

Atrie 2842RM MODEM User's Manual



**2842RM
MODEM
USER'S MANUAL**

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CHAPTER 1

INTRODUCTION

Overview

This manual is written for the models below:

1. The standalone 28800bps modem.
2. The rack mounted 28800bps modem.

We will call these modems "2842 modem" latter on and will show the difference between these modems if necessary. The 28800bps standalone modems are standalone modems with individual casing while the 28800bps rack mounted modems are 16 modems build into a 19 inches shelf which can be fixed into a 19 inches rack.

The modem is a high speed Hayes compatible modem which can be used with various types of computers and terminals. It meets to the BELL 103/212A standards and ITU-T V.21, V.22, V.23, V.22bis, V.32, V.32bis, V.25bis, V.42 and V.42bis recommendations and also equippes with the Microcom Networking Protocol (MNP) class 5 service. It can be instructed via the Hayes AT command set to automatically dial or answer, or to perform MNP class 5 service or ITU-T V.42/V.42bis recommendations. It can also be instructed via ITU-T V.25bis command to perform auto-dial or auto-answer functions. The effective throughput of full duplex asynchronous communication can be 57600bps and also the modem can support the ITU-T multi-mode handshake recommendation.

REMARK: 2842 Modem Function

For the 2842 modem, it also compatible with the ITU-T V.34, V.8,V.FC and MNP10 to perform 28800bps communication. The effective throughput is also increased to 115200bps

It supports 2-wire full duplex dial up line, 2-wire full duplex leased line and 4-wire full duplex leased line with 2-wire dial back-up. It can meet most application requirements.

The 2842 modem can operate in both the asynchronous and synchronous modes and provide 100% error-free data transmission and data compression with auto-dial, redial, auto-answer and full call progress monitoring functions. Moreover, it supports dynamic packet size adjustment to ensure optimum data throughput.

2842 Modem Features

- . Compatible with BELL 103, 212A standards and ITU-T V.21, V.22, V.23, V.22bis, V.32, V.32bis, V.25bis, V.42, V.42bis, recommendations.
- . Compatible with ITU-T V.34, V.8, V.FC recommendations and Microcom MNP10. (2842 modem only)
- . Provides Hayes AT command set with programmable S register.
- . Provides ITU-T V.25bis auto-answer, auto-dial recommendation.
- . Supports ITU-T V.42/V.42bis error correction and data compression recommendations.
- . Supports Microcom Networking Protocol (MNP) Class 5 data compression protocol.
- . Provides multi-mode handshake according to ITU-T recommendation.
- . Utilizes full duplex asynchronous transmission with a maximum effective throughput of 57600bps. (2842 modem's maximum throughput is 115200bps).
- . Provides 100% error-free data transmission.
- . Supports dynamic packet size adjustment to optimize data throughput.

- . Provides 2-wire full duplex dial up line operation.
- . Provides 4-wire or 2-wire full duplex leased line operation with dial back-up option.
- . Asynchronous and synchronous operation selectable on both DIP switch and AT command.
- . Provides manual dial, manual answer, auto-dial, auto-answer, redial, and full call progress monitoring functions.
- . Group III Facsimile with EIA SP-2388 service class 1 and class 2 command as an option.

CHAPTER 2

INSTALLATION

Package Contents

Carefully unpack the product package that you have received. The following is a checklist of the contents of the package:

- . 2842(RM) modem
- . A Dip-Switch Definition
- . A modem power cable
- . Two telephone cables for RJ-45 and RJ-11; A terminal box
- . 2842 User's Manual

If there is any wrong, missing or damaged parts, please contact your dealer.

Modem Panel Description

Modem Front Panel

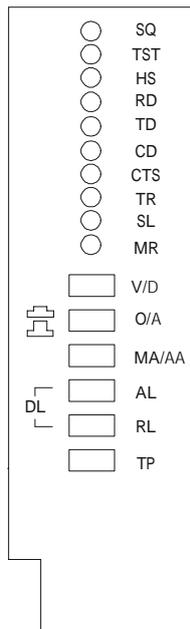


Figure 2-1 Rack Mounted Modem Front Panel

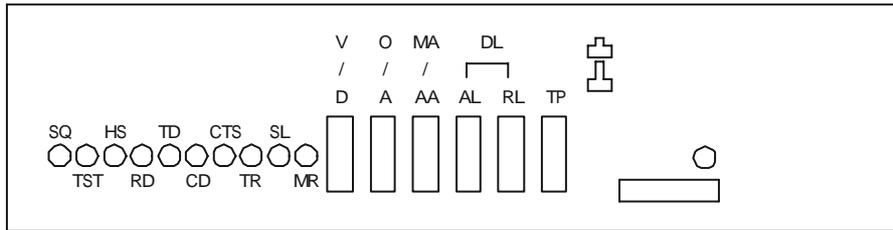


Figure 2-2 Standalone Modem Front Panel

The 2842(RM) modem's front panel contains ten LED indicators and six push-button switches (see Figure 2-1 and 2-2). These LED indicators serve to display the current operating status and these push button switches serve to configure the modem. The following sections describe the functions of LED indicators and the push-button switches:

LED Indicators

SQ : Signal Quality

Indicates the signal quality of the telephone line.

On	Good
Flash	Medium
Off	Bad

TST : Test Indicator

Lights up when the modem is performing self-test. It will also flash when the modem is in test mode and the test failed or when the modem connect in error correction mode and found error data received.

HS : High Speed

Indicates the speed of the modem. In command mode, if the DTE-to-Modem speed is 9600bps or above the indicator will light up. In data mode, if the line speed is 9600bps or above the indicator will light up.

MR : Modem Ready

Lights up when power is applied to the modem.

CD : Carrier Detect
Lights up when carrier signal from a remote modem is detected.

CTS : Clear-to-Send
Indicates the status of RS-232C D-SUB connector pin 5. This LED turns ON when the modem is ready to receive data from DTE.

TR : Terminal Ready
Lights up when the RS-232C DTR signal is asserted, which indicates that the computer or terminal is ready.

SL : Switch/Leased Line
This LED lights up when the modem is on switch line (dial-up line), goes off when on leased line. This LED also indicates the dial back-up by flashing.

RD : Receive Data
Flashes when the local DTE (Data Terminal Equipment) receives data from the modem.

TD : Transmission Data
Flashes when your local DTE transmits data into the serial port of the modem.

Front Panel Switches

V/D : Voice/Data
Toggles between the voice mode and the data mode. This switch is a toggle switch, push and release the switch once will change the mode from voice to data or vice versa.

O/A : Originate/Answer
Selects between the originate and the answer mode. When the switch is in the "PUSH" position the modem is in the originate mode; when in the "POP" position the modem is in the answer mode. In the originate mode, activating the data mode sets your modem to a "waiting for answer tone" state. Conversely, in the

answer mode, activating the data mode makes your modem generate an answer tone. This switch is effective only when D/V been pushed or the DIP sw2-6 (2-wire or 4-wire leased line operation) been on; otherwise you should use AT command to enter originate or answer mode.

MA/AA: Manual Answer/Auto Answer

Selects the manual answer or auto answer. If this switch is in "PUSH" position, the modem is in the auto answer mode. The S register 0 defines the ring count that the modem will answer the phone. If this switch been pushed while the S register is 0, the modem will answer the phone at the end of the first ring. If this switch is in "POP" position, the modem will not answer phone even the S register 0 contains none 0 value.

AL : Analog Loopback

In command mode, sets the switch to "PUSH" position will cause the modem to perform analog loopback test. If you push this switch during connection, the modem will drop the line and performing analog loopback.

RL : Remote Digital Loopback

When connected, sets the switch to "PUSH" position will cause the remote modem to perform digital loopback test.

DL : Digital Loopback

Sets the switch "AL" and "RL" to "PUSH" position in the same time when connected with another modem will cause the modem to perform the digital loopback test.

TP : Test Pattern

When the modem is performing self-test, this switch selects whether to send test pattern automatically or not. If it is set to "PUSH" position, the modem will send test pattern automatically when entering self-test. If you want to stop sending, just released this switch to "POP" position.

Modem Rear Panel

Standalone Modem Rear Panel

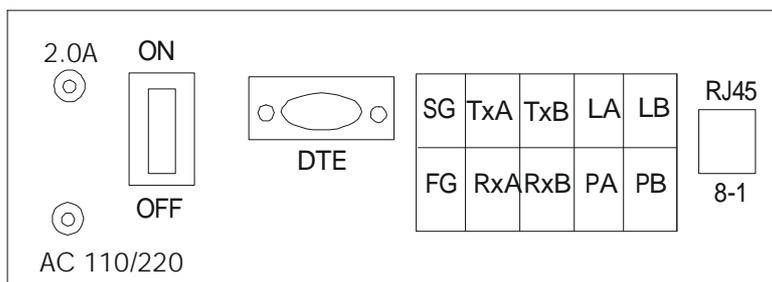


Figure 2-3 Standalone Modem Rear Panel

The standalone modem's rear panel has one power switch, one fuse holder, one power cable, one serial port (RS-232C), one RJ-45 connector and one terminal block for wiring (see Figure 2-3). The following sections detailedly describe the functions of each part:

Power Switch:

The power switch controls the whole power of the modem. Turn the switch to "OFF" position will turn off the modem.

Power Cable:

The power cable is for the user to plug into the wall outlet of the AC power source. The modem uses AC 110V or 220V as input rating. Please contact your dealer for power rating.

Fuse:

This fuse holder contains a fuse of 2.0A/250VAC. The user should NOT change this fuse with different specification.

RS-232C Serial Port:

The serial port is a female DB25 connector for the RS-232 cable. This connects your modem to your local computer or terminal.

RJ-45 Connector:

This jack is for the user to connect the telephone line and telephone set. There are 8 connector pins inside this jack, the detail description about these pins (from right to left) are listed below:



Figure 2-4 RJ-45 Connector

1/2: LA and LB

Connect the PSTN telephone line to these two pins. Use these two pins to do dialing and answering the PSTN telephone system. You can also use these two pins to do dial back-up function.

3/4: PA and PB

Connect the telephone set to these two pins. You can use the telephone set to dial telephone number and talk to the other end or do manual dialing function using these two pins.

5/6: TXA and TXB

These two pins perform two functions. The first is the transmit and receive pair of the 2-wire leased line operation. And the second is the transmit pair of the 4-wire leased line operation.

7/8: RXA and RXB

Connect the 4-wire leased line's receiving pair to these two pins.

This connector is identical to the terminal block below.

Terminal Block:

There is a terminal block on the rear panel, it contains 10 terminals which can be wired to 4-wire leased line or 2-wire leased line, 2-wire dialup line, telephone set, signal ground and framing ground. The detail descriptions are listed below:

SG : Signal Ground Terminal

Connect this terminal to another equipment's SG may reduce the noise interference.

FG : Framing Ground Terminal

Connect this terminal to the framing ground of the power source (the earth) can prevent some damage from unexpected high voltage.

TXA and TXB: Transmit Line Terminals

These two terminals are the transmit line when in 4-wire leased line mode. They also are the full duplex transmit and receive line when in 2-wire leased line mode.

RXA and RXB: Receive Line Terminals

These two terminals are the receiving line when in 4-wire leased line mode.

LA and LB: Telephone Line Terminals

These two terminals are for the user to connect to the public telephone line.

PA and PB: Phone Set Terminals

These two terminals are for the user to connect to the telephone set.

Rack Mounted Modem Rear Panel

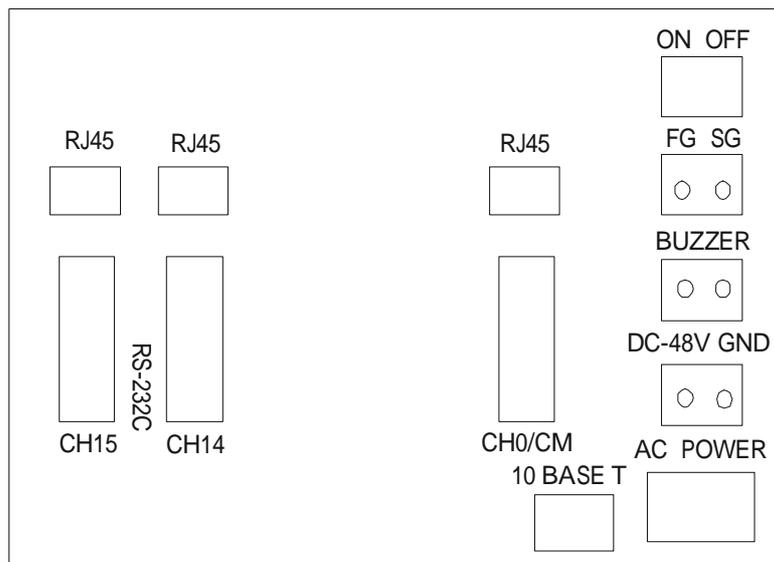


Figure 2-5 Rack Mounted Modem Rear Panel (RJ-45)

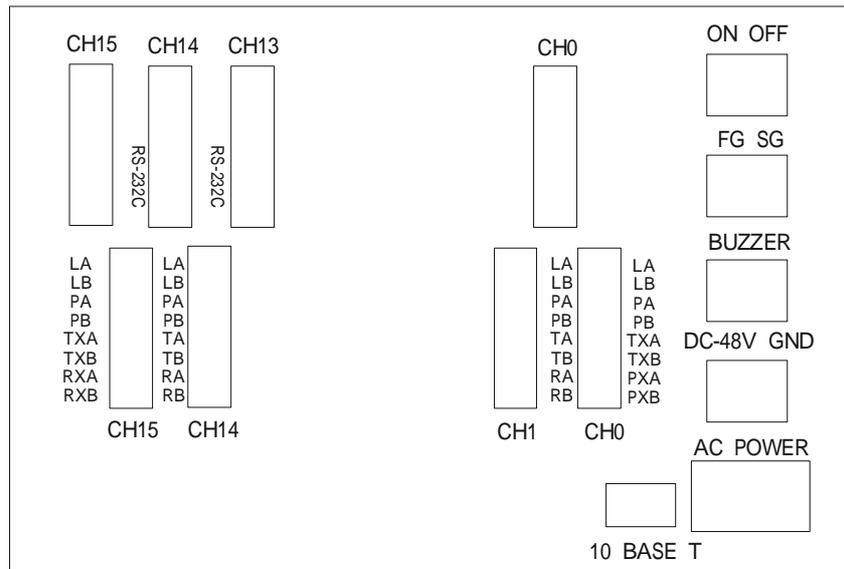


Figure 2-6 Rack Mounted Modem Rear Panel (Terminal Block)

The rack mounted modem's rear panel contains AC power source jack, DC power source terminator, Power failure alarm terminator, Ground terminator, 16 RS-232 25 pin D type connectors and 16 RJ-45 phone jacks or 16 terminal blocks.

AC Power Source Jack:

This jack is for the user to connect the AC power to the modem. The acceptable range is from AC 90V to 260V, 47Hz to 63Hz.

DC Power Source Terminator:

This terminator is for the user to connect the DC-48V power to the modem. The acceptable range is from DC-36V to -72V.

Power Failure Alarm Terminator:

This terminator is for the user to connect the power failure signal to an alarm circuit to indicate that the redundancy power is failed. This function can only be used if this modem is configured to dual power system.

Ground Terminator:

This terminator contains the signal ground and framing ground. The signal ground is for the user to connect to another equipment. The framing ground is for the user to connect to the protection ground of

the power source to avoid damage from unexpected high voltage.

RS-232 D Type Connector:

The 16 D type connectors is for the user to connect the terminal to the modem. There are 16 modems in one shelf, CH0 to CH15, please make sure to make the right connection to respective channel.

RJ-45 Jack/Terminal Block:

There are two versions for the rack mounted type modem. The RJ-45 phone jack or terminal block are used for connecting the telephone line and handset. If you are using the RJ-45 phone jack type, please refer to the RJ-45 Connector in "Standalone Modem Rear Panel" above for the wiring information. If you are using the terminal block type, the detail wiring information are described below: (the same as Figure 2-4)

LA and LB: Telephone Line Terminals

These two terminals are for the user to connect to the public telephone line.

PA and PB: Phone Set Terminals

These two terminals are for the user to connect to the telephone set.

TXA and TXB: Transmit Line Terminals

These two terminals are the transmit line when in 4-wire leased line mode. They also are the full duplex transmit and receive line when in 2-wire leased line mode.

RXA and RXB: Receive Line Terminals

These two terminals are the receiving line when in 4-wire leased line mode.

The DIP Switches

There are 5 DIP switches on the modem P.C. Board, you have to remove the modem P.C. Board from the casing (standalone case or rack mounted

shelf) to see or adjust these DIP switches. On power up or reception of the ATZ command the modem will scan the DIP switches and configure itself to meet the setting. If any AT command issued changes the setting after power up or ATZ, it will change the setting of the modem. The function of these DIP switches is described below:

DIP-SWITCH DEFINITION

DIP-SWITCH S0:

POSITION	STATE	DESCRIPTION
1,2		Reserved
3	On	Sets secondary channel on
	Off	Sets secondary channel off
4	On / Off	Select different DCE speed (see S1-1~S1-4)

DIP-SWITCH S1:

POSITION	STATE				DESCRIPTION	
1,2,3,4	1	2	3	4	When S0-4 off	When S0-4 on
	On	On	On	On	V.21 300 bps	BELL 103
	Off	On	On	On	V.23 1200 /75 bps	V.34 2400 bps
	On	Off	On	On	V.22 1200 bps	V.34 4800 bps
	Off	Off	On	On	V.22b 2400 bps	V.34 7200 bps
	On	On	Off	On	V.32 4800 bps	V.34 9600 bps
	Off	On	Off	On	V.32b 7200 bps	V.34 12000 bps
	On	Off	Off	On	V.32 9600 bps	V.34 14400 bps
	Off	Off	Off	On	V.32b 12000 bps	V.34 16800 bps
	On	On	On	Off	V.32b 14400 bps	V.34 19200 bps
	Off	On	On	Off	V.34 16800 bps	V.34 21600 bps
	On	Off	On	Off	V.34 19200 bps	V.34 24000 bps
	Off	Off	On	Off	V.34 21600 bps	V.34 26400 bps
	On	On	Off	Off	V.34 24000 bps	V.34 28800 bps
	Off	On	Off	Off	V.34 26400 bps	V.34b 31200 bps
	On	Off	Off	Off	V.34 28800 bps	V.34b 33600 bps
	5,6,7,8	5	6	7	8	Following DTE Speed
On		On	On	On	The DTE Speed Selection	
Off		On	On	On	1200 bps	
On		Off	On	On	2400 bps	
	On	On	Off	4800 bps		

	Off	Off	On	On	7200 bps
	On	On	Off	On	9600 bps
	Off	On	Off	On	12000 bps
	On	Off	Off	On	14400 bps
	Off	Off	Off	On	16800 bps
	On	On	On	Off	19200 bps
	Off	On	On	Off	21600 bps
	On	Off	On	Off	24000 bps
	Off	Off	On	Off	26400 bps
	On	On	Off	Off	28800 bps
	Off	On	Off	Off	38400 bps
	On	Off	Off	Off	57600 bps
	Off	Off	Off	Off	115200 bps

DIP-SWITCH S2:

POSITION	STATE		DESCRIPTION
1,2	1	2	The Modem Operating Mode Selection
	On	On	Direct Mode
	Off	On	MNP Mode
	On	Off	V.42 Mode
	Off	Off	Auto-Reliable Mode
3,4			The Flow Control Selection
	3	4	
	On	On	Disable Flow Control
	Off	On	Enable Bidirection Xon/Xoff Flow Control
	On	Off	Enable Unidirection CTS/RTS Flow Control
5,6	Off	Off	Enable Bidirection CTS/RTS Flow Control
			The Line Operation Selection
	5	6	
	On	On	4-Wire Leased Line Operation
	Off	On	2-Wire Leased Line Operation
7	On	Off	Power-On Dial-Up Line Operation
	Off	Off	Dial-Up Line Operation
	On		Enable Dial Backup Function
8	Off		Disable Dial Backup Function
	On		Non-Redundancy Code Modulation
	Off		Trellis Code Modulation

DIP-SWITCH S3:

POSITION	STATE			DESCRIPTION
1,2	1	2		DTR Operation Selection
	On	On		Ignore DTR
	Off	On		Reserved
	On	Off		DTR following ITU V.24/108.1 Recommendation
	Off	Off		DTR following ITU V.24/108.2 Recommendation
3	On	Ignore RTS		
	Off	RTS following ITU V.24/105 Recommendation		
4,5,6	Synchronous/Asynchronous Operation Mode Selection			
	4	5	6	
	On	On	On	Synchronous Mode with External Clock
	Off	On	On	Synchronous Mode with Slave Clock
	On	Off	On	Synchronous Mode with Internal Clock
	Off	Off	On	Asynchronous Mode with 8 bits Character Length
	On	On	Off	Asynchronous Mode with 9 bits Character Length
	Off	On	Off	Asynchronous Mode with 10 bits Character Length
	On	Off	Off	Asynchronous Mode with 11 bits Character Length
	Off	Off	Off	Reserved
7	On	Dump Mode		
	Off	Smart Mode		
8	On	V.25bis Command		
	Off	AT Command		

DIP-SWITCH S4:

POSITION	STATE				DESCRIPTION
1	On	Read Dip-Switch for Power On Configuration			
	Off	Read NVRAM for Power On Configuration			
2	Reserved				
3,4	Transmit Level Selection for Dial-Up Line Operation				
	3	4			
	On	On			-4 dBm
	Off	On			-6 dBm
	On	Off			-8 dBm
Off	Off			-10 dBm	
5,6,7,8	Transmit Level Selection for Leased Line Operation				
	5	6	7	8	
On	On	On	On	0 dBm	

Off	On	On	On	-2 dBm
On	Off	On	On	-4 dBm
Off	Off	On	On	-6 dBm
On	On	Off	On	-8 dBm
Off	On	Off	On	-10 dBm
On	Off	Off	On	-12 dBm
Off	Off	Off	On	-14 dBm
On	On	On	Off	-16 dBm
Off	On	On	Off	-18 dBm
On	Off	On	Off	-20 dBm
Off	Off	On	Off	-22 dBm
On	On	Off	Off	-24 dBm
Off	On	Off	Off	-26 dBm
On	Off	Off	Off	-28 dBm
Off	Off	Off	Off	-30 dBm

Modem Installation

Installing Your Modem

1. Look for a location for the modem.
A suitable location for the modem is one that is near the power outlet and close to the telephone line and your computer. It should be placed on a sturdy level surface where there is enough space for unimpeded operation.
2. Check the modem's settings.
You must check the modem carefully to make sure that all the DIP switches and the front panel switches are in proper position. Please refer to the sections before on this chapter for details on the modem's settings.
3. Connect the modem to the telephone line.
The modem has a terminal block or RJ-45 connector which allows user to connect 2-wire PSTN, 4-wire leased line or 2-wire leased line.
 - a. The PSTN Line:

Connect the "RING" and "TIP" of PSTN line to the positions marked LA and LB.

b. The Telephone Set Line:

Connect the "RING" and "TIP" of telephone set line to the positions marked PA and PB.

c. The 4-Wire Leased Line:

Connect the transmitting pair of 4-wire leased line to the positions marked TXA and TXB, connect the receiving pair of 4-wire leased line to the positions marked RXA and RXB.

d. The 2-Wire Leased Line:

Connect the 2-wire leased line to the positions marked TXA and TXB.

It should be used in conjunction with the DIP switches to set the line type of the modem, otherwise it might fail to make connections.

The SG position is used to connect the signal ground to other equipments, the FG position is used to connect the framing ground of the power source.

4. Connect the modem to the computer.

Your modem provides a 25-pin RS-232C serial port connector which is used to connect the modem to any of the serial ports on your computer or terminal. Please make sure that the computer or terminal has been turned off before you connect the modem with it.

5. Connect the modem to the power adapter and the power source.

Make sure the power switch of the modem is in "OFF" position and plug the power adapter to the power socket of your modem. Plug the other end of the power cable into the power source.

Installation Check

Turn the power switch to "ON" position. Check the modem's front panel to determine its current operating state. If there is no problem with the

installation, the modem will automatically enter the command state when you turn on the power.

Another way to check if your modem has been properly installed is to use a proper communication software to input the following commands from your computer or terminal to the modem:

<Enter>

ATZ <Enter>

If your modem is functioning properly, it will respond with the message "OK". However, if this message fails to appear, turn off your modem and computer or terminal, and check all the steps detailed in section "Installing Your Modem". When you are certain that the modem is correctly installed, repeat the procedure listed above. If the modem still do NOT response, please contact your dealer.

CHAPTER 3

MORE ABOUT THE MODEM

This chapter describes a few concept about the modem, the user should read this chapter carefully to avoid miss understanding or confusing about the modem's function.

The Modem Mode

The modem has three basic modes: the command mode, data mode and escape mode. In the command mode you can enter command to the modem to set registers, parameters and carry out a variety of dialing and control functions. Details about commands are given in Chapter 4.

In the data mode, you can transmit and receive data over the telephone line to another remote modem. The data mode can be further subdivided into three modes. The first is the originate mode under which the modem originates a call; the second is the answer mode, under which the modem answers the incoming call. The third is the self-diagnostic mode, under which the transmitted data is looped back through the modem, allowing evaluation of the modem's performance and line condition.

When the modem is in data mode, if you issue the escape character (defined in S register 2) three times with the guard time (defined in S register 12), the modem will enter escape mode. In the escape mode, the modem will not drop the line but entering the command mode. Any characters that coming from the DTE will be treated as command rather than data and will be executed after "ENTER" character has been received. But some of the AT commands can not be excuted during the escape mode, such as ATDn, ATA, AT&Wn etc.

The Modem Port and Serial Port

Modem port means data link between two modems, serial port means data link between computer or terminal(DTE) and modem(DCE). The modem port and serial port of the modem are independent. There are buffers between modem and serial ports, so different speeds are possible. The following sections discuss these related concepts.

Automatic Speed Matching

Automatic speed matching matches the speed of the modem port to the speed of the remote modem. A connection can be established between two modems even if the two modems are not initially set to the same speed. If the remote modem is not capable of automatic speed matching, a connection may or may not be established, depending on the speed to which both modems are set. The connection speed may be determined by the originating or the answering speed. The resulting connection speed will be shown on the terminal as below:

CARRIER 28800

PROTOCOL: LAP-M

COMPRESSION: V.42BIS

CONNECT 115200

The ***CARRIER 28800*** means the modem is connecting to a remote modem in ITU-T V.34, which allows user to transmit or receive data at 28800bps. The ***PROTOCOL: LAP-M*** means the modem has negotiated with the remote modem and established an ITU-T V.42 connection. The ***COMPRESSION: V.42BIS*** indicates that the two modems are using ITU-T V.42bis to do data compression. Finally, the ***CONNECT 115200*** shows that the modem is using 115200bps to communicate with the DTE. These result codes may or may not be shown on the terminal screen depending on the setting of the modem.

The modem supports three methods of automatic speed matching:

1. Multi-mode Handshake

The multi-mode handshake (ATN1) follows the ITU-T multi-mode handshake recommendation, which can provide full range of speed to connect to the other modem. That means whatever speed (protocol) the modem is set to, the modem can connect to BELL 103/212A and ITU-T V.21, V.22, V.23, V.22bis, V.32, V.32bis, V.34 without changing speed. This feature is convenience for the user to connect to an unknown modem.

2. ITU-T V.8 Multi-mode Handshake

The modem supports ITU-T V.8 multi-mode handshake. The V.8 will cause the answering modem to send a "ANSam" signal and if the originate modem is capable of V.8, it response with "CM". After that both modems will begin a protocol handshake to determine modulation method, error correction protocol and whether using cellular connection. When all the condition is cleared, both modem begin the preselected ITU-T handshake. This procedure makes the modems connect faster than the old ITU-T multi-mode hadshake.

If the modem can not detect an "ANSam" or "CM" signal from the remote modem, the modem will abort the ITU-T V.8 handshake and using other method to connect.

3. Fix-mode Handshake

If you want to connect to the remote modem with a particular speed, then the fix-mode handshake (ATN0) is useful for you. Using the fix-mode handshake will cause the modem to use the DTE speed to make connection. The connection speed will not exceed the DTE speed, it can only perform the auto fallback from V.34 28800bps to V.34 2400bps or V.32bis 14400bps to V.32 4800bps or V.22bis 2400bps to V.22 1200bps.

Another way to determine the connection speed is the S register 37. Setting the S register 37 to a none zero value will cause the modem to connect to particular speed regardless of the DTE speed and will also perform the same auto fallback as describes above.

Flow Control

Flow control is the ability to turn on and turn off the flow of information between transmitting devices. Most computers and terminals support flow control. However, if the terminal device does not support flow control, it (flow control) should be disabled on both the modem port and the terminal serial port. You should also operate the terminal serial port at the same speed with the actual connection speed.

The modem can receive and transmit data over the serial port at a speed different from the modem port. If the serial port operates at a speed greater than the modem port, the buffer fills to capacity. If the computer

or terminal attached to the serial port of the modem supports flow control, there is no loss of data when the buffer fills.

Flow control is achieved by using two methods - software flow control and hardware flow control.

Software Flow Control

The modem supports two types of software flow control, the first is the unidirectional flow control and the second is the bi-directional flow control. In unidirectional software flow control, only the modem can control the terminal's data flow. `XOFF` and `XON` characters are sent by the modem to the local or remote computer. The `XOFF` character (Determined by S register 33) signals the local or remote computer to pause the flow of data while the `XON` character (Determined by S register 32) signals the local or remote computer to resume the flow of data. The bi-directional software flow control uses `XOFF` and `XON` characters to control both the modem's and the computer's or terminal's data flow. Your modem supports software flow control on both the modem port and the serial port; it also supports hardware flow control on the serial port.

When flow control is enabled on the modem port, the serial port, an `XOFF` character received over the communication lines, causes the modem port to stop transmitting data from the modem buffer to the communication lines. If the local device attached to the serial port continuously sends data, the buffer eventually fills. When this happens, the modem sends an `XOFF` character from the serial port to instruct the local device to stop transmitting data. In effect, the local device will stop send data and will only restart sending when it receives an `XON` message from the remote system.

Hardware Flow Control

The modem supports two types of hardware flow control - the unidirectional and the bi-directional hardware flow control. The unidirectional hardware flow control is similar to the `XON/XOFF` unidirectional software flow control. It accomplishes flow control by turning ON and OFF of CTS (Clear-to-send) signal. When the CTS signal is turned OFF, the local device will cease to send data to the serial port of the modem; data transmission will only be resumed when the CTS signal is turned ON.

Bi-directional flow control uses both the CTS (Clear-to-Send) and the RTS (Request-to-Send). The RTS signal works in the same manner as the

CTS signal, i.e. the modem stops sending data to the serial port of the local device when the RTS signal is turned OFF, and resumes sending data only when RTS signal is turned ON. For most of the applications, the unidirectional hardware flow control is sufficient. Examples of these applications are systems primarily involved in downloading files. For applications that need to support file uploading and do not support XON/XOFF flow control, bi-directional hardware flow control is recommended so that the local device can also control the flow of data from the modem.

The modem also supports hardware flow control using DTR (Data-Terminal-Ready) and DSR (Data-Set-Ready) signal in the RS-232. The DTR signal works in the same manner with the RTS signal and the DSR signal works in the same manner with the CTS signal when setting the modem to do DTR/DSR hardware flow control.

The Modem Operating Mode

The modem operating mode determines how the modem communicates with the remote modem. The modem operating modes are: direct mode, normal mode and error correction mode. These modes are described below:

Direct Mode

A direct mode connection is equivalent to any standard 28800bps modem connection. In a direct mode connection, the maximum throughput is equal to the connection rate, and the terminal (DTE) rate must always match the connection rate. For instance, if the DTE is set to 28800bps (CARRIER 28800), the throughput will not exceed 28800bps. On the other hand, if the DTE is set to 28800bps and the modem falls back to a 9600bps connection (CARRIER 9600), the terminal must be adjusted to operate at 9600bps, and the throughput will never exceed 9600bps.

The flow control (AT&K) command is ignored when the modem is set to direct mode. The serial port speed is always adjusted to the connection speed of the modem port.

Normal Mode

In a Normal mode connection, the modem provides data buffers. This allows the terminal speed to be different from the connection speed. However, the maximum modem-to-modem throughput continues to be equal to the connection rate. For instance, if the DTE is set to 115200bps and the modem connects at 28800bps (CARRIER 28800), then as long as the DTE does not overflow the transmit buffer, data will pass intact, and the terminal speed must remain at 115200bps. Throughput will not exceed 28800bps.

Since it is difficult to ensure that the DTE will not overflow the transmit buffer, two methods are provided to indicate to the DTE whether it can send data to the modem or not. These two methods are hardware flow control and software flow control. When hardware flow control is enabled, the RS-232 control line CTS is controlled by the modem; it indicates to the DTE whether it can send data or not. When software flow control is enabled, the modem sends control characters (XON/XOFF) to the DTE to do flow control. Conversely, the DTE may also indicate to the modem's ability to receive data by RTS, an RS-232 control line in hardware flow control or by XON/XOFF software flow control characters.

Error Correction Mode

The modem support ITU-T V.42 error correction protocol. When configured to V.42, the modem looks for incoming protocol of V.42 from the remote modem and try to establish an error correction connection. The modem will provide data buffer so that the terminal speed may be different from the connection speed. It also provides error detection and error correction. Flow control must be activated when in error correction mode.

The ITU-T V.42/V.42bis

The ITU-T V.42 supports two methods of error correction: LAP-M and, as a fallback, Alternative Protocol (MNP4 compatible). The modem offers a negotiation technique for determining and establishing the best method of error correction between two modems. This technique involves two phases: the detection phase and the negotiation phase. In the detection phase, which occurs immediately after the establishment of the modem handshake, the communicating modems exchange a sequence of detection patterns to verify that both modems support the error-correction technique. In the negotiation phase, which follows the

detection phase, the communicating modem exchange configuration information to make a best connection. When the modem originates a call, it will send a detection pattern and wait for the answering modem to respond. If the answering modem responds, they will enter the negotiation phase; if the answering modem does not respond, the originating modem will send the alternative handshake pattern and try to make the alternative connection.

If the detection phase fails, or negotiation does not achieve the desired connection type, the modem can hang up, fallback to alternative protocol (MNP4), or fallback to a standard asynchronous mode. Desired action to take is selected with S register 36. Since MNP does not support a detection phase, the selection of MNP must be made as a force fallback of V.42 with S register 48 and 36.

S48 -- The V.42 Negotiation Action Register

The negotiation process determines the capabilities of the remote modem. If the capabilities of the remote modem are known and negotiation is unnecessary, this process can be bypassed if desired. The following options are selectable using S register 48:

- S48 =7 Enables negotiation (Default)

- S48 =0 Disables negotiation; bypass the detection and negotiation phases; and process with LAP-M.

- S48 =128 Disables negotiation; bypass the detection and negotiation phases; and proceed at once with the fallback action specified in S register 36. This option can be used to force the modem to use MNP to communicate.

S36 -- The V.42 Negotiation Fallback

S register 36 specifies the action to take when the desired connection cannot be made. The options are:

S36 =0 Modem disconnects

S36 =1 Modem stays on line and a Direct mode connection is established

- S36 =3 Modem stays on line and a Normal mode connection is established
- S36 =4 An MNP connection is attempted; if it fails, the modem disconnects
- S36 =5 An MNP connection is attempted; if it fails, a direct connection is established
- S36 =7 An MNP connection is attempted; if it fails, a normal connection is established (Default)

These fallback options are initiated immediately on connection if S register 48 = 128.

This register can be used with S register 48 = 128 to set the modem to MNP mode only. For example:

Modem with S48=128	FUNCTION
S36=4	An MNP is attempted; if fails, disconnects.
S36=5	An MNP is attempted; if fails, a Direct mode is made.
S36=7	An MNP is attempted; if fails, a Normal mode is made.

S46 --Data Compression Protocol Selection

This register selects whether the data compression is effective or not:

- S46 = 136 Execute the error correction protocol without data compression.
- S46 = 138 Execute the error correction protocol with data compression.

The GIII Fax Function

The modem supports the ITU-T V.27ter/V.29 and V.17 for GIII fax. It uses the EIA Class 1 and Class 2 command for compatibility of most communication software. It can support from 2400bps to 14400bps GIII Fax speed.

The Voice Function

The modem optionally supports VOICE function. The voice function include a voice pass-through mode which allows the host to transmit and receive audio signals. It uses an ADPCM voice coder and decoder for compression and decompression. It can compress and decompress voice signals to allow efficient digital storage of voice messages. Using this voice option with the voice application software to achieve the voice function such as answering machine, voice on demand, and voice mail function.

CHAPTER 4

AT COMMAND GUIDELINES

Introduction

This chapter gives you a detailed explanation of commands available. The commands include the Hayes AT command set and some other commands that control extra functions. An alphabetical listing of commands is listed below:

Command Syntax

The command must be preceded by "AT" (ATtention code) except A/ and "+++" escape commands. AT can be entered as upper or lower case characters, and can NOT be deleted by backspace or delete keys. The attention code is used by the modem to determine the speed and data format of the incoming data from DTE.

More than one command can be entered in one command line and may be separated by space for readability. The command line can NOT exceed 40 characters excluding the attention code and must be ended by the ASCII character specified by S register 3. The default of the S register 3 is the decimal 13 -- "Carriage Return". A line without carriage return will be ignored. Commands following the AT are processed after receiving the "Carriage Return" character, and the space added for readability will be ignored.

Any parameters following the AT command that were ignored will be treated as equal to 0.

AT Command Summary

ATA	Manual Answer.....	4-4
A/	Repeat Last Command.....	4-4
ATBn	Select ITU-T/BELL Mode.....	4-4
ATDn	Dial.....	4-4
ATEn	Echo Command.....	4-6
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ATIn	Identification Command.....	4-6
ATLn	Speaker Volume Control.....	4-7
ATMn	Speaker Control.....	4-7
ATNn	Set Multi-or Fix-Mode Handshake.....	4-7
ATOn	Return to On-Line Mode.....	4-8
ATP	Set Pulse Dial.....	4-8
ATQn	Result Code Command.....	4-8
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ATT	Set Tone Dial.....	4-9
ATVn	Result Code Type.....	4-9
ATWn	Negotiation Progress Message Command.....	4-11
ATXn	Extended Result Codes.....	4-11
ATYn	Long Space Disconnect.....	4-11
ATZn	Reset.....	4-12
AT&Cn	Serial Port DCD Control.....	4-12
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AT&Fn	Restore Factory Setting.....	4-12
AT&Gn	Select Guard Tone.....	4-13
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AT&Ln	Telephone Line Type Select Command.....	4-13
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AT&Rn	Serial Port RTS Option Command.....	4-15
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AT&Un	Trellis Coding Modulation Selection Command.....	4-16
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AT&Wn	Store Current Configuration.....	4-16
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AT&Zn=m	Store Telephone Number.....	4-17
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AT\Rn	Serial Port Ring Indicator Control.....	4-21
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AT+MS	Select Modulation.....	4-23
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AT)Mn	Power Level Adjust Command.....	4-27
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AT-Kn	MNP Extended Services.....	4-28
AT-Qn	Enable Fallback to V.22bis/V.22.....	4-28
AT@Mn	Initial Cellular Power Level Setting.....	4-29
AT:En	Compromise Equalizer Enable Command.....	4-29

AT Command Set

ATA -- Manual Answer

The modem will go off-hook and attempt to answer an incoming call if correct conditions are met. Upon successful completion of answer handshake, the modem will go on-line in answer mode. The modem will enter the connect state after exchanging carrier with the remote modem. If no carrier is detected within the period specified in S register 7, the modem hangs up. Any character entered during the connect sequence will abort the connection attempt.

ATA/ -- Repeat Last Command

There is no need to type <Return>, after the "/" has typed, the modem executes the last executed command immediately.

ATBn - Select ITU-T/BELL Mode

When the modem is configured to line speed of 300 or 1200 bps, the modem will select BELL or ITU-T modulation according to the parameter supplied. Any other line speed will use an ITU-T modulation recommendation.

- ATB0 Selects ITU-T recommendation at 300 or 1200 bps during call establishment and a subsequent connection. **(Default)**
- ATB1 Selects BELL standard at 300 or 1200 bps during call establishment and a subsequent connection.

ATDn -- Dial

This command directs the modem to go off-hook, dial according to the string "n" entered and attempt to establish a connection in originate mode. If no dial string is supplied, the modem will go off-hook and attempt the handshake in originate mode.

The modem will have up to the period of time specified by S register 7 to wait for carrier and complete the handshake. If this time expires before the modem can complete the handshake, the modem will go on-hook with the "NO CARRIER" response. This command will be aborted in progress upon receipt of any DTE character before completion of the

handshake, if the AT*K0 command is issued.

Dial Modifies

The valid dial string parameters are described below. Punctuation characters may be used for clarity, with parentheses, hyphen, and spaces being ignored.

0-9	Dialing digits 0 to 9.
*	The "star" digit. (tone dialing only)
#	The "gate" digit. (tone dialing only)
A-D	DTMF digits A , B , C , and D .
J	Perform MNP 10 link negotiation at 1200bps. (for this call only)
K	Enable power level adjustment during MNP 10 link negotiation. (for this call only)
L	Re-dial last number. The modem will re-dial the last valid telephone number. The "L" must be immediately after the D with all the following characters ignored.
P	Select pulse dialing. Pulse dial the numbers that follow until "T" is encountered.
T	Select tone dialing. Tone dial the numbers that follow until a "P" is encountered.
R	This command will be accepted, but not acted on.
S=n	Dial the number stored in the directory (n = 0 to 5). (See AT&Zn=m)
!	Flash, the modem will go on-hook for a time defined by the value of S register 29.
W	Wait for dial tone. The modem will wait for dial tone before dialing the digits following "W". If no dial tone is detected within the time specified by S register 7, the modem will abort the rest of the sequence, return on-hook, and generate an error message.
@	Wait for silence. The modem will wait for at least 5 seconds of silence in the call progress frequency band before continuing with the next dial string parameter. If the modem does not detect these 5 seconds of silence before the expiration of the call abort timer (S register 7), the modem will terminate the call attempt with a "NO ANSWER" message. If busy detection is enabled, the modem may terminate the call with the "BUSY"

result code. If answer tone arrives during execution of this parameter, the modem handshakes.

& Wait for AT&T "bong" tone for credit card dialing before continuing with the dial string. If bong is not detected within the time specified by S register 7, the modem will abort the rest of the sequence, return on-hook, and generate an error message.

, Dial pause. The modem will pause for a time specified by S register 8 before dialing the digits following ",".

; Return to command state. Added to the end of a dial string, this causes the modem to return to the command state after it processes the portion of the dial string preceding the ";". This allows the user to issue additional AT commands may be placed in the original command line following the ";", and/or may be entered on subsequent command lines. The modem will enter call progress only after an additional dial command is issued without the ";". terminator. Use ATH0 to abort the dial in progress, and go back on-hook.

^ Enable calling tone. Applicable to current dial attempt only.

ATEn -- Echo Command

The modem enables or disables the echo of characters to the DTE according to the parameter supplied.

ATE0 Disables command echo
 ATE1 Enables command echo (**Default**)

ATHn -- Hang Up The Telephone Line

ATH0 Directs the modem to disconnect the remote modem and hang-up (**Default**)
 ATH1 Causes the modem to go off-hook.

ATI n -- Identification Command

ATI0 Reports product code "28800".
 ATI1 Reports a pre computed checksum, in the format of "Checksum: XXX".
 ATI2 Performs the calculation of ROM checksum and check with

the pre computed checksum. If correct, reports "OK"; if not reports "ERROR".

ATI3 Reports firmware revision in the format of "28800 Version SA X.X".

ATI4 Reports model name, EPROM version, issue date.

ATI5 Reports country code, area code.

ATI6 Reports DATA PUMP version.

Returns the identification code and checksum result of the modem.

REMARK: 14400bps Modem Function

For the 14400bps modem, it reports "14400" when ATIO command is received. It reports "14400 Version SB X.X" when ATI3 command is received.

ATLn -- Speaker Volume Control

The modem uses software volume control to avoid poor contact of the volume VR. The volume is divided into 3 steps, described below:

ATL0,L1 Low speaker volume
 ATL2 Medium speaker volume (**Default**)
 ATL3 High speaker volume

ATMn -- Speaker Control

ATM0 Speaker always off
 ATM1 Speaker on until the modem receives a carrier (**Default**)
 ATM2 Speaker always on
 ATM3 Speaker off while dialing, then on until the modem receives a carrier

Controls the speaker. Immediately takes effect upon execution.

ATNn -- Set Multi- or Fix- Mode Handshake

ATN0 Fix-mode handshake. The connection speed depends on the DTE speed or S register 37 speed. It can NOT connect with higher speed modem. The remote modem must have the ability to fall back if using higher speed than your

modem.

ATN1 Multi-mode handshake. Follows the recommendation of
ITU- T multi-mode handshake. It can automatically change
the connection speed to make most efficient connection.

(Default)

ATN3 Same as ATN1 but without V.23 mode.

This command controls the handshake method of the modem. When the modem is set to answer mode, it usually sets to multi-mode handshake (ATN1) to get the most effective connection. If the remote modem's speed is known, you can set the modem to fix-mode handshake and adjust the DTE speed to meet the remote modem's speed to reduce the time needed for handshake.

ATOn -- Return to On-Line Mode

This command determines how the modem will enter the on-line data mode. If the modem is in the escape (on-line command) mode, whether enters the on-line data mode with or without retrain. If the modem is in the off-line command mode (no connection), ERROR is reported.

ATO0 Enters on-line data mode without a retrain. Generally, if a connection exists, this command connects the DTE back to the remote modem after an escape (+++).

ATO1 Enters on-line data mode with a retrain before returning to on-line data mode.

ATQn -- Result Code Command

ATQ0 Sends result codes to the local system. **(Default)**

ATQ1 Prohibits the modem from sending result codes to the local system.

Some of the central site computers do not recognize the result code of the modem, please use the ATQ1 command to disable the result code of the modem.

ATSr=n -- Change The Content of S Register

ATSr=n r indicates the number of S register.
 n indicates the content of S register.

ATSr Select S register

AT? Read pre-selected S register

AT=n Change the content of pre-selected S register to n.

This command can change the content of S register. The content, n, should be in decimal form.

ATSr? Read the content of S register r

This command causes the modem to return a 3 digits decimal number indicates the content of the specified S register. The r indicates the number of the S register.

ATVn -- Result Code Type

ATV0 Selects short (digit) form result codes.

ATV1 Selects long (verbose) form result codes. **(Default)**

The command result code is reported in two ways. The first is the long form, is reported in verbose type result code. This is easy to read for user. The second is the short form, is reported in numeric digit form. This is useful for the software programmer to identify during program application.

The result code is also divided into standard and extended result codes. The standard result code is reported while the ATX0 command is issued. The extended result code is reported while other ATXn parameter is issued. Some other result codes are reported upon ATW1 command issued. The detail result codes are listed below:

Short Form	Long Form	Standard	Extended
0	OK	*	
1	CONNECT	*	
2	RING	*	
3	NO CARRIER	*	
4	ERROR	*	
5	CONNECT 1200		*
6	NO DIALTONE		*
7	BUSY		*
8	NO ANSWER		*

9	CONNECT 0600	*
10	CONNECT 2400	*
11	CONNECT 4800	*
12	CONNECT 9600	*
13	CONNECT 7200	*
14	CONNECT 12000	*
15	CONNECT 14400	*
16	CONNECT 19200	*
17	CONNECT 38400	*
18	CONNECT 57600	*
19	CONNECT 115200	*
22	CONNECT 1200TX/75RX	*
23	CONNECT 75TX/1200RX	*
40	CARRIER 300	*
44	CARRIER 1200/75	*
45	CARRIER 75/1200	*
46	CARRIER 1200	*
47	CARRIER 2400	*
48	CARRIER 4800	*
49	CARRIER 7200	*
50	CARRIER 9600	*
51	CARRIER 12000	*
52	CARRIER 14400	*
53	CARRIER 16800	*
54	CARRIER 19200	*
55	CARRIRE 21600	*
56	CARRIER 24000	*
57	CARRIER 26400	*
58	CARRIER 28800	*
59	CONNECT 16800	*
61	CONNECT 21600	*
62	CONNECT 24000	*
63	CONNECT 26400	*
64	CONNECT 28800	*
66	COMPRESSION: CLASS 5	*
67	COMPRESSION: V.42 bis	*
69	COMPRESSION: NONE	*
70	PROTOCOL: NONE	*
77	PROTOCOL: LAPM	*
80	PROTOCOL: ALT	*
81	PROTOCOL: ALT-CELLULAR	*
+F4	+FCERROR	*

ATWn -- Negotiation Progress Message Command

This command controls the format of CONNECT messages.

ATW0 Upon connection, the modem reports only the DTE speed

(e.g., CONNECT 57600). Subsequent responses are disabled.
(Default)

ATW1 error Upon connection, the modem reports the line speed, the correction protocol, and the DTE speed, respectively. Subsequent responses are disabled.

ATW2 Upon connection, the modem reports the DCE speed (e.g., CONNECT 14400). Subsequent responses are disabled.

ATXn -- Extended Result Codes

ATX0 The modem ignores dialtone and busy tone when dialing. Sends standard result codes when a connection is completed regardless of connection speed.

ATX1 The modem ignores dialtone and busy tone. Sends extended result codes when a connection is made.

ATX2 The modem ignores busy tone. Sends "NO DIALTONE" if no dialtone is detected in 5 seconds of a dial attempt.

Sends extended result codes when a connection is made.

ATX3 The modem ignores dial tone. Sends "BUSY" if busy tone is detected. Sends extended result codes when a connection is made.

ATX4 The modem sends "NO DIALTONE" if no dialtone is detected in 5 seconds of a dial attempt. Sends "BUSY" if busy tone is detected. Sends extended result codes when a connection is made. **(Default)**

ATYn -- Long Space Disconnect

This command sets the modem whether to disconnect when a space of 1.6 seconds or more is received from the remote modem or not.

ATY0 Disables the long space disconnect feature **(Default)**

ATY1 Enables the long space disconnect feature

ATZn -- Reset

The reset command performs the following:

1. Disconnects the telephone line.
2. Performs self-test diagnostics.
3. Clears the modem and serial port buffer.

4. Restores the profiles that stored in NVRAM.
5. Reads configuration switches.
6. Enters the command mode.

The ATZ command can also select the profile 0 or 1 to recall. Key in ATZ or ATZ0 will cause the modem to recall profile 0, ATZ1 will cause the modem to recall profile 1.

+++ -- The Escape Code

The Escape Code returns the modem to the command state from the online state, without releasing the telephone line. This command consists of an escape guard time (defined by S register 12, default 1 second) and an escape character (ASCII code of which is specified in S register 2, default '+'). The escape character must be entered three consecutive times with a guard time before and after the three characters.

The modem returns to the local command state and sends the result code "OK" without releasing the telephone line connections.

Also see the "ATOn" and "AT&D1" commands

AT&Cn -- Serial Port CD Control

- AT&C0 Sets CD always ON
- AT&C1 Sets CD to follow the state of carrier **(Default)**
- AT&C2 Sets CD ON except during disconnect (3~5 sec.)

Controls the CD signal of the serial port. Use this command to achieve special effects to meet the need of central site computers.

AT&Dn -- Serial Port DTR Control

- AT&D0 Assumes DTR ON.
- AT&D1 Enters command mode on detecting ON-to-OFF transition of DTR.
- AT&D2 Goes ON-HOOK on detecting ON-to-OFF transition of DTR. **(Default)**
- AT&D3 Resets the modem on detecting ON-to-OFF transition of DTR.

Controls the action on detecting the ON-to-OFF transition of DTR. You can use this command to meet the special requirements for terminals or computers.

AT&Fn -- Restore Factory Setting

The factory default setting is stored on the EPROM; whatever the modem sets, you can always return to default setting by this command.

AT&F0 Restore factory configuration 0 **(Default)**
AT&F1 Restore factory configuration 1

The AT&F0 restores the default settings in each AT command description. The AT&F1 restores the AT&D2S0=1S95=44 command and the others are the same as AT&F0.

AT&Gn -- Select Guard Tone

AT&G0 Disables guard tone **(Default)**
AT&G1 Disables guard tone
AT&G2 Selects 1800 Hz guard tone

AT&Kn -- Serial Port Flow Control

AT&K0 Disables local flow control.
AT&K1 Enables unidirectional RTS/CTS hardware flow control.
AT&K2 Enables unidirectional XON/XOFF software flow control.
AT&K3 Enables bi-directional RTS/CTS hardware flow control.
(Default)
AT&K4 Enables bi-directional XON/XOFF software flow control.
AT&K5 Enables transparent XON/XOFF software flow control.
AT&K6 Enables both RTS/CTS and XON/XOFF flow control.
(Default for fax mode)
AT&K7 Enables bi-directional DTR/DSR hardware flow control.
AT&K8 Enables unidirectional DTR/DSR hardware flow control.

This command controls the type of flow control between the modem and the serial port of the computer or terminal. When the modem connects to the remote modem using normal mode, or error correction mode, the data flow between the modem and the serial port should be controlled by flow control to avoid data loss. If the modem connects to remote modem using direct mode, this command will be ignored. Please refer to Chapter 3 for

detail of flow control.

AT&Ln -- Telephone Line Type Select Command

- AT&L0 Disables leased line operation, enables PSTN operation.
 (Default)
- AT&L1 Enables 2-wire leased line operation, disables PSTN
 operation.
- AT&L2 Enables 4- wire leased line operation, disables PSTN
 operation.

AT&Mn -- Asynchronous/Synchronous Mode Selection

This command determines the asynchronous or synchronous operating mode. The modem treats the &M command as subset of the &Q command.

- AT&M0 Selects direct asynchronous operation. **(Default)**
- AT&M1 Selects synchronous data mode with Async. off-line
 command mode.
- AT&M2 Selects synchronous data mode with Async. off-line
 command mode. Same as &M1 except that &M2 enables
 DTR dialing of stored telephone number at location 0. The
 modem will disconnect if DTR is OFF for more than the
time period in S register 25 (in units of hundredths of a
second); the data connection will be synchronous.
- AT&M3 Selects synchronous data mode. This mode allows DTR to
 act as Voice/Data switch. The call is manually initiated
while DTR is inactive. When DTR becomes active, the
handshake proceeds in originate or answer mode according to
the front panel LCD's setting.

AT&Pn -- Select Pulse Dial Make/Break Ratio

This command determines the Make/Break ratio used during pulse dialing. It has no effect in tone dialing.

- AT&P0 Selects 39%-61% Make/Break ratio at 10 pulses per second.
- AT&P1 Selects 33%-67% Make/Break ratio at 10 pulses per second.
 (Default)
- AT&P2 Selects 39%-61% Make/Break ratio at 20 pulses per second.

AT&P3 Selects 33%-67% Make/Break ratio at 20 pulses per second.

AT&Qn -- Select Communication Mode

This command selects synchronous or asynchronous, error control or normal mode operation.

AT&Q0 Communicates in asynchronous mode.
AT&Q1 Communicates in synchronous mode 1 -- Async.-to-Sync.
AT&Q2 Communicates in synchronous mode 2 -- stored number dial.
AT&Q3 Communicates in synchronous mode 3 -- voice/data switch.
AT&Q4 Selects AutoSync. Set S registers 19, 20, and 25 to the desired values before selecting AutoSync operation with &Q4. After the CONNECT message is issued, the modem waits the period of time specified by S register 25 before examining DTR. If DTR is ON, the modem enters the synchronous operating state; if DTR is OFF, the modem terminates the line connection and returns to the asynchronous command state. Stopping AutoSync. AutoSync operation is stopped upon loss of carrier or the ON-to-OFF transition of DTR. Loss of carrier will cause the modem to return to the asynchronous command state and either do not terminate the line connection (AT&D1 active) or terminate the line connection (any other AT&Dn command active).
AT&Q5 Communicates in error correction mode. **(Default)**
AT&Q6 Communicates in asynchronous mode with automatic speed buffering -- for interfaces requiring constant speed between the DTE and DCE.

AT&Rn -- Serial Port RTS/CTS Option Command

AT&R0 CTS follows RTS at all time **(Default)**
AT&R1 Assumes CTS always on

This command selects the CTS option of the serial port. Some of the DTE need to set different options, you can select AT&R0 or AT&R1 according to the specification of DTE. This command effects only in synchronous mode and asynchronous direct mode. In V.25bis operation, the CTS acts according to V.25bis recommendation.

AT&Sn -- Serial Port DSR Control Command

AT&S0 DSR remains ON at all time **(Default)**
AT&S1 DSR follows the ITU-T recommendation
AT&S2 DSR follows carrier

AT&Tn -- Loop Test Functions

AT&T0 Ends loop test
AT&T1 Local analog loop back
AT&T3 Local digital loop back
AT&T4 Responds to remote digital loop back request **(Default)**
AT&T5 Ignores remote digital loop back request.
AT&T6 Initiates ITU-T remote digital loop back
AT&T7 Remote digital loop back with self-test
AT&T8 Local analog loop back with self-test

AT&Un -- Trellis Coding Modulation Selection Command

This command selects whether to use trellis coding modulation or not. Using trellis coding modulation will provide up to 4 dB of extra noise immunity improve data reliability in V.32 mode. Both the local and remote modem should be set to enable to ensure trellis coding modulation takes place.

AT&U0 Enables trellis coding modulation **(Default)**
AT&U1 Disables trellis coding modulation

AT&V -- View Profiles and Stored Telephone Number

This command shows the active configuration, and four user profiles.

AT&Wn -- Store Current Configuration

AT&W0 Saves current configuration at user profile 1, including commands and registers. **(Default)**
AT&W1 Saves current configuration at user profile 2, including commands and registers.
AT&W2 Saves current configuration at user profile 3, including commands and registers.
AT&W3 Saves current configuration at user profile 4, including commands and registers.

AT&Xn -- Select Synchronous Clock Source

Selects the source of the transmit clock for the synchronous mode operation.

In asynchronous mode, the transmit and receive clocks are turned OFF. In synchronous mode, the clocks are turned ON with the frequency of 1200 Hz or faster corresponding to the speed that is selected for modem operation.

- AT&X0 Selects internal clock. The modem generates the transmit clock signal and applies it to the TXCLK output at the serial interface. **(Default)**
- AT&X1 Selects external clock. The local DTE causes the transmit clock signal on the XTCLK input of the serial interface. The modem applies this clock to the TXCLK output at the serial interface.
- AT&X2 Selects slave receive clock. The modem drives the transmit clock signal from the incoming carrier and applies it to the TXCLK output at the serial interface.

AT&Yn -- Power On Profile Selection Command

This command selects the prestored profile 0 or 1 to recall when turn ON the power of the modem. This command has NO effect when issuing the ATZ command, the user should use the ATZ0 or ATZ1 to recall profile when software reset.

- AT&Y0 Recalls profile 1 when power on (Default)
- AT&Y1 Recalls profile 2 when power on
- AT&Y2 Recalls profile 3 when power on
- AT&Y3 Recalls profile 4 when power on

AT&Zn = m -- Store Telephone Number

AT&Zn = m The n indicates the telephone number locations, is valid within 0 to 9. The m is a dial string of up to 35 characters. Valid dial string characters are 0 to 9, dial modifiers and for tone dialing #, *. Modem will ignore invalid characters and truncate dial strings longer than 35 characters. This command must be the last one on a command

The line quality is reported in three decimal digits, range from 000 to 128. The modem will return "ERROR" if not connected to the remote modem.

AT%Rn -- Ring Back Message Command

AT%R0 Disables ring back message (**Default**).

AT%R1 Enables ring back message

If issues the AT%R1 command, the modem will return the "RING BACK" or "102"(depending on the ATVn command) message to indicate the ring back signal.

AT\An -- Select Maximum MNP Block Size

The modem will operate an MNP error correction link using a maximum block size controlled by the parameter supplied.

AT\A0 The maximum MNP block size to be 64 characters

AT\A1 The maximum MNP block size to be 128 characters
(Default)

AT\A2 The maximum MNP block size to be 192 characters

AT\A3 The maximum MNP block size to be 256 characters

AT\Bn -- Transmit Break to Remote

In non-error correction mode, the modem will transmit a break signal to the remote modem with a length in multiples of 100 ms according to parameter n specified. If a number in excess of 9 is entered, 9 is used. The command works in conjunction with the S register 82.

In error correction mode, the modem will signal a break through the active error correction protocol, giving no indication of the length. The modem will return a "NO CARRIER" result code if not connected.

Note: When the modem receives a break from the remote modem, break is

passed to the DTE as follows: In direct mode , the break length is passed; in normal mode and in error correction mode, a 300 ms break is passed.

AT\F -- View Stored Telephone Number

This command shows the content of the four stored telephone numbers.

AT\Gn -- Modem Port Flow Control

AT\G0 Disables modem port flow control (**Default**)

AT\G1 Enables modem port flow control

If enables the modem port flow control, the modem will use the XON/XOFF characters to do the flow control. This command only valids when the modem is in normal mode, has no effect during error correction or direct mode connection.

AT\Kn--Break Control

Controls the response of the modem to a break received from the DTE or the remote modem or the \B command according to the parameter supplied. The default of this command is AT\K5. The response is different in three separate states, describe below:

	Break received from DTE while in connect state during on line mode	\Bn command received from DTE while in on line command state	Break received from remote modem while in connect state during non error corrected connection
\K0	Enter on line command mode, no break sent to the remote modem	Purge buffers, immediately send break to remote modem	Purge buffers, immediately send break to DTE
\K1	Clear data buffers and send break to remote modem	Purge buffers, immediately send break to remote modem	Purge buffers, immediately send break to DTE
\K2	Same as 0	Immediately send break to remote modem	Immediately send break to DTE
\K3	Immediately send break to remote modem	Immediately send break to remote modem	Immediately send break to DTE
\K4	Same as 0	Send break to remote modem with data	Send break to DTE in sequence with

			data
\K5 (Default)	Send break to remote modem in sequence with transmitted data.	Send break to remote modem with data	Send break to DTE in sequence with data

AT\Nn - Operating Mode

This command controls the preferred error correcting mode to be negotiated in a subsequent data connection. This command has the similar function with the S register 36 and 48 and AT&Qn command. Changing this command will affect these registers and command's content.

- AT\N0 selects normal speed buffered mode (disables error-correction mode)
- AT\N1 Selects direct mode and is equivalent to &M0, &Q0 mode of operation (Forces &Q0)
- AT\N2 Selects reliable (error-correction) mode. The modem will first attempt a LAP-M connection and then an MNP connection. Failure to make a reliable connection results in the modem hanging up (Forces &Q5, S36=4, and S48=7)
- AT\N3 Selects auto reliable mode. This operates the same as \N2 except failure to make a reliable connection results in the modem falling back to the speed buffered normal mode (Forces &Q5, S36=7, and S48=7) **(Default)**
- AT\N4 Selects LAP-M error-correction mode. Failure to make a LAP-M error-correction results in the modem hanging up. (Forces &Q5 and S48=0)
Note: The AT-K1 command can override the AT\N4 command.
- AT\N5 Selects MNP error-correction mode. Failure to make an MNP error-correction connection results in the modem hanging up. (Forces &Q5, S36=4 and S48=128)

AT\Rn -- Serial Port Ring Indicator Control

- AT\R0 Keeps the ring indicator ON for the duration of the telephone call **(Default)**
- AT\R1 Turns OFF the ring indicator after the telephone call is

answered

This command controls the RS-232C pin No.22 (ITU-T V.24 No.125 signal, Calling Indicator). You can set this pin to always ON or ON until answered during the telephone call.

AT\S -- Modem Status Display

This command displays the active command setting and lists the command. The following is an example of the screen display when the AT\S command is issued:

```
AT+MS Report:11,1,2400,28800
Protocol :11 (V.34)
Mode :1 (Auto with V.8)
Min. Speed: 2400
Max. Speed: 28800
```

```
DTE SPEED: 115200 bps, DATA BITS: 8 PARITY: NONE STOP BIT: 1
```

```
DCE SPEED: Idle
```

```
LINK LAYER PROTOCOL: Idle
```

```
COMPRESSION: Idle
```

```
LAST DIAL NUMBER=T 886 2 999-5155
```

CMD	DESCRIPTION	OPTION	CMD	DESCRIPTION	OPTION
B1	BELL OR ITU-T.....	.....Bell	E1	COMMAND ECHO....	.....On
L1	SPK VOLUME.....	.....Low	M1	SPK MODE.....	.....Mode 1

Press ESC to stop or press ANY KEY to continue.....

CMD	DESCRIPTION	OPTION	CMD	DESCRIPTION	OPTION
N1	MULTI MODE.....	.....Auto mode	T	DIAL MODE.....	.....Tone dial
Q0	QUIET MODE.....	.....Off	V1	VERBOSE MODE.....	.....On
W0	NEGO PROGRES MSG	.....DTE	X4	RESULT CODE TYPE	.....Mode 4
Y0	LONG SPACE DISC..	.....Off	&C0	DCE OPTION.....	.....Always on
&D0	DTR OPTION.....	.....Always on	&G0	GUARD TONE.....	.....Off
&K3	FLOW CONTROL.....	.....RTS/CTS	&L0	LINE MODE.....	.....PSTN
&P0	PULSE RATE.....	39%-61% 10pps	&Q5	CONNECT MODE.....	..Error Correct
&R1	RTS/CTS.....	.....Always on	&S0	DSR OPTION.....	.....Always on
&U0	V.32 9600 TCM.....	.....On	&X0	SYNC CLOCK.....	.....Internal
&Y0	POWER ON PROFILE	.....Profile 0	%C3	COMPRESSION.....	..Enable Both
%E2	AUTO RETRAIN.....	..Enable+FF/FB	%L	LINE LEVEL.....	.....Idle
%Q	LINE QUALITY.....	.....Idle	%R0	RINGBACK OPTION..	.....Off
\A1	MNP BLOCK SIZE..	.....128	\G0	MODEM FLOW CNTRL	.....Off

```

\K5  BREAK CONTROL... ..Mode 5    \L0  MNP BLOCK XFER.. ..Mode 0
\R1  R1 OPTION..... ..Follow ring )M0  MNP10 PWR ADJUST ..Off
*K0  MNP10 LINK SPEED ..Highest  *K0  KEY INTERRUPT..... ..On
-K0  MNP10 EXT SERVE.. ..Off      @M26 MNP10 XMIT LEVEL ..-26 dbm
-R1  RTS OPTION..... ..Normal

```

Press ESC to stop or press ANY KEY to continue.....

CMD	DESCRIPTION	OPTION	CMD	DESCRIPTION	OPTION
-Q1	MNP10 FBACK 2400	.....On	:E1	COMPROM EQUILIZER	.....On
S000	RINGS TO ANSWER...	.....000	S001	RING COUNTER.....	.....000
S002	ESCAPE CHAR.....	.....043	S003	<CR> CHAR.....	.....013
S004	<LF> CHAR.....	.....010	S005	<BS> CHAR.....	.....008
S006	WAIT DIAL TONE.....	.....002	S007	WAIT CARRIER.....	.....050
S008	PAUSE TIME.....	.....002	S009	CARRIER RESPONSE..	.....006
S010	CARRIER LOS DISC...	.....014	S011	DTMF DURATION.....	.....095
S012	ESC GUARD TIMER...	.....050	S018	TEST TIMER.....	.....000
S020	AUTOSYNC CHAR.....	.....000	S024	SLEEP INACT.....	.....000
S025	DELAY TO DTR OFF..	.....005	S026	RTS TO CTS DELAY...	.....001
S029	FLASH DIAL TIMER...	.....070	S030	CONNECT INACT.....	.....000
S032	XON CHAR.....	.....017	S033	XOFF CHAR.....	.....019
S037	LINE CONNECT SPD...	.....000	S038	HANGUP DELAY.....	.....020
S046	COMPRESS CONTROL	.....138	S048	V42 NEGO. CONTROL	.....007
S082	BREAK CONTROL.....	.....128	S086	CALL FAILURE COD...	.....000
S091	PSTN XMIT LEVEL....	.....010	S092	FAX XMIT LEVEL.....	.....010
S099	L.L XMIT LEVEL.....	.....010			

OK

AT*Kn -- Keyboard Interrupt Command

AT*K0 Enables keyboard interrupt during handshake (**Default**)
AT*K1 Disables keyboard interrupt during handshake

This command controls the keyboard interrupt function. After the modem enters the waiting for handshake state, if any character coming from the terminal to the modem before the handshake has finished, the modem will drop the telephone line and return the "NO CARRIER" result code. If your system will send characters during the handshake sequence, please use this command to disable the keyboard interrupt. This command controls only in AT command mode. If you set the modem to power on operation, V.25bis or dumb mode, the modem will ignore AT*Kn command and act as disable keyboard interrupt.

AT-Rn--Serial Port RTS Option

AT-R0 Ignore RTS signal (**Default**)
AT-R1 RTS action follows RS-232 definition.

AT+MS=?

The response is:

(list of supported <mod> values), (list of supported <automode> values), (list of supported <min_rate> values), (list of supported <max_rate> values)

For example:

(0,1,2,3,9,10,11,64,69,74), (0,1), (300-28800), (300-28800)

Sub Parameter Definitions

1. <mod>= A decimal number which specifies the preferred modulation (automode enabled) or modulation (automode disabled) to use in originating or answering a connection.

The options are:

<mod>	Modulation	Possible Rates (bps)	Notes
0	V.21	300	
1	V.22	1200	
2	V.22 bis	2400 or 1200	
3	V.23	1200	See Note 1
9	V.32	9600 or 4800	
10	V32 bis	14400, 12000, 9600, 7200, or 4800	
11	V.34	28800, 26400, 24000, 21600, 19200, 16800, 14400, 12000, 9600, 7200, 4800, or 2400	Default
64	Bell 103	300	
69	Bell 212	1200	
74	V.FC	28800, 26400, 24000, 21600, 19200, 16800, or 14400	

The modem may also automatically switch to another modulation (automode), subject to the following constraints:

- a. There is no standard way to switch from Bell to ITU-T in automode.
- b. The DTE may disable automode operation. (see <automode>)

below)

- c. The DTE may constrain the range of modulations available by specifying the lowest and highest rates. (see <min_rate> and <max_rate> below)

2. <automode> is an optional numeric value which enables or disables automatic modulation negotiation using ITU-T V.8 or ITU-T multi-mode handshake. The options are:

<automode>	Option Selected	Notes
0	Automode disabled	
1	Automode enabled using V.8 or multi-mode	Default

The default value is 1, which enables automode. Note, however, there are modulations for which there is no automatic negotiation, e.g., Bell 212 (<mod>=69).

For <automode> = 0 (automode disabled, i.e., fixed modulation):

- a. If <max_rate> is within the rates supported by the selected modulation, the selected rate is that specified by <max_rate>.

For example:

AT+MS=9,0,1200,4800 selects V.32 4800 bps fixed rate.

- b. If <max_rate> is greater than the highest speed supported by the modulation specified by <mod>, the starting rate is the highest rate supported by the selected modulation. For example:

AT+MS=9,0,2400,14400 selects V.32 9600 or 4800 bps.

- c. To emulate issuance of the ATN0S37=x command sequence to select fixed mode operation, specify the <max_rate> and <min_rate> both to be the (same) requested speed, and <mod> to be the modulation for that speed. For example:

AT+MS=11,0,16800,16800 selects V.34 16800 bps fixed mode (no comparable S register 37 value).

AT+MS=9,0,12000,12000 selects V.32bis 12000 bps fixed mode (same as ATN0S37=10).

For <automode> = 1 (automode enabled, i.e., automatically select speed and modulation):

The modem connects at the highest possible rate in accordance with V.8, or multi-mode if V.8 is not supported by the remote modem.

- a. If <max_rate> is greater than the highest rate supported by the modulation specified by <mod>, the modem autotmodes down from the highest rate of the selected modulation. For example:

AT+MS=10,1,1200,24000 selects automoding down from V.32bis 14400 bps.

- b. To emulate issuance of the ATN1S37=x sequence command, specify the modulation and the rate to start automoding down from using <mod> and <max_rate>, respectively. Set <min_rate> to 300 to allow automoding all the way down to V.21 300 bps. For example:

AT+MS=11,1,300,16800 selects automode starting at V.34 16800 bps (no comparable S register 37 value).

AT+MS=9,1,300,12000, selects automode starting at V.32bis 12000 bps (same as ATN1S37=10).

3. <min_rate> is an optional number which specifies the lowest rate at which the modem may establish a connection. The value is decimal coded, in units of bps, e.g., 2400 bps. The default is 300 for 300 bps.
4. <max_rate> is an optional number which specifies the highest rate at which the modem may establish a connection. The value is decimal coded, in units of bps, e.g., 14400 bps. specifies the highest rate to be 14400 bps. The default is 28800 for 28800 bps.

REMARK: 14400bps Function

The 14400bps modem do not support the AT+MS command. To change the protocol and connect mode, please use the ATN1S37=m and ATNn command.

MNP 10 COMMAND SET

AT)Mn -- Power Level Adjust Command

Enables or disables adjustment of the transmit power level to accommodate the signalling requirements of cellular telephone equipment.

AT)M0 Disables power level adjustment during MNP 10 link negotiation. The AT)M0 command will allow the transmitter adjustment if cellular operation is requested by the remote modem.**(Default)**

AT)M1 Enables power level adjustment during MNP 10 link negotiation.

NOTE: AT)M1 should not be used with AT*H2.

AT*Hn -- Link Negotiation Speed

This command controls the connection speed for link negotiations before upshift occurs between two MNP 10 modems.

AT*H0 Link negotiation occurs at the highest supported speed.
(Default)

AT*H1 Link negotiation occurs at 1200bps; used primarily for establishing cellular connections.

AT*H2 Link negotiation occurs at 4800bps; used primarily to negotiate an MNP 10 connection on less than average quality telephone lines.

AT-Kn -- MNP Extended Services

Enables or disables conversion of a V.42 LAP-M connection to an MNP 10 connection.

AT-K0 Disables V.42 LAP-M to MNP 10 conversion. **(Default)**

AT-K1 Enables V.42 LAP-M to MNP 10 conversion.

AT-K2 Enables V.42 LAP-M to MNP 10 conversion; inhibits MNP Extended Services initiation during V.42 LAP-M answer modem detection phase.

AT-Qn -- Enable Fallback to V.22bis/V.22

Enables or disables fallback from MNP 10 to V.22bis/V.22.

AT-Q0	Disables fallback to 2400 bps (V.22bis) and 1200 bps (V.22). Fallback is enabled only to 4800 bps.
AT-Q1	Enables fallback to 2400 bps (V.22bis) and 1200 bps(V.22). (Default)

When the modem is connected to V.34, the AT-Q0 command cause the modem to fallback to V.34 2400bps; the AT-Q1 command cause the modem to fallback to V.22 1200bps.

AT@Mn -- Initial Cellular Power Level Setting

Sets the initial transmit power level for upshift at connect until line conditions can be determined. AT@M0 corresponds to -26dBm, AT@M1 corresponds to -30dBm, AT@M2 through AT@M10 correspond to -10dBm, and AT@M11 through AT@M31 corespond to -11dBm to -31dBm, respectively.

AT@M0	-26 dBm (Default)
AT@M1	-30 dBm
AT@M2 to AT@M10	-10 dBm
AT@M11	-11 dBm
AT@M12	-12 dBm
.	.
.	.
.	.
AT@M30	-30 dBm
AT@M31	-31 dBm

AT:En -- Compromise Equalizer Enable Command

Enables or disables the V.32 compromise equalizer. This command can be used when the modem is attached to either a flat line or a cellular connection.

AT:E0	Disables the equalizer
AT:E1	Enables the equalizer (Default)

CHAPTER 5

REGISTERS

Introduction

This chapter describes each register and explains how to change its value. Some registers control a single function while others control several functions and are bit mapped. Bit-mapped registers are recommended for reading modem status only.

Commands to Change or Read Registers

- ATSn=??? Changes the value of a register.
"n" = number of register
??? = new value of register in decimal
- AT = ??? Changes the value of the last referenced register.
??? = new value
- AT? Displays the value of the last referenced register.
- ATSn Points to new register.
"n" = number of register to point
- ATSn? Displays the contents of the register selected with n.
"n" = number of register to point.

The modem uses registers to store configuration status. Some of the registers control only one function, but some of them are called bit mapped registers which control several functions in single register.

Table 5-1 summarizes the functions of each register used by the modem:

Register	Function Description	Default	Range	Units
S0	Rings to Auto-Answer	1	0-255	Rings
S1	Ring Counter	0	0-255	Rings
S2	Escape Character	43	0-127	ASCII

S3	Carriage Return Character	13	0-127	ASCII
S4	Line Feed Character	10	0-127	ASCII
S5	Backspace Character	8	0- 32	ASCII
S6	Wait Time for Dial Tone	2	2-255	Sec.
S7	Wait Time for Carrier	45	1-255	Sec.
S8	Pause Time for Dial Delay	2	0-255	Sec.
S9	Carrier Detect Response Time	6	1-255	.1 Sec.
S10	Delay for Hanging Up after Carrier Loss	14	0-255	.1 Sec.
S11	DTMF Duration and Spacing	95	50-255	.001 Sec.
S12	Escape Code Guard Time	50	0-255	.02 Sec.
S14	Bit Mapped Register			
S16	Bit Mapped Register			
S18	Test Timer	0	0-255	Sec.
S19	Bit Mapped Option			
S20	AutoSync HDLC Address or BSC Sync. Character	0	0-255	
S21	Bit Mapped Register			
S22	Bit Mapped Register			
S23	Bit Mapped Register			
S25	Delay to DTR	5	0-255	.01 Sec.
S26	RTS to CTS Delay Interval	1	0-255	.01 Sec.
S27	Bit Mapped Register			
S28	Bit Mapped Register			
S29	Flash Dial Modifier Timer	70	0-255	.01 Sec.
S30	Inactivity Timer	0	0-255	10 Sec.
S31	Bit Mapped Options Status			
S32	XON Character	17	0-255	ASCII
S33	XOFF Character	19	0-255	ASCII
S36	Negotiation Fallback	7	0-7	
S37	Desired Line Speed	0	0-12	
S38	Delay before Forced Hang up	5	0-255	Sec.
S39	Bit Mapped Options Status			
S40	Bit Mapped Options Status			
S41	Bit Mapped Options Status			
S46	Data Compression Selection	138	136 or 138	
S48	Negotiation Selection	7	0,7, or 128	
S82	Break Signaling Control		(For compatibility only)	
S86	Call Failure Reason Code		0,4,5,9,12,13,14	
S91	PSTN Transmit Attenuation Level	10	0-15	dB
S92	Fax Transmit Attenuation Level	10	0-15	dB
S95	Negotiation Message Options	0		
S99	Leased Line Transmit Attenuation Level	10	0-31	dB
S201	Cellular Transmit Level	58		
S211	Restore Timer	60	0-255	Minute
S212	Backup Timer	60	1-255	Second

Table 5-1 Modem S-registers

Register Description

S0 Number of Rings to Auto-Answer

Sets the number of rings required before the modem automatically answers a call. Setting this register to zero disables the auto-answer function.

Range: 0-255, rings

Default: 1

S1 Ring Counter

S1 is incremented each time the modem detects a ring signal on the telephone line. S1 is cleared if no rings occur over an eight seconds interval.

Range: 0-255, rings

Default: 0

S2 Escape Character

S2 holds the decimal value of the ASCII character used as the escape character. The default value corresponds to an ASCII "+". A value over 127 disables the escape process, i.e., no escape character will be recognized.

Range: 0-127, ASCII decimal

Default: 43 (+)

S3 Carriage Return Character

Sets the command line and result code terminator character. Pertains to asynchronous operation only.

Range: 0-127, ASCII decimal

Default: 13 (Carriage Return)

S4 Line Feed Character

Sets the character recognized as a line feed. Pertains to asynchronous operation only. The Line Feed control character is output after the Carriage Return control character if verbose result codes are used.

Range: 0-127, ASCII decimal

Default: 10 (Line Feed)

S5 Backspace Character

Sets the character recognized as a backspace. Pertains to asynchronous operation only. The modem will not recognize the Backspace character if it is set to a value that is greater than 32. This character can be used to edit a command line. When the echo command is enabled, the modem echoes back to the local DTE the Backspace character, an ASCII space character and a second Backspace character, this means a total of three characters are transmitted each time the modem processes the Backspace character.

Range: 0-32, ASCII decimal

Default: 8 (Backspace)

S6 Wait Time for Dial Tone before Blind Dialing, or after "W" Dial Modifier

Sets the length of time, in seconds, that the modem will wait before starting to dial after going off-hook when blind dialing. The "Wait for Dial Tone" call progress feature (W dial modifier in the dial string) will override the value in S register 6.

The modem always pauses for a minimum of 2 seconds, even if the value of S register 6 is less than 2 seconds.

Range: 2-255, seconds

Default: 2

S7 Wait Time for Carrier after Dial, for Silence, or for Dial Tone after "W" Dial Modifier

1. Sets the length of time, in seconds, that the modem will wait for carrier before hanging up. The timer is started when the modem finishes dialing (originate), or 2 seconds after going off-hook

(answer). In originate mode, the timer is reset and restart upon detection of answer tone.

2. Sets the length of time, in seconds, that modem will wait for silence when encountering the @ dial modifier before continuing with the next dial string parameter.

Range: 1-255, seconds

Default: 45

S8 Pause Time for Dial Delay

Sets the time, in seconds, that the modem must pause when the “,” dial modifier is encountered in the dial string.

Range: 0-255, seconds

Default: 2

S9 Carrier Detect Response Time

Sets the time, in tenths of a second, that the carrier must be present before the modem considers it valid and turns on CD signal. As this time is increased, there is less chance to detect a false carrier due to noise from the telephone line.

Range: 1-255, tenths of a second

Default: 6 (0.6 second)

S10 Delay for Hang Up after Carrier Loss

This delay time allows the carrier to momentarily disappear without causing the modem to disconnect. Both modems should have equal values in S register 10, otherwise disconnect occurs when the lower value is reached. If the modem can NOT disconnect the line correctly, please adjust the register to a lower value. If the modem disconnects the line very often, please adjust the register to a higher value. If the modem connect to V.32 or above protocols, this register is ignored. The modem will use line quality to disconnect the telephone line.

Range: 0-255, tenths of a second

Default: 14 (1.4 seconds)

S11 DTMF Duration and Spacing

This register controls the duration and spacing of DTMF tones. The content of this register representing the duration and spacing between DTMF tones generated during tone dialing.

Range: 50-255, milliseconds

Default: 95 (95 milliseconds)

S12 Escape Code Guard Time

Sets the time delay which must be present before and after entering the three characters escape code sequence (+++). Set this guard time to zero will disable the escape feature.

Range: 0-255, 1/50 of a second

Default: 50 (1 second)

S14 Bit Mapped Options Status

Indicates the status of command options.

Bit 0 --	Reserved
Bit 1 --	Command echo (En) 0 = Disabled (E0) 1 = Enabled (E1) (Default)
Bit 2 --	Quiet mode (Qn) 0 = Sends result codes (Q0) (Default) 1 = Does not send result codes (Q1)
Bit 3 --	Result codes (Vn) 0 = Digit (V0) 1 = Verbose (V1) (Default)
Bit 4 --	Keyboard Interrupt command (*Kn) 0 = Enables keyboard interrupt (*K0) (Default) 1 = Disables keyboard interrupt (*K1)
Bit 5 --	Tone (T)/Pulse (P) 0 = Tone (T) (Default) 1 = Pulse (P)
Bit 6 --	Trellis Coding Modulation selection (&Un) 0 = Enables trellis coding modulation (&U0) (Default) 1 = Disables trellis coding modulation (&U1)
Bit 7 --	Originate/Answer 0 = Answer 1 = Originate (Default)

S16 Bit Mapped Test Options Status

Indicates the test in progress status.

Bit 0 --	Local Analog Loop Back 0 = Disabled (Default) 1 = Enabled (&T1)
Bit 1 --	Reserved
Bit 2 --	Local Digital Loop Back 0 = Disabled (Default) 1 = Enabled (&T3)
Bit 3 --	Remote Digital Loop Back (RDL) status 0 = Modem not in RDL (&T5) (Default) 1 = RDL in progress (&T4)
Bit 4 --	RDL requested 0 = RDL not requested (Default) 1 = RDL requested (&T6)
Bit 5 --	RDL with self test 0 = Disabled (Default) 1 = Enabled (&T7)
Bit 6 --	Local Analog Loop Back (LAL) with self test 0 = Disabled (Default) 1 = Enabled (&T8)
Bit 7 --	Reserved

S18 Test Timer

Sets the length of time the modem conducts a diagnostic test. S register 18 is available only when the modem is set to 1200bps or higher. When S register 18 is set to 0, the modem will not end the test. You must enter the AT&T0 command to end the test.

Range: 0-255, seconds

Default: 0

S19 Bit Mapped Options

Defines the options for AutoSync operation (see &Q4 command). S register 19 must be set to the desired value before &Q4 is issued.

Bit 0 --	Reserved
Bit 1 --	BSC/HDLC format selection 0 = BSC selected (Default) 1 = HDLC selected
Bit 2 --	Address detection enable/disable 0 = Disabled (Default)

	1 = Enabled
Bit 3 --	NRZI/NZI coding selection
	0 = NRZI selected (Default)
	1 = NZI selected
Bit 4 --	Idle indicator select
	0 = Mark idle (Default)
	1 = Flag or Sync. idle
Bits 5-7 --	Reserved

S20 AutoSync HDLC Address or BSC Sync. Character

Defines the HDLC address (S register 19 bit 1 = 1) or BSC Sync. Character (S register 19 bit 1 = 0) for AutoSync operation (see &Q4 command). S register 20 must be set to the desired value before &Q4 is issued.

Range: 0-255
Default: 0

S21 Bit Mapped Options Status

Indicates the status of command options.

Bit 0 --	Reserved
Bit 1 --	Ring indicator control (\Rn)
	0 = Ring indicator ON (\R0)
	1 = Ring indicator OFF after answer (\R1) (Default)
Bit 2 --	CTS behavior (&Rn)
	0 = CTS tracks RTS (&R0)
	1 = CTS always on (&R1) (Default)
Bits 3-4 --	DTR behavior (&Dn)
	0 = &D0 selected
	1 = &D1 selected
	2 = &D2 selected (Default)
	3 = &D3 selected
Bits 5-6 --	RLSD (DCD) behavior (&Cn)
	0 = &C0 selected
	1 = &C1 selected (Default)
	2 = &C2 selected
Bit 7 --	Long space disconnect (Yn)
	0 = Y0 selected (Default)
	1 = Y1 selected

S22 Bit Mapped Options Status

Indicates the status of command options.

- Bits 0-1 -- Speaker volume (Ln)
 - 0 = Low (L0, same as L1)
 - 1 = Low (L1) (Default)
 - 2 = Medium (L2)
 - 3 = High (L3)
- Bits 2-3 -- Speaker control (Mn)
 - 0 = Speaker OFF (M0)
 - 1 = Speaker ON until connect (M1) (Default)
 - 2 = Always ON (M2)
 - 3 = ON during handshake (M3)
- Bits 4-6 -- Limit result codes (Xn)
 - 0 = X0 selected
 - 4 = X1 selected
 - 5 = X2 selected
 - 6 = X3 selected
 - 7 = X4 selected (Default)
- Bit 7 -- Ring back message command (%Rn)
 - 0 = Disables ring back message (%R0) (Default)
 - 1 = Enables ring back message (%R1)

S23 Bit Mapped Options Status

Indicates the status of command options.

- Bit 0 -- Grant RDL
 - 0 = RDL not allowed (&T5)
 - 1 = RDL allowed (&T4) (Default)
- Bits 1-3 -- DTE Rate
 - 0 = 0 to 300 bps
 - 1 = 600 bps
 - 2 = 1200 bps
 - 3 = 2400 bps
 - 4 = 4800 bps
 - 5 = 9600 bps
 - 6 = 19200 bps
 - 7 = 38400 bps or higher
- Bits 4-5 -- Assumed DTE parity
 - 0 = Even
 - 1 = Not used
 - 2 = Odd
 - 3 = None (Default)
- Bits 6-7 -- Guard Tone (&Gn)
 - 0 = None (&G0) (Default)
 - 1 = None (&G1)
 - 2 = 1800 Hz (&G2)

S25 Delay to DTR

This register has two functions, describes below:

Normally this S register 25 defines the length of time the modem recognizes a DTR changed. The unit of S register 25 is hundredth of a second.

When sets to AT&Q1, it controls the length of time the modem waits to check DTR after establishing a connection. The unit of S register 25 is second. This allows enough time to disconnect the modem from an asynchronous terminal and attach it to a synchronous terminal without forcing it back to the command mode. After this time delay, the unit of S register 25 is changed to hundredth of a second. All the DTR status changes must last longer than the time specified by S register 25 before the modem recognizes the DTR changed.

Range: 0-255, 1 second for synchronous mode 1 right after connect;
0.01 second otherwise

Default: 5

S26 RTS to CTS Delay Interval

This register controls synchronous mode and asynchronous direct mode only, has no effect in asynchronous normal or error correction mode.

When Clear-To-Send(CTS) tracks Request-To-Send(RTS) and the modem detects an OFF-to-ON transition on RTS, S register 26 sets the length of time the modem waits before turning on CTS. CTS tracks RTS when AT&R0 is set.

Range: 0-255, hundredths of a second

Default: 1

S27 Bit Mapped Options Status

Indicates the status of command options.

Bits 0,1,3 --	Synchronous/asynchronous selection (&Mn/&Qn)			
	Bit3	Bit1	Bit0	
	0	0	0	&M0 or &Q0 selected
	0	0	1	&M1 or &Q1 selected
	0	1	0	&M2 or &Q2 selected
	0	1	1	&M3 or &Q3 selected
	1	0	0	&Q4 selected
	1	0	1	&Q5 selected (Default)

	1	1	0	&Q6 selected
Bit 2 --	Reserved			
Bits 4-5 --	Synchronous clock selection (&Xn)			
	0 = Internal clock (&X0) (Default)			
	1 = External clock (&X1)			
	2 = Slave clock (&X2)			
Bit 6 --	ITU-T/Bell mode selection (Bn)			
	0 = ITU-T mode (B0)			
	1 = Bell mode (B1) (Default)			
Bit 7 --	Reserved			

S28 Bit Mapped Options Status

Indicates the status of command options.

Bits 0-2 --	Reserved			
Bits 3-4 --	Pulse dialing (&Pn)			
	0 = 39%-61% Make/Break ratio at 10 pulses per second (&P0)			
	1 = 33%-67% Make/Break ratio at 10 pulses per second (&P1) (Default)			
	2 = 39%-61% Make/Break ratio at 20 pulses per second (&P2)			
	3 = 33%-67% Make/Break ratio at 20 pulses per second (&P3)			
Bit 5 --	Reserved			
Bits 6-7 --	MNP Link Negotiation Speed (*Hn)			
	0 = Link negotiation at highest speed (*H0) (Default)			
	1 = Link negotiation at 1200 bps (*H1)			
	2 = Link negotiation at 4800 bps (*H2)			

S29 Flash Dial Modifier Time

Sets the length of time, in units of 10mS, the modem will go on-hook when it encounters the Flash (!) dial modifier in the dial string.

Range: 0-255, 10 mS interval
 Default: 70

S30 Inactivity Disconnect Timer

This register monitors the activity on the line. It specifies the time that the modem waits before hanging up while no data is received or sent. The timer is disabled when set to 0.

Range: 0-255, 10 seconds
Default: 0 (Disabled)

S31 Bit Mapped Options Status

Indicates the status of command options.

For 2842(RM) modem:

Bit 0 --	Reserved
Bits 1 --	0 = Fix-mode (N0) 1 = Multi-mode (N1) (Default)
Bits 2-3 --	0 = W0 (Default) 1 = W1 2 = W2
Bits 4 --	0 = N3 off 1 = N3 on
Bits 5-7 --	Reserved

For 1442(RM) modem:

Bit 0 --	0 = N3 off 1 = N3 on
Bits 1 --	0 = Fix-mode (N0) 1 = Multi-mode (N1) (Default)
Bits 2-3 --	0 = W0 (Default) 1 = W1 2 = W2
Bits 4 --	0 = N2 off 1 = N2 on
Bits 5-7 --	Reserved

S32 XON Character

Sets the value of the XON character for software flow control.

Range: 0-255, ASCII decimal
Default: 17 (CTL-Q)

S33 XOFF Character

Sets the value of the XOFF character for software flow control.

Range: 0-255, ASCII decimal
Default: 19 (CTL-S)

S36 LAP-M Failure Control

This value indicates what should happen upon a LAP-M failure. These fallback options are initiated immediately upon connection if S48=128. If an invalid number is entered, the number is accepted into the register, but S36 will act as if the default value has been entered.

S36 = 0 Modem disconnects

S36 = 1 Modem stays on-line and a Direct mode connection is established

S36 = 2 Reserved

S36 = 3 Modem stays on-line and a Normal mode connection is established

S36 = 4 An MNP connection is attempted and if it fails, the modem disconnects

S36 = 5 An MNP connection is attempted and if it fails, a Direct mode connection is established

S36 = 6 Reserved

S36 = 7 An MNP connection is attempted and if it fails, a Normal mode connection is established.

Default: 7

S37 Desired Line Connection Speed

Desired line connection speed. If an invalid number is entered, the number is accepted into the register, but S register 37 will act as if the default value has been entered.

S37 = 0 Attempts auto mode connection

S37 = 1-3 Attempts to connect at 300 bps

S37 = 4 Reserved

S37 = 5 Attempts to connect at V.22 1200 bps

S37 = 6 Attempts to connect at V.22 bis 2400 bps

S37 = 7 Attempts to connect at V.23 75/1200 bps

S37 = 8 Attempts to connect at V.32 bis/V.32 4800 bps

S37 = 9 Attempts to connect at V.32 bis/V.32 9600 bps

S37 = 10 Attempts to connect at V.32 bis 12000 bps

S37 = 11 Attempts to connect at V.32 bis 14400 bps

S37 = 12 Attempts to connect at V.32 bis 7200 bps

Default: 0

S38 Delay before Forced Hang up

This register specifies the delay between the modem's receipt of the ATH0 command to disconnect (or ON-to-OFF transition of DTR if the modem is programmed to follow the signal), and the disconnect operation. Applicable to error-correction connection only. This register can be used to ensure that data in the modem buffer is sent before the modem disconnects.

1. If S register 38 is set to a value between 0 and 254, the modem will wait that number of seconds for the remote modem to acknowledge all data in the modem buffer before disconnecting. If time expires before all data is sent, the NO CARRIER result code is issued to indicate that the data has been lost. If all data is transmitted prior to time-out, the response to the ATH0 command will be OK.
2. If S register 38 is set to 255, the modem does not time-out and continues to attempt to deliver data in the buffer until the connection is lost or the data is delivered.

Range: 0-255, seconds

Default: 5

S39 Bit Mapped Options Status

- Bits 0-3 -- Flow control option (&Kn)
0 = No flow control (&K0)
1 = Unidirectional RTS/CTS (&K1)
2 = Unidirectional XON/XOFF (&K2)
3 = RTS/CTS (&K3) (Default)
4 = XON/XOFF (&K4)
5 = Transparent XON/XOFF (&K5)
6 = Both methods (&K6)
7 = DTR/DSR (&K7)
8 = Unidirectional DTR/DSR(&K8)
- Bits 4-5 -- DSR option (&Sn)
0 = &S0 selected (Default)
1 = &S1 selected
2 = &S2 selected

S40 Bit Mapped Options Status

Indicates the status of command options.

- Bits 0-1 -- MNP Extended Services (-Kn)
0 = Disable extended services (-K0) (Default)

- 1 = Enables extended services (-K1)
- 2 = Enables extended services (-K2)
- Bit 2 -- Power Level Adjustment for cellular use ()Mn)
 - 0 = Auto-adjustment ()M0) (Default)
 - 1 = Force adjustment ()M1)
- Bits 3-5 -- Break handling (\Kn)
 - 0 = \K0 selected
 - 1 = \K1 selected
 - 2 = \K2 selected
 - 3 = \K3 selected
 - 4 = \K4 selected
 - 5 = \K5 selected (Default)
- Bits 6-7 -- MNP block size (\An)
 - 0 = 64 bytes (\A0)
 - 1 = 128 bytes (\A1) (Default)
 - 2 = 192 bytes (\A2)
 - 3 = 256 bytes (\A3)

S41 Bit Mapped Options Status

Indicates the status of command options.

- Bits 0-1 -- Compression protocol selection (%Cn)
 - 0 = Disabled (%C0)
 - 1 = MNP 5 (%C1)
 - 2 = V.42 bis (%C2)
 - 3 = MNP 5 and V.42 bis (%C3) (Default)
- Bits 2,6 -- Auto retrain and fallback/fall forward (%En)
 - 0 = Retrain and fallback/fall forward disabled (%E0)
 - 1 = Retrain enabled (%E1)
 - 2 = Return and fallback/fall forward enabled (%E2)
- (Default)
- Bit 3 -- Modem-to-modem flow control (\Gn)
 - 0 = Disabled (\G0) (Default)
 - 1 = Enabled (\G1)
- Bit 4 -- Block mode control (\Ln)
 - 0 = Stream mode (\L0) (Default)
 - 1 = Block mode (\L1)
- Bit 5 -- Reserved
- Bit 7 -- Enable fallback to V.22bis/V.22 (-Qn)
 - 0 = Disabled (-Q0)
 - 1 = Enabled (-Q1) (Default)

S46 Data Compression Selection

This register controls whether the data compression takes effect or not.

S46 = 136 Using error correction without data compression.

S46 = 138 Using error correction with data compression.

Default: 138

S48 V.42 Negotiation Action

The V.42 negotiation process determines the capabilities of the remote modem. However, when the capabilities of the remote modem are known and negotiation is unnecessary, this process can be bypassed if desired. If an invalid number is entered, it is accepted into the S register, but S register 48 will act as if 128 has been entered.

S48=0 Disables negotiation; bypass the detection and negotiation phases; and proceed with LAP-M.

S48=7 Enables negotiation.

S48=128 Disables negotiation; bypass the detection and negotiation phases; and proceed at once with the fallback action specified in S register 36. This content can be used to force MNP.

Default: 7

S82 Break Handling Options

S register 82 is for compatibility purpose only, changing this register will not have any affect.

S86 Call Failure Reason Code

When the modem reports a NO CARRIER result code, a value is written to this S register to help determine the reason for the failed connection. S register 86 records the first event that contributes to a NO CARRIER message. The cause codes are:

S86=0 Normal disconnect, no error occurs.

S86=4 Loss of carrier.

S86=5 V.42 negotiation failed to detect an error-correction modem at the other end.

S86=9 The modems could not find a common protocol.

S86=12 Normal disconnect initiated by the remote modem.

S86=13 Remote modem does not respond after 10 re-transmissions of the same message.

S86=14 Protocol violation.

S91 PSTN Transmit Attenuation Level

Sets the transmit attenuation level from 0 to 15 dB for the PSTN mode, resulting in a transmit level from 0 to -15 dBm.

Range: 0 to 15, dB (Corresponding to 0 to -15 dBm transmit level.)
Default: 10 (-10 dBm transmit level)

S92 Fax Transmit Attenuation Level

Sets the transmit attenuation level from 0 to 15 dB for the fax mode, resulting in a transmit level from 0 to -15 dBm.

Range: 0 to 15, dB (Corresponding to 0 to -15 dBm transmit level.)
Default: 10 (-10 dBm transmit level)

S95 Extended Result Codes

The bits in this register can be set to override some of the ATWn command options. A bit set to a "1" in this register will enable the corresponding result code regardless of the ATWn setting.

Bit 0 --	CONNECT result code indicates DCE speed instead of DTE speed
Bit 1 --	Appends /ARQ to CONNECT XXXX result code in error-correction mode (XXXX = bps rate)
Bit 2 --	Enables CARRIER XXXX result code (XXXX = bps rate)
Bit 3 --	Enables PROTOCOL XXXX result code (XXXX = protocol identifier)
Bit 4 --	Reserved
Bit 5 --	Enables COMPRESSION XXXX result code (XXXX = compression type)
Bits 6-7 --	Reserved

S99 Leased Line Transmit Attenuation Level

Sets the transmit attenuation level from 0 to 31 dB for the Leased Line mode, resulting in a transmit level from 0 to -31 dBm.

Range: 0 to 31, dB (Corresponding to 0 to -31 dBm transmit level.)
Default: 10 (-10 dBm transmit level)

S201 Cellular Transmit Level

The bits in this register are set by the AT@Mn and AT:En commands to support cellular connections.

Default: 3AH

Bits 0-4 --	Initial Cellular Power Level Setting (@Mn)
Bit 5 --	Compromise Equalizer Enable Command (:En)
Bits 6-7 --	Reserved

S211 Dial Back-up Restore Timer

This register defines the restore timer when dial back-up enabled. That means when leased line's carrier is lost and the dial up line is connected successfully, this timer starts to count, and when the time is up, the modem will hold the dial up line and switch to leased line try to connect to remote modem.

Range: 0 - 255, Minutes

Default: 60

S212 Dial Back-up Timer

This register defines the time interval that when the modem try to change line type. When dial back-up starts (leased line is lost and try dial up line) or restore starts (dial up line is hold and try leased line), the modem will try each line type for the time interval that define by this register.

Range: 1 - 255, Seconds

Default: 60

CHAPTER 6

ITU-T V.25BIS OPERATION

The modem supports ITU-T V.25bis command. You can use application programs that support V.25bis command to drive the modem.

Configuration of ITU-T V.25bis

To configure your modem to operate at ITU-T V.25bis mode, please follow the procedures below:

1. Set the DTE speed (DIP switch 1-5 to 1-8) to the speed meets your terminal or computer. And set the line speed (DIP switch 1-1 to 1-4) according to the remote modem. Set the operating mode(DIP switch 2-1,2-2) to the desired mode and finally set the DIP switch 4-1 to ON position to let the modem read DIP switch while power on or upon reception of ATZ command.

The above setting can also be set via AT command and S registers and save it using the AT&W command.

2. Set the DIP switch 3-8 to ON to configure your modem to operate at ITU-T V.25bis command mode.
3. Turn the power switch OFF and then ON again to let the modem to read the DIP switches and configure itself to ITU-T V.25bis command mode.

The modem is now ready to operate at ITU-T V.25bis command mode. The AT command is no longer valid, all the actions that you want the modem to perform has to issue by V.25bis command.

ITU-T V.25bis Command Set

The V.25bis command set provides you to do dialing, storage dialing, storage of telephone number, auto answer, manual answer, etc. The command can be entered in either upper or lower cases. Detail descriptions about the command set are listed below:

CRN n Dialing Command

This command dials a telephone number specified by the parameter "n". The "n" in this command is a dial string which includes telephone number 0 to 9, and #, * for tone dialing only, dial modifiers (please refer to Chapter 4 ATD command). Any dial modifier specified in ATD command is valid here in ITU-T V.25bis command mode. There are four extra dial modifiers that V.25bis defined listed below:

- : Same definition as **W** modifier in the ATD command.
- < Same definition as **,** modifier in the ATD command.
- & Same definition as **!** modifier in the ATD command.
- = Same definition as **;** modifier in the ATD command.

CRS m Dialing Stored Number Command

Dials the telephone number that previously stored in memory location "m". The range of "m" is between 0 to 5. You can store these telephone numbers using AT&Z command (please refer to Chapter 4) in AT command mode or using PRN command below.

PRN m;n Store Telephone Number in Location m

This command stores telephone number in memory location "m" for later dialing. It is identical with the AT&Z command in AT command mode. The range of "m" is between 0 to 5. The "n" is a dial string of up to 23 characters. Valid dial string characters are 0 to 9, dial modifiers, and for tone dialing #, *.

RLN Display the Stored Telephone Number

This command shows the six (location 0 to 5) stored telephone numbers. You can use this command to verify the number that you stored.

DIC Disregard Incoming Call

The DIC command disables the auto answer function of the modem in ITU-T V.25bis operation mode.

CIC Connect Incoming Call

This command enables the auto answer function of the modem.

CNL Execute AT Command

This command allows the user to issue and execute the AT command while in the V.25bis command mode.

ITU-T V.25bis Result Code

The result code shows the result of the command been executed. Detail descriptions of the result codes are showed below:

RESULT CODE	DESCRIPTION
-----	-----
--	
VAL	Command valid and executed successfully.
INV	Command error, can not be executed.
CNX m	Modem connect to the remote modem. The "m" indicate the DCE speed.
INC	Ring signal detected.
CFI m	Failure of dialing, the "m" represents the meanings below: ET Line busy RT No answer CB Local modem busy NT No carrier NS Memory location is empty, no telephone number stored
LSN m;n	AB Receive interrupt while dialing Display the stored telephone numbers, "m" indicates the memory location of the telephone number, "n" indicates the telephone number.

HDLC Sync. Operation of ITU-T V.25bis

Use the DIP switch 3-8 to ON to configure your modem to operate at V.25bis mode. Turn the power switch OFF and then ON again to let the modem to read the DIP switches and configure itself to ITU-T V.25bis command mode. To use the HDLC command and indications are the

same as the V.25bis command above. You have to use the format of HDLC (High-level Data Link Control):

....	|Flag	|Address	|Control	| Message	| FCS	|Flag	|.....
Flag-----	Opening/Closing flag-----			01111110 (7EH)				
Address-----	Address Field-----			11111111 (FFH)				
Control-----	Control Field-----			00000011 (03H)or				
					00010011 (13H)			
Message-----	Command to or Response from modem							
FCS-----	Frame check-Sequence							

The message is 8 bit ASCII code. The modem will ignore the parity bit when received the V.25bis command from DTE. The modem sends 7 data bits and odd parity to computer when the modem responses to DTE.

The control field of each response should be 03H, and the last response should be 13H, if the responses are multiple.

CHAPTER 7

DIAL BACK-UP OPERATION

The modem provide dial back-up function. You can use this function to ensure the data's continuity of leased line operation if your data is important. If leased line is malfunctioned, the modem will automatically dial the stored number in NVRAM, and try to connect to dial up line in order to continue data transmission.

The data transmission must stop during the process of telephone line change, flow control is essential to avoid data lose while dial back-up function is activated.

Preparation

- 1、 Use the AT command (AT&Zn=m) to store the remote telephone number into the NVRAM of the modem. Upto six telephone numbers can be stored.
- 2、 Connect the leased line and dial-up line to the rear panel connectors, please refer to Chapter 2 "Modem Rear Panel" for detail connect information.
- 3、 Change the content of the registers S211、 S212 according to the system requirement. Register S211 is the dial back-up automatically restore timer, the unit is minute and the default is 60 minutes; register S212 is the dial back-up timer, the unit is second and the default is 60 seconds.
- 4、 Use the AT command or DIP switch 2-3 to 2-7 to activate flow control and set the modem to 4-Wire or 2-Wire leased line operation and activate the dial back-up function.

Dial Back-up Operation

If the leased line quality is not good enough to maintain data transmitting, the modem will retrain and if retrain fails, the modem will lose carrier. The originate modem will automatically dial the stored telephone number

in NVRAM, from 0 to 5. If the time interval that specified by register S212 cannot connect (Default: 60 seconds), the modem will go back to leased line and try again to connect and so on until the modem connect successfully.

If the dial up line connect successfully, the modem will begin to transmit data. If the time interval of the register S211 is achieved (Default: 60 minutes), the modem will automatically stop transmitting and change the dial up line to leased line and try to connect. The dial line will be hold. If the leased line connect successfully, the dial back-up sequence will be ended and the dial up line will be hanged up. If the connection is failed after the time interval that specified by the register S212, the modem will go back to dial up line and await the next time interval that specified by the register S211 to achieve.

If you want the modem to manually restore to the leased line, please use the front panel switch V/D to hang-up the dial up line during dial back-up mode and entering restore sequence.

CHAPTER 8

SPECIAL FUNCTIONS

The modem includes four special functions that offer more applications and secure protections for users. These functions are only on the modem equip with EPROM version upper than 2.0. The details of four special functions are listed below:

- . **Connection Security**
- . **Callback Security**

Connection Security:

This function is designed specially for people who need security connection. The connection modems have to be model 2842(RM) or 1442(RM) and the same password when this function activated. (please refer to AT * PC for password setting) When the modems connect, it will confirm password each other. If the password check is passed, the modems enter data mode. If not, hang up. This action has no need to enter password, it will confirm right after connection automatically.

The AT Commands for Connection Security:

AT * OP—Set Connection Security

This command controls the ON/OFF of the connection security. You need to enter password to turn ON or OFF the function.

AT * PC - Change the Password of the Connection Security

The length of the password are 5 digits. You can use this command to change the password. The factory default is "modem".

Call Back Security:

This function is designed for restricted user group. The user have to use

particular phone line and password to connect. This modem can store 20 sets of password and telephone number. The length of password are 10 digits and telephone number are 20 digits. You can use colon sign " : " to separate the password and telephone number.

- 1、 Enter password and call back telephone number and then activate call back security function at the answer modem.
- 2、 The user dial for connection, the answer modem will ask to enter password (The terminal of the originate modem shows: ENTER PASSWORD:). After the originate user keyin the correct password, the answer modem will hang-up and call the corresponding telephone number. (The terminal of the answer modem shows: CHECK OK and CALL BACK IN PROGRESS)
- 3、 If you enter wrong password, The answer modem will ask password for two more times. Each entry has a time limit of 20 seconds. The modem will hang-up automatically when the third wrong password has entered.

This function can be simplified for only password protection. To accomplish this function, enter the password follows the colon sign " : " and then <CR> using AT * S command. After entering the password, the answer modem will check for password only and will NOT hang-up and call back anymore.

AT Commands for Call Back Security:

AT * E - Set Call Back Security

This command controls the ON/OFF of call back security. Only the answer modem is needed to activate the call back security.

- * E0 / * E : Call back security disabled
- * E1 : Call back security enabled (**default**)

Remark:

Please enter at least one set of the password before

activating the call back security function to ensure the modem answers correctly.

AT * L - Call Back Security Password List

The modem will display all the passwords and telephone numbers after reception of this command.

AT * S - Store the Call Back Password and Telephone Number

This command stores the password and telephone number for call back security. The length of the password is 10 digits and the telephone number is 20 digits. The command format is listed below:

AT * Sn= <password> : <telephone number> <CR>

Where n=0 to 19

If only the password and the colon sign been input, the modem will do the password check only.