression and disable Constant Speed Interface, you need to change bit 0, 1 and 2 respectively.

Using the steps outlined previously would yield the following table:

BIT:	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	
Current Setting :	1	0	1	1	1	1	0	0	
New Setting :	1	0	1	1	1	0	1	1	TOTAL
Decimal equivalent if bit set to 1 (0 otherwise)	<u>128</u>	64	<u>32</u>	<u>16</u>	<u>8</u>	4	<u>2</u>	<u>1</u>	187

3. Finally, to assign the new decimal value to the register contents you would type **A T S 3 0 = 1 8 7 Enter**. The changes are now in affect.

S0 Rings to Answer
Default : 2 (Answer on second ring)
Range : 0 to 255 (Stored in NVRAM)

Establishes the number of rings that the modem must receive before the auto answer sequence is started. Values of 0 ensure the *DPX-213* never answers (the value for Originate Mode) while values from 1-255 will enable auto answer.

NOTE: *When in leased line Mode, S0=0 forces the DPX-213 into Originate Mode and S0=(1-255 but not zero) forces the DPX-213 into Answer Mode. For a point to point leased line application, you must set ATSO=0 at one end and ATSO=1 to 255 at the other end; n must NOT be 0 at both ends.*

S1 Ring Count
Default : 0
Range : 0 to 255

S1 is a read only register that is incremented every time an incoming ring signal is detected. This register is automatically cleared if no ring is received within an 8 second interval.

S2 Escape Code Character
Default : 43 Decimal (☐+); {2B HEX}
Range : 0-255

S2 contains the ASCII value of the escape code character. The escape code allows the user to exit the on-line state and return to local command state.

S3 Carriage Return Character
Default : 13 Decimal (###☐M); {0D HEX}
Range : 0-255

S3 contains the ASCII value of the Carriage Return character. This character serves as the command line terminator.

S4 Line Feed Character
Default : 10 Decimal (###☐J); {0A HEX}
Range : 0-255

S4 contains the ASCII value of the Line Feed character. The Line Feed character is output after the Carriage Return character if full word (verbose) results are enabled (*ATVI* command).

S5 Back Space Character**Default** : 8 Decimal (###H); {08 HEX})**Range** : 0-255

S5 contains the ASCII value of the Back Space character. When a character matching the Back Space character is received any time during a command entry, the modem performs the following :

1. The Back Space Character is echoed.
2. A Forward Space {20 HEX} is output to the DTE.
3. Another Back Space Character is output to the DTE.

If the user tries to backspace past the attention code ('AT') the modem will ignore the backspace characters.

S6 Wait for Dial Tone**Default** : 2 Decimal**Range** : 2 to 255 Seconds (Stored in NVRAM)

S6 contains the time (in seconds) that the *DPX-213* will wait before dialling a phone number. This delay allows for the delay in dial tone after going off-hook. S6 will be ignored if *ATX3* or *ATX4* is enabled. If S6 is set to a value less than 2 seconds the *DPX-213* will ignore the value and wait a minimum of 2 seconds.

S7 Wait for Carrier after Dial**Default** : 45 Decimal**Range** : 0 to 255 Seconds (Stored in NVRAM)

S7 contains the time (in seconds) that the *DPX-213* will wait for carrier after dialling is completed. In the answer mode S7 is the time that the modem waits for carrier after sending answer tone.

S8 Dial Pause Time**Default** : 2 Decimal**Range** : 0 to 255 Seconds (Stored in NVRAM)

S8 contains the time (in seconds) that the *DPX-213* will wait when a comma is encountered in the dial string. This feature is used to insert a pause during dialling to allow for PABX exchange delays.

S10 Carrier Loss Response Time

Default : 40 Decimal (0.04 Seconds)

Range : 0 to 255 (in 0.02 Second increments, Stored in NVRAM)

S10 establishes the delay between loss of carrier to the time that the *DPX-213* disconnects. By increasing this time, the modem will become less susceptible to line dropouts. By setting register S10 to 255 the *DPX-213* will ignore the carrier status and function as if carrier were always present.

S12 Escape Code Guard Time

Default : 50 Decimal (1 Second)

Range : 0 to 255 (Stored in NVRAM)

S12 contains the value (in 20 millisecond intervals) of the Escape code guard time. The escape code guard time is the time that the modem must see steady MARK (idle, no key strokes) before and after the escape code sequence before the sequence is recognized. It is also the maximum amount of time that the escape code characters can be spaced apart. If the escape guard time = 0, the '+ + +' feature is disabled.

S14 Echo, Quiet, Leased Line and Dialling

Default : 14 Hex

Range : 0 to 255 (Stored in NVRAM)

S14 contains a bit map of certain internal states of the modem. This register is a read only register and writing to this register may cause unpredictable results.

BIT	VALUE(S)	AT COMMAND	DESCRIPTION
1	0 0 0 1 1 0 1 1	<i>AT&D0</i> <i>AT&D1</i> <i>AT&D2</i> <i>AT&D3</i>	Ignore DTR input. On DTR fall enter On-line Command. On DTR fall hang up call. On DTR fall initialize modem.
2	0 1	<i>ATE0</i> <i>ATE1</i>	No command echo. Command echo.
3	0 1	<i>ATQ0</i> <i>ATQ1</i>	Result code enabled. Result code disabled.
4	0 1	<i>ATV0</i> <i>ATV1</i>	Numeric result codes. Verbose result codes.
5	0 1	<i>AT&L0</i> <i>AT&L1</i>	Dial network. Leased line mode.
6	0 1	<i>ATDT</i> <i>ATDP</i>	Tone dial default. Pulse dial default.
7	0 1	<i>Not Used</i>	NZ dialling (enables N+1 dialling).

S21 DTR Control, Dumb Mode, Alarm Mode, Password**Default** : 0**Range** : 0 to 255 (Stored in NVRAM)

This register is read only and writing to this register may cause unpredictable results.

BIT	VALUE(S)	AT COMMAND	DESCRIPTION
0	0	<i>AT&C0</i>	CD always asserted.
	1	<i>AT&C1</i>	CD follows line carrier.
2 1	0 0	<i>AT*D0</i>	Disable dumb mode.
	0 1	<i>AT*D1</i>	Ignore AT commands.
	1 0	<i>AT*D2</i>	Ignore abort options.
	1 1	<i>AT*D3</i>	Ignore AT and abort key operations.
4 3	0 0	<i>AT*A0</i>	Alarm mode disabled.
	0 1	<i>AT*A1</i>	Full alarm mode enabled.
	1 0	<i>AT*A2</i>	Partial alarm mode enabled.
	1 1	<i>AT*A3</i>	Reserved.
6 5	0 0	<i>AT*P0</i>	Password security disabled.
	0 1	<i>AT*P1</i>	Password security enabled.
	1 0	<i>AT*P2</i>	Password with dialback.
7	0	<i>AT*R0</i>	Remote configuration disabled.
	1	<i>AT*R1</i>	Remote configuration enabled.

S23 Modulation, CCITT\Bell, Parity, Guard Tone, Calling Tone**Default** : 18 Hex**Range** : 0 to 255 (Stored in NVRAM)

This register is read only and writing to this register may cause unpredictable results.

BIT	VALUE(S)	AT COMMAND	DESCRIPTION
2 1 0	0 0 0	<i>ATF0</i>	Line speed set by terminal speed.
	0 0 1	<i>ATF1</i>	300 bps.
	0 1 0	<i>ATF2</i>	Not used.
	0 1 1	<i>ATF3</i>	Not used.
	1 0 0	<i>ATF4</i>	V.22 or Bell 212A 1200 bps.
	1 0 1	<i>ATF5</i>	V.22bis 2400 bps.
3	0	<i>ATB0</i>	Disable Bell Mode.
	1	<i>ATB1</i>	Enable Bell Mode.
5 4	0 0	<i>Not Applicable</i>	Even parity.
	0 1		Space parity.
	1 0		Odd parity.
	1 1		Mark parity.
6	0	<i>AT&G0</i>	No Guard tone.
	1	<i>AT&G1</i>	Guard tone enabled.
7	0	<i>AT*G0</i>	No calling tone.
	1	<i>AT*G1</i>	Calling tone enabled.

S30 MNP, CSI, Result Codes, Pulse Ratio, Character Size**Default** : BC Hex**Range** : 0 to 255 (Stored in NVRAM)

BIT	VALUE(S)	AT COMMAND	DESCRIPTION
0	0	<i>AT&E0</i>	MNP 2-4 error control disabled.
	1	<i>AT&E1</i>	MNP 2-4 error control enabled.
1	0	<i>AT*E0</i>	MNP 2-5 compression disabled.
	1	<i>AT*E1</i>	MNP 2-5 compression enabled.
2	0	<i>AT&I0</i>	Disable Constant Speed Interface.
	1	<i>AT&I1</i>	Enable Constant Speed Interface.
4 3	0 0	<i>ATX0</i>	Result code settings.
	0 1	<i>ATX1</i>	
	1 0	<i>ATX2</i>	
	1 1	<i>ATX3</i>	
5	0	<i>AT&P0</i>	U.S.A. pulse dial make ratio.
	1	<i>AT&P1</i>	CCITT ratio.
7 6	0 0	<i>Not Applicable</i>	8 bit character length.
	0 1		9 bit character length.
	1 0		10 bit character length.
	1 1		11 bit character length.

S31 Flow Control, Pass Through, Break Handling, Sync\Async and Remote Loop Disable**Default** : 01 hex**Range** : 0 to 255 (Stored in NVRAM)

BIT	VALUE(S)	AT COMMAND	DESCRIPTION
1 0	0 0	<i>AT&K0</i>	Disable flow control.
	0 1	<i>AT&K1</i>	Enable Xon/Xoff flow control.
	1 0	<i>AT&K2</i>	Enable RTS/CTS flow control.
	1 1	<i>AT&K3</i>	Enable both.
3 2	0 0	<i>AT&U0</i>	Pass through OFF, modem flow OFF.
	0 1	<i>AT&U1</i>	Pass through ON, modem flow OFF.
	1 0	<i>AT&U2</i>	Pass through OFF, modem flow ON.
	1 1	<i>AT&U3</i>	Pass through ON, modem flow ON.
4	0	<i>AT*Y0</i>	Expedited/non destructive.
	1	<i>AT*Y1</i>	Expedited/destructive.
6 5	0 0	<i>AT&M0</i>	Async mode normal.
	0 1	<i>AT&M1</i>	Async dial stored number.
	1 0	<i>AT&M2</i>	Async dial sync connect.
	1 1	<i>AT&M3</i>	Async dial slave sync connect.
7	0	<i>AT&T5</i>	Disable remote loops.
	1	<i>AT&T4</i>	Enable remote loops.

S32 Modem Flow Control Xoff Character

Default : 19 decimal (###S13 HEX)
Range : 0 to 255 (Stored in NVRAM)

Stores the ASCII 8-bit value of the modem (AT&K) flow control X-off character.

S33 Modem Flow Control Xon Character

Default : 17 decimal (###Q11 HEX)
Range : 0 to 255 (Stored in NVRAM)

Stores the ASCII 8-bit value of the modem (AT&K) flow control X-on character.

S36 &**S37 Inactivity Timer Duration**

Default : 0 Decimal
Range : 0 to 65535 Seconds (Stored in NVRAM)

This register pair (high byte and low byte) contain the timer duration for line or DTE inactivity. The value placed in these S registers is used to determine if the modem has been inactive for a given period of time and subsequently causes the modem to disconnect the call. To calculate registers S36 and S37, use the following equations:

$S37 = (\text{Inactivity Timer Duration} \text{ divided by } 256) - \text{Whole Number Only}$
 $S36 = \text{Remainder of above equation.}$

For example, setting the inactivity timer duration to 1 minute and 30 seconds (or 90 seconds) would involve setting register S37 to 0 (as 90 divided by 256 yields 0) and setting register S36 to 90 (as the remainder of the previous equation is 90). In other words, when the duration of the inactivity timer is less than 256 then S37 will be 0 and S36 will be the duration. Alternatively, setting the inactivity timer duration to 5 minutes (300 seconds) would involve setting register S37 to 1 (as 300 divided by 256 yields 1) and setting register S36 to 44 (as the remainder of the previous equation is 44). In other words, when the duration of the inactivity timer is greater than 256, then S37 will store the multiples of 256 and S36 the remainder.

If the inactivity timer is employed, the modem will attempt to go into the low power/standby mode (provided the modem is left off-line in the command state for greater than the inactivity period). The actual time in seconds is $((256 \times \text{S-Register S37}) + \text{S-Register S36})$.

S50 Redial Attempts**Default** : 5 Decimal**Range** : 0 to 256 Seconds (Stored in NVRAM)

If a call is made in *AT*A* mode and the message is not successfully sent, the unit will attempt to redial the number of times stored in this register before giving up. This takes into account alternate number dialling. In this scenario, the modem attempts to connect using the number stored in location 0 and then the number stored in location 1 on failure to send an alarm message. For example, if alternate numbers are provided and S50 is set to four then both numbers will be dialed four times before the units stops. If S50 is set to zero unit will attempt to dial indefinitely and S51 should be set to 3 to comply with Austel Permit.

S51 Delay Before Redialling**Default** : 3**Range** : 1 to 256 Seconds (One minute increments)

If the unit is attempting to dial after dropping a previously raised telephone line, the unit will wait for a interval of S51mins before raising the line again and attempting to dial. If no alternate number is provided then the unit will wait 2*S51 minutes before redialling.

Attempting to set this value to 0 will result in a default delay of 3 minutes. To comply with Austel Permit the unit should not be allowed to dial more than 10 times in 30 minutes. It is recommended that this register should not be changed from the default value.

S52 Delay Before Alarm Message**Default** : 0**Range** : 0 to 256 Seconds (Increments of 100mS)

This register provides control of the delay before the modem outputs an alarm message to line. This value is only valid in Constant Speed Interface mode as in MNP modes the modem monitors the MNP level activity to guarantee reception of the message by the called party.

S53 MNP Autoreliable Delay**Default** : 0**Range** : 0 to 256 Seconds (One second increments)

This delay is the period that the modem will attempt to provide an MNP connection before dropping through to Constant Speed Interface or Disconnecting. When set to 0 then modem will use a standard 8 second period.

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9.0 TECHNICAL SPECIFICATIONS

The *DPX-213* is a multi standard modem, with high reliability and low power consumption. The modem features an extended *AT* command set, error correction, data compression, pulse and tone dialling, automatic adaptive equalisation, synchronous and asynchronous capability, leased line and dial network support and numerous other features.

Compatibility & Modulation	2400 bps QAM - CCITT V.22bis. 1200 bps DPSK - CCITT V.22, and Bell 212A. 300 bps FSK - CCITT V.21, and Bell 103.
Data Format	<i>Asynchronous</i> - 8-11 bit character format including parity and stop bit. <i>Synchronous</i> - serial, binary, bit synchronous; protocol independent.
Interface Speeds	Asynchronous 300, 1200, 2400, 4800, 9600. Synchronous 1200 and 2400 bps.
Line Speeds	Asynchronous 300, 1200, 2400 bps. Synchronous 1200, 2400 bps.
Operation	Full duplex over two wire switched and leased lines. Automatic or manual originate and answer.
Equalisation	Auto-adaptive equaliser.
Transmit Timing	Internal or external +.01%, loop timing.
Transmit Level	-10dBm.
Guard Tone Frequency	550 Hz, 1800 Hz, or none.
Loss of Carrier Disconnect	0.04 Seconds (Programmable).
Answer Tone Frequency	CCITT 2100Hz, Bell 2135 Hz.
Receiver Dynamic Range	-6 dBm to -45 dBm.
Carrier Detect	ON at -43 dBm. OFF at -48 dBm.
Hysteresis	Greater than 2dB.
Ring Detection	Level = 35 to 150 V RMS. Frequency = 13 to 55 Hz.
DTE Interface	CCITT V.24/V.28; EIA RS-232-C, DB-25-S (female).
VF Interface	RJ-11 jack with mode 3 wiring.
Power Requirements	7.5 - 18VDC 600mW.

Environmental	Temperature 0 to 85 degrees C. Relative humidity < 95%, non-condensing.
Physical	Height - 20 mm. Width - 127.8 mm. Depth - 130 mm. Weight - 0.6 kg.

MODELS AVAILABLE

<i>DPX-213-01</i>	240VAC Standard Mains Operation
<i>DPX-213-02</i>	7-20VDC Standard DC Operation
<i>DPX-213-03</i>	20-70VDC Standard DC Operation

Standard Accessories Supplied

Four wire VF line cord RJ-11 to Telecom 605 plug

Optional or Replacement Items

023-0008-1	RS232C Data Cable
023-0091-2	Adapter, RJ-11 to Telecom 610

10.0 WARRANTY AND REPAIRS

Dataplex warrants the *DPX-213* to be free from defective materials or workmanship for a period of 3 months from the date of purchase. This warranty is extended to 12 months from date of purchase for users who return the warranty registration card within 30 days from the date of purchase. This warranty does cover equipment damaged by accident, abuse, unauthorised modifications, or improper use. When subjected to normal, proper and intended usage, Dataplex agrees to repair or replace, at their option, any defective material without cost, provided:

1. You promptly notify Dataplex of any defect.
2. You return the equipment, freight prepaid, to the Dataplex office that you purchased the equipment from.
3. Dataplex's inspection of the equipment shows that any defect was not caused by accident, misuse, negligence, alteration, improper installation, unauthorised repair or improper testing.

Dataplex will return the equipment, freight prepaid, after repair or replacement within a reasonable time.

Dataplex shall not be responsible or liable for any consequential damages or loss of profits which may arise as a result of any defect in its products during use.

Dataplex warrants all repairs and upgrades performed at its factory for 90 days after completion unless an off-site repair maintenance agreement is .

Out of warranty repairs will be performed at ruling time and materials rates. Before returning any equipment, you must phone Dataplex Pty. Ltd. and obtain a Return Material Authorisation (RMA) number from Customer Service.

All returns must be shipped freight prepaid. Check the latest telephone directory for the number of your local Dataplex Customer Service center.

Dataplex Pty Ltd.
PO BOX 901
L2, 71 Epping Rd,
NORTH RYDE, NSW, 2113 AUSTRALIA
DPX: (02) 9869 2500
FAX: (02) 9869 2600

PROBLEM REPORT SHEET

Use this form to list any problems which you find in the modem, then mail or fax it to Dataplex

Fax No. **(02) 9869 2500.**

SOFTWARE REVISION NO.: _____ (USE AT/I3 TO FIND OUT)

MODEL NO.: **DPX-213** DATE OF PURCHASE: _____

SERIAL NO.: _____

PROBLEM/BUG:

'AT' CONFIGURATION USED BY MODEM
(USE AT*C and print screen dump TO FIND OUT):

USER IDENTIFICATION: _____

NAME: _____

DEPARTMENT/TITLE: _____

COMPANY: _____

ADDRESS: _____

_____ P/CODE: _____

TELEPHONE (_____) _____ DATE: _____

*THANK YOU FOR YOUR HELP
PRODUCT MANAGER DPX-213
DATAPLEX Pty Ltd*

S REGISTER SUMMARY

Register		Brief Description	Defaults (Decimal unless stated)
S0	®	Rings to answer.	2
S1		Ring count.	0
S2	®	Escape code character.	43
S3	®	Carriage return character.	13
S4	®	Line feed character.	10
S5	®	Back space character.	8
S6	®	Wait for dial tone.	2
S7	®	Wait for carrier after dial.	45
S8	®	Dial pause time for comma.	2
S10	®	Loss of carrier response time.	3
S12	®	Escape code guard time.	50
S14	®	Echo response codes verbose leased line dialling.	14 Hex
S21	®	CD control, dumb alarm mode, password, remote configuration.	0
S23	®	Modulation, parity, guard tone, calling tone.	18 Hex
S30	®	MNP, CSI, result codes, make/break	08 Hex
S31	®	Flow control, break, pass through, remote loop.	01 Hex
S32	®	Xoff character.	19
S33	®	Xon character.	17
S36,37	®	Inactivity duration.	0
S50	®	Redial attempts.	5
S51	®	Delay before redialling.	3
S52	®	Delay before alarm message.	0
S53	®	MNP autoreliable delay.	0

NOTE: ® indicates the S-register contents are stored in non-volatile memory.

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ASCII CONVERSION TABLE

KEY:

DEC	BINARY
HEX	ASCII/CTRL

Please Note: ASCII or character equivalents are given only for the first 127 entries (as ASCII is a 7 bit code). Also, control (Cntrl) sequences exist for the first 32 entries only.

0	00000000	16	00010000	32	00100000	48	00110000	64	01000000	80	01010000	96	01100000	112	01110000
00	NUL ^@	10	DLE ^P	20	SPACE	30	0	40	@	50	P	60	`	70	p
1	00000001	17	00010001	33	00100001	49	00110001	65	01000001	81	01010001	97	01100001	113	01110001
01	SOH ^A	11	DC1 ^Q	21	!	31	1	41	A	51	Q	61	a	71	q
2	00000010	18	00010010	34	00100010	50	00110010	66	01000010	82	01010010	98	01100010	114	01110010
02	STX ^B	12	DC2 ^R	22	"	32	2	42	B	52	R	62	b	72	r
3	00000011	19	00010011	35	00100011	51	00110011	67	01000011	83	01010011	99	01100011	115	01110011
03	ETX ^C	13	DC3 ^S	23	#	33	3	43	C	53	S	63	c	73	s
4	00000100	20	00010100	36	00100100	52	00110100	68	01000100	84	01010100	100	01100100	116	01110100
04	EOT ^D	14	DC4 ^T	24	\$	34	4	44	D	54	T	64	d	74	t
5	00000101	21	00010101	37	00100101	53	00110101	69	01000101	85	01010101	101	01100101	117	01110101
05	ENE ^E	15	NAK ^U	25	%	35	5	45	E	55	U	65	e	75	u
6	00000110	22	00010110	38	00100110	54	00110110	70	01000110	86	01010110	102	01100110	118	01110110
06	ACK ^F	16	SYN ^V	26	&	36	6	46	F	56	V	66	f	76	v
7	00000111	23	00010111	39	00100111	55	00110111	71	01000111	87	01010111	103	01100111	119	01110111
07	BEL ^G	17	ETB ^W	27	'	37	7	47	G	57	W	67	g	77	w
8	00001000	24	00011000	40	00101000	56	00111000	72	01001000	88	01011000	104	01101000	120	01111000
08	BS ^H	18	CAN ^X	28	(	38	8	48	H	58	X	68	h	78	x
9	00001001	25	00011001	41	00101001	57	00111001	73	01001001	89	01011001	105	01101001	121	01111001
09	HT ^I	19	EM ^Y	29	)	39	9	49	I	59	Y	69	i	79	y
10	00001010	26	00011010	42	00101010	58	00111010	74	01001010	90	01011010	106	01101010	122	01111010
0A	LF ^J	1A	SUB ^Z	2A	*	3A	:	4A	J	5A	Z	6A	j	7A	z
11	00001011	27	00011011	43	00101011	59	00111011	75	01001011	91	01011011	107	01101011	123	01111011
0B	VT ^K	1B	ESC ^[	2B	+	3B	;	4B	K	5B	[	6B	k	7B	{
12	00001100	28	00011100	44	00101100	60	00111100	76	01001100	92	01011100	108	01101100	124	01111100
0C	FF ^L	1C	FS ^\	2C	,	3C	<	4C	L	5C	\	6C	l	7C	|
13	00001101	29	00011101	45	00101101	61	00111101	77	01001101	93	01011101	109	01101101	125	01111101
0D	CR ^M	1D	GS ^]	2D	-	3D	=	4D	M	5D	]	6D	m	7D	}
14	00001110	30	00011110	46	00101110	62	00111110	78	01001110	94	01011110	110	01101110	126	01111110
0E	SO ^N	1E	RS ^^	2E	.	3E	>	4E	N	5E	^	6E	n	7E	~
15	00001111	31	00011111	47	00101111	63	00111111	79	01001111	95	01011111	111	01101111	127	01111111
0F	SI ^O	1F	US ^~	2F	/	3F	?	4F	O	5F	_	6F	o	7F	DEL

ASCII CONVERSION TABLE

128	10000000	144	10010000	160	10100000	176	10110000	192	11000000	208	11010000	224	11100000	240	11110000
80		90		A0		B0		C0		D0		E0		F0	
129	10000001	145	10010001	161	10100001	177	10110001	193	11000001	209	11010001	225	11100001	241	11110001
81		91		A1		B1		C1		D1		E1		F1	
130	10000010	146	10010010	162	10100010	178	10110010	194	11000010	210	11010010	226	11100010	242	11110010
82		92		A2		B2		C2		D2		E2		F2	
131	10000011	147	10010011	163	10100011	179	10110011	195	11000011	211	11010011	227	11100011	243	11110011
83		93		A3		B3		C3		D3		E3		F3	
132	10000100	148	10010100	164	10100100	180	10110100	196	11000100	212	11010100	228	11100100	244	11110100
84		94		A4		B4		C4		D4		E4		F4	
133	10000101	149	10010101	165	10100101	181	10110101	197	11000101	213	11010101	229	11100101	245	11110101
85		95		A5		B5		C5		D5		E5		F5	
134	10000110	150	10010110	166	10100110	182	10110110	198	11000110	214	11010110	230	11100110	246	11110110
86		96		A6		B6		C6		D6		E6		F6	
135	10000111	151	10010111	167	10100111	183	10110111	199	11000111	215	11010111	231	11100111	247	11110111
87		97		A7		B7		C7		D7		E7		F7	
136	10001000	152	10011000	168	10101000	184	10111000	200	11001000	216	11011000	232	11101000	248	11111000
88		98		A8		B8		C8		D8		E8		F8	
137	10001001	153	10011001	169	10101001	185	10111001	201	11001001	217	11011001	233	11101001	249	11111001
89		99		A9		B9		C9		D9		E9		F9	
138	10001010	154	10011010	170	10101010	186	10111010	202	11001010	218	11011010	234	11101010	250	11111010
8A		9A		AA		BA		CA		DA		EA		FA	
139	10001011	155	10011011	171	10101011	187	10111011	203	11001011	219	11011011	235	11101011	251	11111011
8B		9B		AB		BB		CB		DB		EB		FB	
140	10001100	156	10011100	172	10101100	188	10111100	204	11001100	220	11011100	236	11101100	252	11111100
8C		9C		AC		BC		CC		DC		EC		FC	
141	10001101	157	10011101	173	10101101	189	10111101	205	11001101	221	11011101	237	11101101	253	11111101
8D		9D		AD		BD		CD		DD		ED		FD	
142	10001110	158	10011110	174	10101110	190	10111110	206	11001110	222	11011110	238	11101110	254	11111110
8E		9E		AE		BE		CE		DE		EE		FE	
143	10001111	159	10011111	175	10101111	191	10111111	207	11001111	223	11011111	239	11101111	255	11111111
8F		9F		AF		BF		CF		DF		EF		FF	

INTERFACE CONNECTIONS

The following Section applies to the *DPX-213* only. There are two cables required for use with the *DPX-213*, one cable for the phone line and another cable that is connected between the modem and the terminal. The wiring for these cables is described in this Section.

Line and Phone Connector

The phone and line connector are both RJ-11 type connectors. The Line Connector has mode 3 connections in addition to the standard tip and ring connections. See the Figure below for details.

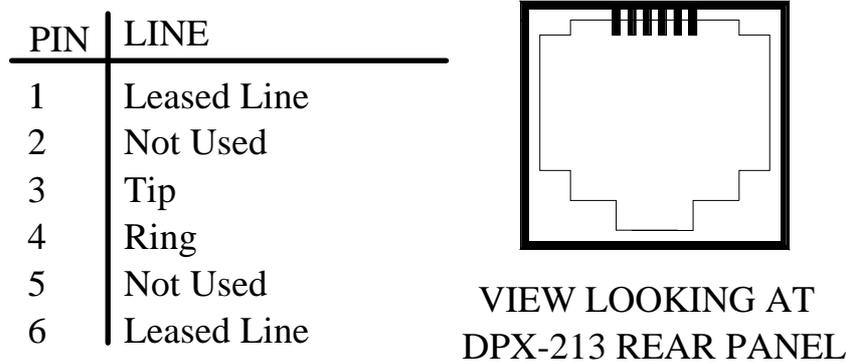


Figure D.1 RJ-11 Connector Wiring

V.24/28 Interface Wiring

The **DPX-213** uses the industry standard V.24 (RS-232) 25 Pin interface configured for a modem (DCE - female). It is unlikely that the **DPX-213** and your computer will need all the pins shown, some are used only in synchronous operation, while other pins are needed only by certain software packages.

The **DPX-213** modem will operate with only three (3) active leads in the cable, transmit data, receive data and ground on Pins 2, 3, and 7.

Table D.1 V.24 Interface Connectors

Pin	Function	CCITT Number	Direction (Modem In / Out)	SEE NOTE (Below)
1	Protective Ground	101	Not Used	
2	Transmit Data	103	In	1
3	Receive Data	104	Out	1
4	Request to Send	105	In	2
5	Clear to Send	106	Out	2
6	Data Set Ready	107	Out	3
7	Signal Ground	102	Common to Both	1
8	Carrier Detect	109	Out	3
9	Supply		In	5
11	Reserved			6
12	Reserved			6
15	Transmit Clock	114	Out	4
17	Receive Clock	115	Out	4
20	Data Terminal Ready	108	In	3

- NOTES:**
1. *Minimum signals for set-up & operation of the DPX-213.*
 2. *Required for RTS/CTS flow control.*
 3. *Optional for the DPX-213, may be needed by your communications package in asynchronous mode, also needed to access some DPX-213 features such as DTR dialling and so on.*
 4. *Only required for synchronous operation, best left out of the cable for asynchronous operation.*
 5. *DC +12VC.*
 6. *These wires are used to extend an internal serial bus out the DB25 connector and should remain disconnected.*

AT COMMAND SET SUMMARY

Command	Brief Description	Section
A/	Repeat command - NO AT prefix	4-7
ATA	Answer	4-7
ATB	Bell/CCITT select	4-7
ATD	Dial command	4-8
ATDn	Dial stored number	4-9
ATE	Echo command	4-9
ATF	Communication format/force line speed	4-10
ATH	Hook command - hang up	4-10
ATI	Identify modem	4-10
ATNn&Z	Store string in location n	4-11
ATO	On line, originate and retrain	4-11
ATP	Pulse dial modifier	4-12
ATQ	Result code & quiet mode	4-12
ATSr?	S register inquire	4-12
ATS=n	S register set command	4-13
ATT	Tone dial modifier	4-13
ATV	Verbose or terse control	4-13
ATX	Response codes - blind dialing	4-14
ATZ	Modem reset	4-15
AT&C	Carrier detect & DSR options	4-15
AT&D	DTR control	4-15
AT&E	MNP/V42	4-16
AT&F	Load factory defaults from ROM	4-16
AT&G	Guard tone selection	4-16
AT&H	Help screen	4-17
AT&I	Constant Speed Interface	4-17
AT&K	DTE flow control	4-18
AT&L	Leased line control	4-19
AT&M	Sync/Async, dialed stored number	4-20
AT&N	Display or clear dialling directory	4-20
AT&P	Pulse dial make/break ratio	4-20
AT&T	Test modes	4-21
AT&U	Modem flow control	4-21

AT COMMAND SET SUMMARY

Command	Brief Description	Section
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AT&Z	Store phone number to NVRAM	4-22
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AT*E	Data compression.	4-24
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AT*R	Remote configuration	4-25
AT*Y	Break handling	4-25
Dial Modifiers (See ATD command)		
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