



# SPT 173X/SPT 183X Wide Area Network



## Developer's Guide

***SPT 173X/SPT 183X  
WAN Developer's Guide***

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*Revision A*

*May 2002*



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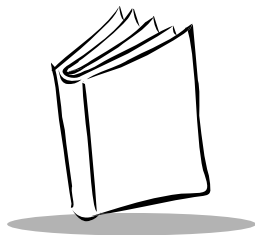
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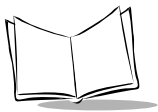
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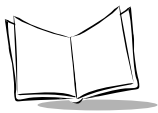
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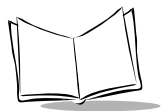
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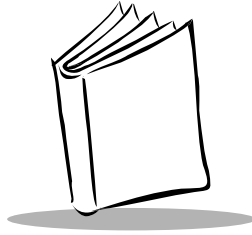
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## *SPT 173X/SPT 183X WAN Developer's Guide*



## About This Guide

The *SPT 173X/SPT 183X WAN Developer's Guide* provides general information for developers creating WAN applications for the SPT 173X or SPT 183X terminals.

### Chapter Descriptions

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Topics covered in this guide are as follows:

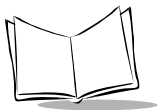
- [Chapter 1, \*SPT 1733/PPT 2733 CDPD\*](#), provides development and programming information for the Novatel Wireless Technology CDPD modem.
- [Chapter 2, \*WWAN\*](#), provides supplemental information for developers of the SPT 1734/1834 with GSM wireless option. Additional information will be added to this guide as the content of the SDK changes.

### Notational Conventions

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The following conventions are used in this document:

- Italics are used to highlight specific items in the general text, and to identify chapters and sections in this and related documents.
- Bullets (•) indicate:
  - action items
  - lists of alternatives
  - lists of required steps that are not necessarily sequential
- Sequential lists (e.g., those that describe step-by-step procedures) appear as numbered lists.



## Related Documents

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- *SPT 1734/PPT 2734 Developer's Guide*, p/n 72-44271-xx
- *SPT 1834 GSM AT Command Set*, p/n 72E-57095-xx
- *SPT Terminal Series System Software Manual*, p/n 72E-56803-xx
- *SPT 1700 Series Quick Reference Guide*, p/n 70-37543-xx
- *SPT 1700 Series Product Reference Guide*, p/n 70-37544-xx
- *SPT 1700/2700 Modem Module Quick Reference Guide*, p/n 72-42908-xx
- *SPT 1800 Series Quick Reference Guide*, p/n 72-51336-xx
- *SPT 1800 Series Product Reference Guide*, p/n 72-51337-xx
- *Spectrum24 Site Survey Utility User Guide*, p/n 72-39283-xx

## Service Information

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If you have a problem with your equipment, contact the [Symbol Support Center](#) for your region. See [page xi](#) for contact information. Before calling, have the model number, serial number, and several of your bar code symbols at hand.

Call the Support Center from a phone near the scanning equipment so that the service person can try to talk you through your problem. If the equipment is found to be working properly and the problem is symbol readability, the Support Center will request samples of your bar codes for analysis at our plant.

If your problem cannot be solved over the phone, you may need to return your equipment for servicing. If that is necessary, you will be given specific directions.

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+45-7020-1718 (Outside Denmark)

### **Finland/Suomi**

Oy Symbol Technologies  
Kaupintie 8 A 6  
FIN-00440 Helsinki, Finland  
9 5407 580 (Inside Finland)  
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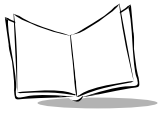
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Symbol Technologies Norway  
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**Sweden/Sverige**

“Letter” address:

Symbol Technologies AB

Box 1354

S-171 26 SOLNA

Sweden

Visit/shipping address:

Symbol Technologies AB

Solna Strandväg 78

S-171 54 SOLNA

Sweden

Switchboard: 08 445 29 00 (domestic)

Call Center: +46 8 445 29 29 (international)

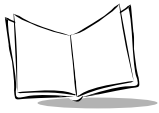
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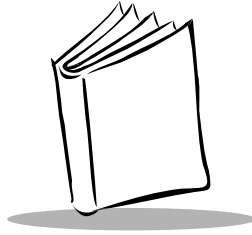
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## *SPT 173X/SPT 183X WAN Developer's Guide*



# *Chapter 1*

## *SPT 1733/PPT 2733 CDPD*

### **AT Command Interface**

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#### ***Introduction***

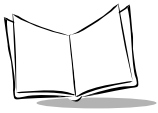
This section is intended to provide the serial AT Command Interface provided by the CDPD modem within the SPT 1733/1833. The modem provides a connection-oriented service so that existing application protocols can be used. In addition, the capability to switch the unit to Serial-Line-Internet-Protocol (SLIP) or Point-to-Point-Protocol (PPP) modes are provided so that new protocols can be developed within the application.

This section also describes the CDPD modem. The modem provides wireless data communication capability via the CDPD (Cellular Digital Packet Data) Network. It features internal TCP and UDP IP stacks as well as SLIP and PPP protocols for an external stack and provisions for using "Sleep Mode" to extend the operating time of battery powered devices.

#### ***Scope***

The scope of this document is limited to providing information on the various AT commands which can be used on Symbol's 1733/1833 terminal as well as a brief summary of some of the standard AT commands which are not supported.

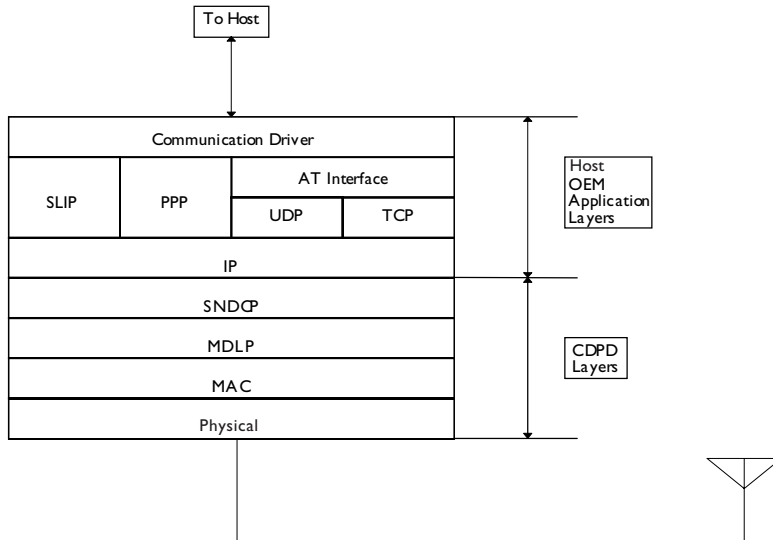




## Physical Interface

### Protocol

CDPD System Specification Part 400 Version 1.1 (CDPD Forum Inc.) This is the protocol stack for the modem:



The modem does not support V.42 compression in SDCP. The TCP/UDP interface is capable of supporting up to 3 sessions simultaneously<sup>1</sup>. The AT-command set described herein is derived from "CDPD Implementor Guidelines", Release 1.1<sup>2</sup>. It contains a subset

1. This is provided to solve the problem presented by delays encountered when closing a TCP session. That is, in order to process Host transactions in rapid succession (and since it is required to establish a new TCP session for each transaction) it is necessary to establish a new TCP session before the previous one has had a chance to close.

2. CDPD Forum makes no representations about the suitability of any material, comprising the CDPD system specification (or any derivative work incorporating any element thereof) for any purpose; it being provided "as is" and without any warranties whatsoever, express or implied. The CDPD Forum shall not be responsible for any damages of any kind related to the use of the CDPD system specification (or any derivative work incorporating any element thereof), including without limitation, actual, direct, indirect, incidental, consequential, special, or general damages.

of the commands described in Part 2014 that are supported by the modem. For the purposes of this specification, "Host" refers to the application controller.

## ***Software Interface***

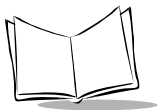
### **AT Command Mode**

AT commands and responses are active in command mode only; as determined by the state of the DSR line. Command mode behavior conforms to ANSI/TIA/EIA-602-1992 section 5, with the limitations stated below. The AT command set is a subset of the AT command set defined in ANSI/TIA/EIA-602 and in the CDPD System Specification Part 2014 Version 1.1, section 4.

### **Command Format**

Note the following limitations:

- The termination character is fixed as CR (ASCII 13)
- Command line editing is supported (BS, ASCII 08 only)
- Command line repeats (A/) is not supported
- The rules described below for buffering and flow control also apply to command mode. The host should not transmit a single AT command which exceeds the buffer length (256 characters). In addition, the host should wait until all responses associated with an AT command string have been received before issuing another AT command
- Abortion of command-in-progress is not supported
- Default command parameters are accepted for the last command on a command line only.



## Result Format

The format of result code responses is determined by the ATV command setting.

In terse mode, the result code is sent as a single ASCII character followed by a carriage return (ASCII 13) character.

In verbose mode, a descriptive text message is sent followed by a carriage return. The following result codes are emitted by the modem:

| Terse mode | Verbose mode | Description of Command  |
|------------|--------------|---|
| 0          | OK           | Command accepted.   |
| 1          | CONNECT      | Connection established.   |
| 2          | RING         | Network origination indication.   |
| 3          | NO CARRIER   | Connection terminated, not established or command aborted.                            |
| 4          | ERROR        | Invalid command parameter/state (e.g. DTR must be active before ATD can be accepted.) |
| 5          | NO SOCKETS   | No free TCP sockets within S7 seconds.  |
| 6          | NO DIALTONE  | CDPD link not established.  |
| 7          | BUSY         | Refused by destination or network, OR: Operation in progress.                         |
| 8          | NO ANSWER    | No response received from the destination within S7 seconds.                          |
| 9          | HELLO        | Issued at power on/reset.   |

## Data Mode Description

The modem contains an integrated TCP/IP protocol stack. It is accessed via AT commands that put the modem into either a TCP or UDP data communications mode. If the application host contains a TCP/IP stack, PPP or SLIP can be used to transfer IP packets between the application host and the modem.

The Data Terminal Ready (DTR) line is used by the modem as a qualifier for its operation in a data mode, TCP, UDP, SLIP or PPP. The DTR line is to be asserted before entering a data mode to indicate to the modem that the host computer is available for operation. The DTR line is de-asserted to terminate a data session. The modem will not sustain a data

mode session without DTR being active. The use of DTR can be overridden by setting register S211 to 1: the equivalent of asserting DTR permanently.

The DSR Signal is driven by the modem to indicate the existence of a data session. When the local host asserts DTR, the modem will respond with the DSR signal to indicate that the modem has entered data mode. DSR is de-asserted to indicate that the modem has exited data mode.

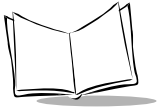
The modem provides Host and Network originated access to the connection-oriented service using TCP/IP. Host origination is accomplished via the DIAL (ATDT) command. Upon successful completion of the DIAL command (i.e. CONNECT result code), the modem switches to TCP-Data mode. DTR must be asserted prior to issuing the ATDT, ATDP, ATASLIP or AT\APPP. If this is not followed the modem will not engage the session in a manner where it can be sustained. The modem signals a network origination to the Host using the RING result code. Failure to have DTR asserted while in "Listen" mode, network origination, will result in a dropped session. The PAD functions are active during TCP-Data mode only, however, the data buffering functions apply in all modes.

For Listen mode applications, the modem must see DTR asserted when the TCP Session request is received. If DTR is not asserted the session request will be rejected. When the DTR signal is asserted, the modem will issue a RING followed by a CONNECT to indicate the beginning of an incoming data session. Here RING indicates the source of the session as being a remote server while the CONNECT indicates the transition from AT Command mode to Data mode. In this mode, the modem will "Listen" for TCP packets with port numbers which match that specified with the modem's IP address (re: S110). Any TCP packets received in AT-CDPD mode, or packets received in TCP-Data mode without a matching port number, are rejected by the modem with no indication to the Host. DTR can be used to terminate the session or the remote server can initiate the termination.

A session may be terminated by the Host de-asserting the DTR line. The remote host may also terminate a session. Connection status is maintained on the DSR line. Once the session has been terminated, the modem returns to AT-CDPD mode. Note that session termination is the only method to return to AT-CDPD mode<sup>1</sup>.

For UDP/IP, a connection-oriented service is "fabricated" within the modem. The DIAL command (ATDP) is used to place the modem into UDP-Data mode. In this mode, the modem will "Listen" for UDP packets with port numbers which match that specified with the modem's IP address (re: S110). Any UDP packets received in AT-CDPD mode, or packets received in UDP-Data mode without a matching port number, are rejected by the modem with no indication to the Host. In UDP-Data mode, the port number for transmitted UDP

*1. The Hayes compatible escape sequence is not supported.*



packets is specified with the destination address associated with the DIAL command. Only the Host Origination and Host Termination scenarios described above apply to UDP operation. The DTR and DSR lines, and the PAD functions, operate as in TCP-Data mode.

## **Internal Stack Description**

IP (Internet Protocol) is the basic network protocol that routes packets on an IP network. CDPD networks and the Internet are IP networks. Transport protocols deliver packets between applications. Transport protocols use the IP service to deliver data packets between network devices.

In order for an application to communicate across a network, it will first open a port on the local device. The IP address of the local device and this port number becomes the unique address for this application, and is sometimes referred to as a socket. When the local application communicates with a distant application, it will send a packet addressed to the IP address and port number of that remote application. This address is the destination address of the packet. The packet will also contain the source address, the IP address and port number of the local application. The remote application may use the source address of the packet received to communicate back to the local application.

There are two common transport protocols used in TCP/IP networks:

## UDP Mode Description

User Datagram Protocol is a basic transport protocol that provides a best-effort, connectionless delivery service with minimum overhead. The protocol does not guarantee delivery of packets. There is no checking or retransmission of the data packets. It does provide minimum overhead as it only adds the source and destination port numbers to the header. Since the protocol is unreliable, the application must provide checking, acknowledgments and retransmissions if the data is critical. In many applications, the data is not critical because updates are sent periodically and occasional losses can be tolerated.

UDP sessions may be originated by the local application host or by the network. The DTR signal must be asserted or S211=1 (pretend DTR is always asserted) for the unit to enter into a data communications session. The session is terminated by dropping DTR or resetting the unit.

## UDP Modes of Operation

Command: ATS82 = <mode>

Where <mode> = Timer value in seconds

0 = Regular mode

1 = Not used (reserved)

2 = Half-Open mode

## Originating a UDP Session

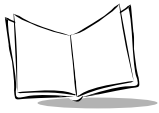
A session is originated by the application host issuing the ATD (Dial) command:

**ATDPnnn.nnn.nnn.nnn/ppppp**

**ATDP** specifies a UDP session. nnn.nnn.nnn.nnn is the destination IP address and ppppp is the destination application port number. If no port is specified then a port number of 0 is assumed. It should be noted that UDP and TCP make extensive use of port numbers, please be aware that the modem will use the port number as a criteria for accepting and passing data to the host application.

**CONNECT** [terse 1] result code will be issued and all ensuing data sent from the host application will be assembled into a UDP packet and transmitted to the destination application.

**ERROR** [terse 4] result code will be generated if the modem is not currently registered on a CDPD network.



**PAD** (Packet Assembly and Disassembly) function will transmit data when the inter-character idle time-out occurs or when the PAD buffer is full. (256 or 512 bytes). The idle time-out is specified in register S50 in 1/10 seconds.

**Receiving Data** - Once the session is started, any packets sent to the modem's IP address with the port number specified in register S110 will be processed and the data portion will be transmitted over the serial link to the host application. Any packets received with a different port number specified will be discarded.

**Termination** - The session is terminated by dropping DTR or resetting the unit.

## TCP Mode

### *Description*

Transport Control Protocol, is a reliable, connection-oriented transport protocol that uses acknowledgments and retransmissions to guarantee delivery. This is an obvious advantage for applications where the data is critical and the application cannot provide the required reliability. There is more overhead in the protocol to provide this reliability, making it less efficient than UDP. For larger data transfers, TCP is the easiest protocol to use to get reliable service.

TCP sessions may be originated by the local application host or by the network. The DTR signal must be asserted or S211=1 (pretend DTR is always asserted) for the unit to enter into a data communications session. The session is terminated by powering the modem off, dropping DTR or by the remote host terminating the connection. If the session is terminated by a power down, the remote host may not tear down its part of the session properly, leaving the remote host waiting for further information for that session. This can pose problems for some applications. Care in session tear down is essential for reliable operation.

### *TCP Modes of Operation*

TCP Listen mode is established by having S0=1 when the modem powers up. The port specified in S110 will be used for the TCP Listen mode. The DTR signal must be asserted or S211=1 (ignore signal on DTR pin and proceed as if DTR is always asserted) for the unit to enter into a data communications session. When a connection request for the correct port is received by the modem, the modem will establish the connection notify the local host with:

| <b>Verbose</b> | <b>Terse</b> |
|----------------|--------------|
| RING           | 2            |
| CONNECT        | 1            |

and begin the TCP session.

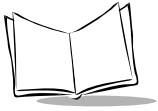
**Termination** - A TCP connection is terminated by dropping DTR, or by the remote end of the TCP connection terminating the session.

### *Originating a TCP Session*

A session is originated by the host application by issuing the ATD (Dial) command:

**ATDTnnn.nnn.nnn.nnn/ppppp**





ATDT specifies a TCP session. nnn.nnn.nnn.nnn is the destination IP address and ppppp is the destination application port number. The modem will attempt to establish a connection with the destination host. If it is successful, a CONNECT [terse 1] result code will be issued and all ensuing data sent from the app host will be assembled into a TCP packet and transmitted to the destination application.

**ERROR** [terse 4] result code will be generated if the modem is not currently registered on a CDPD network.

**Connection Failure** will be signaled by a BUSY [terse 7] result code, and may be caused by one of the following:

- Wrong IP address or port number
- The destination device does not have a TCP Listen process open on the port specified
- The destination host already has a connection established with another client on the specified port
- Connection failed to complete within the time specified in register S7 (sec). Normal values are about 30 seconds, but is very dependent upon the application requirements. Many applications, which provide their own time-out for connection failure, will have this value set to 60+ seconds.

**PAD** (Packet Assembly and Disassembly) function will transmit data when the inter-character idle time-out occurs or when the PAD buffer is full. (256 or 512 bytes). The idle time-out is specified in register S50 in 1/10 seconds.

**Receiving Data** - Once the session is started, any packets sent to the modem's IP address with the port number specified in register S110 will be processed and the data portion will be transmitted over the serial link to the host application. Any packets received with a different port number specified will be discarded.

**Termination** - A TCP connection is terminated by dropping DTR or by the remote end of the TCP connection terminating the session.

## DTR Control Description

The Data Terminal Ready (DTR) line is used by the modem as a qualifier for its operation in a data mode, TCP, UDP, SLIP or PPP. The DTR line is to be asserted before entering a data mode to indicate to the modem that the host computer is available for operation. The DTR line is de-asserted to terminate a data session. The modem will not sustain a data mode session without DTR being active. The use of DTR can be overridden by setting register S211 to 1: the equivalent of asserting DTR permanently.

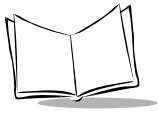
The DSR Signal is driven by the modem to indicate the existence of a data session. When DTR is asserted by the local host, the modem will respond with the DSR signal to indicate that the modem has entered data mode. DSR is de-asserted to indicate that the modem has exited data mode.

For Listen mode applications, the modem must see DTR asserted when the TCP Session request is received. If DTR is not asserted the session request will be rejected. When the DTR signal is asserted, the modem will issue a RING followed by a CONNECT to indicate the beginning of a incoming data session. Here RING indicates the source of the session as being a remote server while the CONNECT indicates the transition from AT Command mode to Data mode. In this mode, the modem will "Listen" for TCPP packets with port numbers which match that specified with the modem's IP address (re: S110). Any TCP packets received in AT-CDPD mode, or packets received in TCP-Data mode without a matching port number, are rejected by the modem with no indication to the Host. DTR can be used to terminate the session or the remote server can initiate the termination.

A session may be terminated by the host using the DTR line. The remote host may also terminate a session. Connection status is maintained on the DSR line. Once the session has been terminated, the modem returns to AT-CDPD mode.<sup>1</sup>

The DTR line de-asserted can also be optionally used to power the modem off in addition to the termination of the session. If the S211 register is set to 4, then the de-asserting of the DTR line will make the modem terminate any current data session, perform a de-registration with the network and power itself off.

*1. The Hayes compatible escape sequence is not supported.*



## Push Technology

To receive data while the modem is unattended by the host, the modem has been incorporated with the means to receive the data packet, determine the type of message and the source IP address. This push technology feature can be enabled or disabled by setting or resetting register S250. The modem can signal the host that there are messages queued up, waiting to be retrieved by the host, using any or all of the following signals. The “message waiting” signal can be asserted when a message arrives and will be de-asserted when all messages have been retrieved or deleted. In the case of multiple messages, the “message waiting” signal will be asserted when the first arrives and will only be de-asserted when all messages have been retrieved. Another signal, the “alert” signal, can also be used to provide a 500msec pulse to the host on its associated pin for each message that arrives. These signals can be made available on any of the programmable pins of the interface. Their assignment is made using the programmable GPIO features of the modem.

The modem can hold up to 4 messages, determined by reading register S251, before the buffer overflows and message data is lost. When the host accesses the modem to retrieve the stored messages, the host first determines which messages it wants to retrieve based upon the source IP address. The host can discard messages by setting register S254. This will cause the current message to be flushed from the queue and the next message made available to the host.

### PUSH Technology Enable

|          |   |
|----------|---|
| ATS250?  | Query Wake Up Protocol State            |
| ATS250=1 | Enable Push Technology                  |
| ATS250=0 | Disable Push Technology                 |
| ATS251?  | Query Number of Pending Messages        |
| Response | [0..4]                                  |
| ATS252?  | Query First Push Message                |
| Response | [IPAddress/port]                        |
| Format   | nnn.nnn.nnn.nnn/xxxxx                   |
| ATS253?  | Query Type of First Push Message        |
| Response | [0, 1] 0 indicates UDP, 1 indicates TCP |
| ATS254=1 | Discard Current Messages                |

## **Slip Mode**

### ***Description***

The command to enter Serial Line Internet Protocol mode (SLIP) is used when an external stack configuration is needed. SLIP is useful if the stack resides in the host computer, multiple sessions and complete control over all aspects of each session can be obtained. SLIP is one of the more common protocols used for splitting the functionality between the modem and the host. SLIP does, however, require certain parameters to be set up prior to activating a session. SLIP does not extract the IP address from the modem. This must be set up in dial-up-networking before starting. SLIP is less flexible than Point to Point Protocol (PPP) which is quickly winning over most users.

The SLIP session is usually controlled by DTR, unless the modem has been configured to ignore DTR by programming register S211. DTR, when used, must be asserted to initiate a session and de-asserted to terminate a session. If the modem has been programmed not to use DTR Control, then the command AT+SLIP can be sent without asserting DTR. To exit SLIP in this case, the host must either power down the modem or use the escape sequence. To terminate a SLIP session, DTR must be de-asserted or the escape sequence can be activated or the modem can be powered down.

### ***Format***

|         |                                |
|---------|--------------------------------|
| AT+SLIP | The command to enter SLIP mode |
|---------|--------------------------------|

### ***Validity***

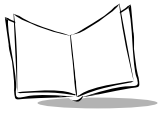
Slip can only be entered from Command Mode. In Program or Diagnostic modes, the modem is not actively connected to the network.

### ***Other Considerations***

While a modem can enter SLIP mode from command mode at any time, the intent of SLIP is to connect to the network. Until there is a network connection established and the modem has registered, it is better to delay entering SLIP mode as you may report errors that will only persist until the modem registers. It is generally recommended that the host check the status of the modem before proceeding with a SLIP connection. The Status can be checked using the "ATS57?" command.

### ***Related Topics***

Enter PPP Mode, DTR Control, Program Mode, Data Mode, Diagnostic Mode, Checking Status, Escape Sequence



## Point to Point Protocol (PPP)

### **Description**

The command to enter Point to Point Protocol mode (PPP) is used when an external stack configuration is needed. PPP is useful if the stack resides in the host computer, providing multiple sessions and complete control over all aspects of each session. PPP is quickly becoming the new standard for dial-in-networking. PPP provides more flexibility and less items that need to be explicitly set.

The PPP session is usually controlled by DTR, unless the modem has been configured to ignore DTR by programming register S211. DTR, when used, must be asserted to initiate a session and de-asserted to terminate a session. If the modem has been programmed not to use DTR Control, then the command AT\APPP can be sent without asserting DTR. To exit PPP in this case, the host must either power down the modem or use the escape sequence. To terminate a PPP session, DTR must be de-asserted or the escape sequence can be activated or the modem can be powered down.

### **Format**

|                                 |                               |
|---------------------------------|-------------------------------|
| AT\APPP                         | The command to enter PPP Mode |
| The response will be            | CONNECT or ERROR              |
| The alternate command to use is | SERVER                        |
| The response will be            | CLIENT                        |

### **Validity**

PPP can only be entered from Command Mode. In Program or Diagnostic modes, the modem is not actively connected to the network.

### **Other Considerations**

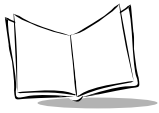
While a modem can enter PPP mode from command mode at any time, the intent of PPP is to connect to the network. Until there is a network connection established and the modem has registered, it is better to delay entering PPP mode as you may report errors that will only persist until the modem registers. It is generally recommended that the host check the status of the modem before proceeding with a PPP connection. The Status can be checked using the "ATS57?" command.

An alternate method of entering PPP mode is to send the word CLIENT to the modem. The modem will respond with SERVER. This is NOT an AT command. It is neither preceded by

an "AT" nor succeeded by a CR. Exiting PPP mode is performed using the DTR control signal.

***Related Topics***

SLIP Mode, DTR Control, Program Mode, Data Mode, Diagnostic Mode. Checking Status



## **Data Transmission Mode**

### ***Packet Assembly***

The modem provides a local Packet Assembly and Disassembly (PAD) function. For transmission, the character stream from the Host is assembled into packets for RF transmission under the following conditions:

- Idle time-out: If the time between successive characters exceeds the time interval specified in register S50, any pending data is assembled for transmission.

### ***Buffering and Flow Control***

The modem has an input data buffer which is intended to be set larger than the longest transmit message used by existing protocols in the host. The size of this buffer is 578 characters.

If hardware flow control is disabled and, the modem is formatting and transmitting data blocks associated with a packet, the host should not send additional data as this may cause input buffer overflow. Buffer overflow will result in a loss of data with no indication to the Host. In order to avoid data loss, it is recommended (and anticipated) that the host application protocol operates using a half-duplex ACK/NAK protocol. It should be expected that the host acknowledgment time-out should be set greater than that required for circuit-switched modem configurations. This is to account for propagation delays through the modem, CDPD base station and CDPD and Internet networks.

## **Data Reception Mode**

### ***Packet Disassembly***

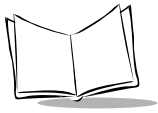
The modem begins transmitting the character stream associated with a received packet to the host as soon as all the associated blocks have been received and processed.

### ***Buffering and Flow Control***

The modem has an output data buffer which is intended to be set larger than the longest receive message used by existing protocols in the host application. The size of this buffer is 2144 characters.

When the modem is sending the characters associated with a received packet to the host, the remote host processor should not send additional data as this may result in output buffer overflow. The modem buffer overflow shall result in a loss of data with no indication to the host or remote host. In order to avoid data loss, it is recommended (and anticipated) that the host application protocol operates using a half-duplex ACK/NAK protocol. The remote host acknowledgment time-out should be lengthened as described above.





## Sleep Mode Description

Sleep mode can be activated by sending the commands AT#ZZ=1, AT#ZZ=2, AT#ZZ=3 or deactivated by the command AT#ZZ=0. Changes must be entered in program mode. The module should be reset after changing the sleep mode activation since the module will have registered and informed the network that it has sleep mode or not. The module will enter sleep mode, if activated, after the inactivity timer has expired and a Network TEI notification message has been received by the modem.

In areas with low signal strength or where the signal strength varies to a high degree, the unit may not enter sleep mode in a regular fashion. The unit must have conditions where the unit can decode the TEI notification messages from a reliable signal.

No notification message or signal is given to the host that sleep mode is engaged. The host must assume that if the modem has been inactive for more than the number of seconds specified by the network inactivity timer that the modem has gone to sleep.

To manually wake the modem up from sleep mode:

Non-GMIC products:

The wake-up signal can be asserted for a minimum of 10 ms or a break character of 20 ms in duration followed by a 2 ms pause or 2 character spaces at 19200 bps can be sent. The module will de-assert CTS when entering sleep mode to inhibit the host from sending data but will periodically assert CTS and check for incoming serial data from the host to prevent any loss of data.

GMIC base products:

Any character on the serial port will wake up modem.

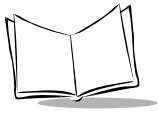
There are two types of sleep mode implemented for this product:

- i. Normal – in normal sleep mode, the modem will attempt to maximize its sleep time based on the configuration of the network where it has registered. Practically, this means that if the network supports a sleep time of 60 seconds, and allows 5 TEI notifications to be missed without penalty, the modem could theoretically sleep for a maximum of 4 minutes.
- ii. Short – in short sleep mode, the modem will attempt to sleep in short bursts of 5 seconds and awaken to allow communication from the host. In this mode, CTS would normally be deasserted so hosts would not normally attempt to send data until the CTS is asserted again in 5 seconds when the modem wakes up for 400msec. This is the same operation as in the NRM6812 products when AT#ZZ=2 and has been maintained for backward compatibility.

- iii. Medium – This sleep mode is similar to “normal sleep mode” but will wake up just in time to receive the second Network TEI notification message after the inactivity timer. This represents the optimal amount of time the modem can sleep without missing any network messages. In this state, the modem will wake up about every minute to check for network messages. On GMIC based products, the modem can wake up from this sleep state using the serial port.

### ***Related Topics***

Sleep Mode Feature Enable/Disable



## Sleep Mode Feature Enable/Disable

### **Description**

This command permits the user to define what sleep mode the modem should use. Since various applications and host computers have different requirements for communicating with a modem that utilizes sleep mode, this command encompasses several different options that should satisfy any application. If sleep mode does not appear to work with your application, please contact Symbol Technologies for assistance. The default setting for this mode is off.

### **Format**

|         |                            |
|---------|----------------------------|
| AT#ZZ?  | Sleep status query command |
| AT#ZZ=0 | Disable sleep feature      |
| AT#ZZ=1 | Enable Long cycle sleep    |
| AT#ZZ=2 | Enable short cycle sleep   |
| AT#ZZ=3 | Enable medium cycle sleep  |

### **Validity**

Changes must be entered in program mode.

### **Other Considerations**

See the sleep mode description.

### **Related Topics**

Sleep Mode Description

## Out-of-service Sleep Mode

The modem must be registered and within a reliable coverage area before it can actually go to sleep for standard sleep mode. This means that the modem cannot sleep and will be in a higher battery discharge state at all times that the modem is outside of CDPD coverage. The Out-of-service Sleep Mode allows the modem to go to sleep during periods of no coverage. The modem will sleep for some (usually relatively long) period and wake occasionally to see if it has returned to a coverage area. The goal is to give the modem a battery life approaching that of standard sleep mode when within CDPD coverage.

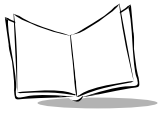
Out-of-service sleep mode is activated by sending the AT#NSZZ=1 command or deactivated by sending the AT#NSZZ=0 command. This change must be saved with the AT&W command, and the module must be reset before this change will take effect.

Following a loss of signal, the modem will make several attempts to find service on the currently registered side before deciding that it is no longer registered and that it must search both sides for service. Once this has occurred, or following modem initialization under no service conditions, the modem will continue to search for a valid CDPD signal for the complete scan period. If no service is found the modem will sleep for the sleep cycle length less the time that it was awake for the search. After this sleep interval, the modem will wake for a brief search. If no service is found, it will sleep again for the sleep cycle length less the brief scan period. This cycle continues with one scan period in each cycle count periods being a complete scan. If the modem finds service and registers during one of the scans, the out-of-service sleep mechanism is reset and waits for the next time that service is lost.

To prematurely wake the modem up from out-of-service sleep mode, the wake-up signal can be asserted for a minimum of 10 ms. The module will de-assert CTS when entering sleep mode to inhibit the host from sending data but will periodically assert CTS and check for incoming serial data from the host to prevent any loss of data.

### **Description**

These commands permit the user to define what the parameters of out-of-service sleep mode and to enable or disable the operation of this mode. If out-of-service sleep mode does not appear to work with your application, please contact Symbol Technologies for assistance. The default setting for this mode is off.



## **Format**

|                   |  |
|-------------------|--|
| AT#NSZZ           | Out-of-service Sleep status query command  |
| AT#NSZZ=0         | Disable out-of-service sleep feature   |
| AT#NSZZ=1         | Enable out-of-service sleep feature  |
| AT#NSZZTM=p,b,c,n | <p>Configure out-of-service sleep feature</p> <p>p = sleep cycle length in seconds. This is the interval between successive wakeups.</p> <p>b = brief scan period in seconds. This is the time that the modem will be awake for most of its waking intervals. It is intended to be a brief look at the hot list of the preferred side.</p> <p>c = complete scan period in seconds. This is the time that the modem will be awake once in each cycle count sleep cycles. It is intended to be long enough for the modem to register on the network if a channel is available on either side; that is, time to completely search the cellular environment for a channel to register on.</p> <p>n = cycle counts in units. One waking interval in "cycle count" wakeups will be a complete scan. All other waking intervals will be a brief scan.</p> |

## **Validity**

Changes must be entered in program mode.

## **Other Considerations**

None

## **Related Topic**

Sleep Mode

## Power-up Default Mode

### *Description*

The power up default mode command permits the user to define how the modem will act after power is applied and the modem begins operating. Upon power up, the modem will perform a quick self test, determine its configuration and then enter the programmed default mode. This can be either the standardAT Command mode or PPP, SLIP or UDP data modes.

The use of PPP or SLIP as the default mode permits the user to eliminate the start up commands and hence have the unit register and activate the data mode more quickly. Since there is no requirement for data exchange to set up SLIP, the host can proceed to set up its stack once the CONNECT message is received from the modem. Because PPP requires some data to be exchanged to set up the IP and other parameters, the host must complete the PPP link before data can be sent or received.

The use of UDP as a default mode permits a host to begin sending or receiving data over the modem connection as soon as the modem has registered on the network. The modem will power up, perform the quick self test, determine its configuration, enter AT Command mode and then, once the modem has registered on the network, enter UDP mode. Upon entering UDP mode a "CONNECT" message is sent to the host. The UDP mode can make use of the half-open or standard UDP features.

### *Format*

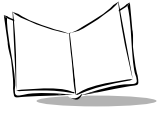
|        |   |
|--------|---|
| ATMD0  | For AT Command mode at power-up                   |
| ATMD1  | For SLIP Data mode at power-up                    |
| ATMD2  | For PPP Data mode at power-up                     |
| ATMD3  | For UDP Data mode at power-up                     |
| ATMD83 | UDP with no IP address verify on incoming packets |

### *Validity*

Power-up default mode changes can be made at anytime. Default modes were introduced in software release on September 97 and are valid for all later software revisions.

### *Other Considerations*

Because the default mode takes effect once the modem has registered with the network, it is important to make any desired changes as soon after power up as possible.



***Related Topics***

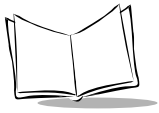
UDP, Enter PPP Mode, Enter SLIP Mode, AT Command Mode

## Set Hardware Configuration

Command to set the hardware release version number, i.e. Rev 3.2, Rev 3.3, Rev SM-1 etc. The hardware configuration setting is set at the factory and should not normally be set by the user. The hardware configuration version can only be set in Diagnostic mode.

|              |                              |
|--------------|------------------------------|
| ATI3         | Query Hardware configuration |
| AT#NH=number | Set Hardware configuration   |
| AT#NH?       | Query Hardware configuration |





## **Profile Configuration Commands**

### ***Description***

Upon power-on/reset, the modem issues a HELLO (verbose) or a 9 (terse) result code and proceeds to register with the CDPD system. AT commands are active by default. This state is referred to as AT-CDPD mode.

These commands affect settings that are stored in the modem's Non-Volatile Memory (NVM). These commands are used by service personnel when the unit is installed and as required thereafter to update service access information. Note that some configuration changes will not be permanently saved until they have been written to Non-Volatile Memory (NVM) with the AT&W command.

## Program Mode

### *Description*

Program mode permits the user to change S register parameters that affect the modem's operation. Program mode was created as a means of protecting the configuration of the modem from spurious or unwanted attempts to change them. The addition of the password protects the equipment from unauthorized access and modification. While in program mode, the modem is disconnected from the network. Data cannot be sent or received over the wireless link.

### *Format*

|                  |                                    |
|------------------|------------------------------------|
| AT+VPROG,NRM6812 | Enter program mode                 |
| AT&W             | Save changes and exit program mode |
| ATZ              | Exit without saving changes        |

**The password field is case sensitive.** The modem will distinguish upper and lower case letters to be different. In the above example, NRM6812 is the default password. "NRM" must be entered as capital letters otherwise the password will not be accepted. Passwords should be more than six characters however the software will accept any number of characters up to 8.

### *Validity*

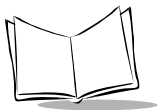
The user can enter program mode while in AT Command mode.

### *Other Considerations*

Besides being used as the password for entry into Program mode, the password is also used as a qualifier for the escape sequence used to exit data modes. Care should be used when changing passwords.

### *Related Topics*

Changing Password, Saving Settings, Soft Reset, S Registers,



## Local Echo

### **Description**

The Set Local Echo command permits the user to select whether the modem should echo the characters sent to it back to the host. For some applications, local echo is not required as the host does not need to confirm what has been sent to the modem. For terminal operation, local echo can be used to verify what has been sent to the modem and aids in sending commands, since each keystroke is displayed on the terminal.

### **Format**

|      |                    |
|------|--------------------|
| ATE0 | Disable Local Echo |
| ATE1 | Enable Local echo  |

### **Validity**

Changes to the local echo setting are valid during program or AT command modes. Changes made while not in program mode will be lost upon power down. Changes made and saved while in program mode will be retained by the modem.

### **Other Considerations**

For a wide variety of applications, local echo is not required or desired. When using local echo with a terminal, it is wise to keep in mind that the application being used may require local echo to be off rather than on. Always ensure that the echo setting is set in the proper mode for the application when re-installing a modem.

### **Related Topics**

Saving Settings, AT Command Modem mode.

## Response Format

### Description

The Set Response Format command is used to define what manner the modem returns when commands are sent to it. Responses can be defined to be either plain text messages or a single numeric digit. Numeric control is better suited for machine applications while plain text is better for interpretation by humans.

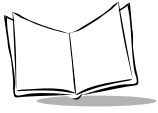
| Terse mode | Verbose mode (Plain Text) | Description of Response   |
|------------|---------------------------|---|
| 0          | OK                        | Command accepted.   |
| 1          | CONNECT                   | Connection established.   |
| 2          | RING                      | Network origination indication.   |
| 3          | NO CARRIER                | Connection terminated, not established or command aborted.                            |
| 4          | ERROR                     | Invalid command parameter/state (e.g. DTR must be active before ATD can be accepted.) |
| 5          | NO SOCKETS                | No free TCP sockets within S7 seconds.  |
| 6          | NO DIALTONE               | CDPD link not established.  |
| 7          | BUSY                      | Refused by destination or network, OR: Operation in progress.                         |
| 8          | NO ANSWER                 | No response received from the destination within S7 seconds.                          |
| 9          | HELLO                     | Issued at power on/reset.   |

### Format

|      |  |
|------|--|
| ATV0 | To enable the response to be in the numeric format |
| ATV1 | To enable the response to be in plain text         |

### Validity

Changes to the Response Format setting are valid during program or AT command modes. Changes made while not in program mode will be lost upon power down. Changes made and saved while in program mode will be retained by the modem.



### ***Other Considerations***

Some machine applications use the plain text response as it saves reformatting the information for presentation to a human operator.

### ***Related Topics***

Saving Settings, AT Command Mode

## Programmable I/O

### Description

Commands used to configure the General Purpose I/O lines for predefined functions. Any of these signals can be associated with any of the GPIO pins on the interface. However, due to the nature of the power up state of these pins, recommendations on which signals should be associated with which pins will be provided.

### Format

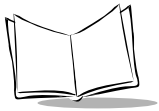
All changes to the state of the GPIO signal associations will only be allowed while in Program Mode of the modem. Also, any changes will only take place only upon device power up.

|                                 |  |
|---------------------------------|--|
| To enter program mode:          | <code>at\aprog,&lt;password&gt;</code> |
| <code>ATIO1?</code>             | To query the current setting of GPIO1  |
| <code>ATIO1=&lt;code&gt;</code> | To set the operating function of GPIO1 |
| <code>ATIO2?</code>             | To query the current setting of GPIO2  |
| <code>ATIO2=&lt;code&gt;</code> | To set the operating function of GPIO2 |
| <code>ATIO3?</code>             | To query the current setting of GPIO3  |
| <code>ATIO3=&lt;code&gt;</code> | To set the operating function of GPIO3 |
| <code>ATIO4?</code>             | To query the current setting of GPIO4  |
| <code>ATIO4=&lt;code&gt;</code> | To set the operating function of GPIO4 |
| <code>ATIO5?</code>             | To query the current setting of GPIO5  |
| <code>ATIO5=&lt;code&gt;</code> | To set the operating function of GPIO5 |
| <code>ATIO6?</code>             | To query the current setting of GPIO6  |
| <code>ATIO6=&lt;code&gt;</code> | To set the operating function of GPIO6 |
| To save the profile:            | <code>at&amp;w</code>                  |

### Default Configuration

OEM:

| Pin          | Type | Signal             |
|--------------|------|--------------------|
| <b>GPIO1</b> | O    | RS232 Control      |
| <b>GPIO2</b> | O    | Service Indication |



| Pin   | Type | Signal      |
|-------|------|-------------|
| GPIO3 | O    | Ready       |
| GPIO4 | O    | RF All      |
| GPIO5 | I    | Power Boost |
| GPIO6 | O    | Ring        |

Minstrel III:

| Pin   | Type | Signal                     |
|-------|------|----------------------------|
| GPIO1 | O    | RS232 Control              |
| GPIO2 | O    | Service Indication         |
| GPIO3 | O    | Hot Sync / Alert           |
| GPIO4 | O    | Message Waiting Indication |
| GPIO5 | I    | Power Down                 |
| GPIO6 | O    | Low Battery Indication     |

Selection Codes

| Code | Type | Pins        | Description   |
|------|------|-------------|---|
| 0    | --   | ---         | Defaults by modem type  |
| 1    | O    | GPIO1-6     | High  |
| 2    | O    | GPIO1-6     | Low   |
| 3    | O    | GPIO1-6     | Ready (binary, ON once registered, OFF if modem has to hunt for service). |
| 4    | O    | GPIO1-6     | Service (current flashing scheme for service detection).                  |
| 5    | O    | GPIO1-6     | Alert (provides positive pulse if PUSH message queued).                   |
| 6    | O    | GPIO1,2,4,6 | Ring (negative logic, OFF if RING, ON once data mode started).            |
| 7    | O    | GPIO1-6     | RF (Tx).  |

| Code | Type | Pins        | Description   |
|------|------|-------------|---|
| 8    | O    | GPIO1-6     | RF (Rx).  |
| 9    | O    | GPIO1-6     | (Rx or Tx).   |
| 10   | O    | GPIO1-6     | Low Battery Indication. Will be asserted when first threshold in NVM is reached.      |
| 11   | O    | GPIO1-6     | Message Waiting (like Alert, ON if PUSH message queued, OFF when last PUSH released). |
| 12   | O    | GPIO1,2,4,6 | Power Down (asserted when the unit is in sleep mode, de-asserted during normal op).   |
| 100  | I    | GPIO1-6     | Power Down indication (when asserted, modem will de-register and power off).          |
| 101  | I    | GPIO1-6     | Power Boost indication (when asserted, modem will enter Power Boost mode).            |

### **Validity**

If the register is set to zero, the modem will use the default setting.

Setting can be changed at any time by the host when in Program Mode but will not be saved unless a AT&W is performed.

### **Other Considerations**

For additional information on the electrical characteristics of the pins and their placement on the connector, please consult the Expedite Wireless IP Hardware Interface Specification.

### **Related Topics**

Host Interface/Power Connector, Program Mode, Low Battery Warnings, Power Boost feature, Push Technology





### Description

In PROG mode, this command may be used to exit without saving any NVM changes.

ATZ To perform a modem soft reset

Valid for AT Command and Program Modes.

Upon issuing a Soft Reset, the modem will disconnect from the CDPD Network and restart the channel scan procedure. This results in a temporary lapse in the modem's ability to send or receive data. Before initiating a data mode session (PPP, SLIP, UDP or TCP) immediately following a soft reset, it is recommended that the application verify that the modem is registered on the network.

## S Registers, Enter Program Mode, Saving Settings

## Side Preference

### **Description**

This command allows the user to specify the CDPD Service Side preference. Since there are two sides within a CDPD service area this command makes it possible to specify one side over the other or simply force the unit to either side only. Check with your carrier to determine on which cellular side CDPD service is provided.

### **Format**

|       |                                     |
|-------|-------------------------------------|
| AT+N? | To determine current setting use    |
| AT+N1 | To set the unit to A side only      |
| AT+N2 | To set the unit to B side only      |
| AT+N3 | To set the unit to A side Preferred |
| AT+N4 | To set the unit to B side Preferred |

### **Validity**

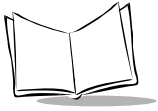
The AT+N command can be used at any time while the unit is in Command or Program Mode. The unit does not need to be in Program Mode for this command to take effect. The setting is stored in NVM each time the setting is changed.

### **Other Considerations**

Along with the side preference, it is often recommended that a user specify a Service Provider Identifier (SPI) or Service Provider Network Identifier (SPNI) to direct the modem to search for a preferred carrier as that carrier may not be on one side throughout the country.

### **Related Topics**

Setting SPI, SPNI, WASI; Setting Carrier Preference



## Password

### *Description*

The set password command is used to change the alphanumeric password string used to secure the entry to program mode and also as a qualifier for the activation of the escape sequence. The password can be set to a string of alpha, the letters a to z in both upper and lower case and the numeric digits 0 to 9. Spaces are not allowed. Upper and lower case alpha characters are distinguished as different characters. A null string, one containing no alpha or numeric characters is considered valid. It is recommended that the password string be 6 to 8 characters in length for optimal security.

### *Format*

AT\P=oldpwd,newpwd,newpwd      To change the password the command

Example      AT\P=NRM6812,NEW6812,NEW6812

In the above example, NRM6822 is the old password (set at the factory) while NEW6812 is the new password being entered. Two copies are required as can be seen by the entry of NEW6812,NEW6812. To enter a null string as a password the command would take the form of

AT\P=NRM6812,,

There is no way to read back and determine the password once it has been set.

### *Validity*

The change password command is valid for Program mode.

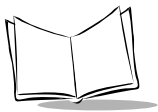
### *Other Considerations*

Care should always be exercised when changing the password. While not all applications warrant altering the password, the need for additional security may be partly satisfied by configuring the password.

For users that make use of the Escape sequence, setting the password to the null string configures the modem to operate in a manner similar to the Hayes modems. The NRM6812 escape sequence does not support the idle time requirement. It simply scans the data stream for the escape characters followed by the password. When the password is a null string, the modem operates similar to a Hayes Modem.

***Related Topics***

Escape Sequence, Program Mode, Data Mode



## Escape Sequence

### Description

The Data Mode Escape sequence is used to discontinue use of the internal UDP or TCP stack. The escape sequence does not cause any deviation to SLIP or PPP operation and would not normally be used in this manner. Unless the modem has been set to use the TCP Suspend feature, once the escape sequence is encountered by the modem it will terminate the current session, tear down the stack and enter AT Command mode.

If the modem has been programmed to use the TCP Suspend feature, the modem will not tear down the stack but will temporarily suspend the TCP session and enter AT Command mode. This would permit the host time to access other parameters to alter the manner of communications.

The escape sequence consists of the string “+++” followed by the program mode password (normally NRM6812). There is no requirement for a guard time or other special pauses before, after or in between escape sequence characters. The string must be an exact match, matching both letter/number and case. The password can be set to a string of alpha, the letters a to z in both upper and lower case and the numeric digits 0 to 9. Spaces are not allowed. Upper and lower case alpha characters are distinguished as different characters. A null string, one containing no alpha or numeric characters is considered valid. It is recommended that the password string be 6 to 8 characters in length for optimal security.

### Format

|                  |                                    |
|------------------|------------------------------------|
| +++<password>    | Escape Sequence                    |
| Example          | +++NRM6812 Default Password        |
| Hayes Compatible | +++ Password is set to null string |

### Validity

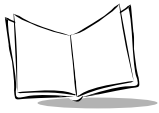
The escape sequence can be used to exit the internal TCP or UDP data modes.

### Other Considerations

For users that make use of the Escape sequence, setting the password to the null string configures the modem to operate in a manner similar to the Hayes modems. The NRM6812 escape sequence does not support the idle time requirement. It simply scans the data stream for the escape characters followed by the password. When the password is a null string, the modem operates similar to a Hayes Modem.

***Related Topics***

Set Password, Program Mode, Data Modes



## Hardware Flow Control

### **Description**

The set flow control command is used to configure the modem to either respond to the hardware flow control signal Request To Send (RTS) and generate Clear To Send (CTS) or ignore them and pass data without regard to the RTS input. When flow control is turned off, CTS is set active.

### **Format**

|       |                                    |
|-------|------------------------------------|
| AT\Q? | Query current flow control setting |
| AT\Q0 | Set flow control off (Default)     |
| AT\Q2 | Set Flow control on (Hardware)     |

### **Validity**

Flow control can be set while in AT Command Mode or Program Mode. Changes made to the flow control setting take effect immediately. There is no need to enter program mode and save the settings.

### **Other Considerations**

Due to the asynchronous nature of sending and receiving data over a wireless channel, it is recommended that flow control be set on so that the host and modem can eliminate data overflow problems. Should the application require only sporadic data reception and transmission of short data packets, the use of hardware flow control is considered optional.

### **Related Topics**

Data Mode, Program Mode, Hardware Interface

## Disconnect (Hang-up)

### **Description**

The Disconnect or Hang-up Command is used to end a TCP or UDP session and possibly power the modem off. When the ATH0-3 command is used, it ends the data mode session and puts the modem into AT Command mode. When the ATH4 command is used, the data mode session is terminated, the modem will perform a de-registration from the network and initiate a shutdown.

### **Format**

|      |   |
|------|---|
| ATH0 | Terminate session & return to AT Command mode                 |
| ATH1 | Terminate session & return to AT Command mode                 |
| ATH2 | Terminate session & return to AT Command mode                 |
| ATH3 | Terminate session, de-register, and return to AT Command mode |
| ATH4 | Terminate session, de-register and shutdown                   |

### **Validity**

Valid for TCP and UDP data modes.

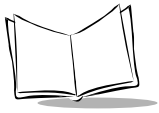
### **Other Considerations**

None

### **Related Topics**

Data Mode, Program Mode, Hardware Interface





## Restore Factory Defaults

### **Description**

The restore factory default command sets the following S registers to their default factory setting. The settings are stored in RAM only and will not be saved unless a Save Settings command is issued before power down or a soft reset.

### **Format**

AT&F                                      Restore factory defaults

### **Validity**

This command is valid only in Program mode.

### **Other Considerations**

Not all registers are altered by the Restore factory default command. For a complete listing of S register settings see the S Register summary.

### **Related Topics**

None

## Line Speed and Format

### Description

This command allows the user to specify the data bit rate or “line speed” and format of the host serial port for all subsequent communications. Some applications have the need for operating at a different line speed, other than 9600, because of existing or established wire-line software. The line speed change will not take effect until the registers have been saved and the modem reset.

### ***Format***

ATS23? To determine the current line setting

OR

AT&L? To determine the current line setting

ATS23=<S>,<D><P><N>      To change the serial port settings

OR

AT&L<S>,<D><P><N>      To change the serial port settings

Where:  $\langle S \rangle$  = Baud rate in bits/second: [1200 | 2400 | 4800 | 9600 | 19200]

<D> = Number of data bits [7 | 8]

$\langle P \rangle = \text{Parity } [O \mid E \mid N]$

<N> = Number of stop bits [1 | 2]

Examples (all have 8 bits, no parity, 1 stop bit)

For 19200 enter      AT&L19200,8N1

For 9600 enter      AT&L9600,8N1

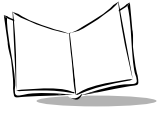
For 4800 enter      AT&L4800,8N1

For 2400 enter      AT&L2400,8N1

For 1200 enter      AT&L1200,8N1

|                 |          |
|-----------------|----------|
| Default Setting | 9600,8N1 |
|-----------------|----------|

**Note:** When AT&L is entered the modem will interpret this as AT&L1200,7O1 (7 bits, odd parity, 1 stop).



### ***Validity***

This command is valid only in Program Mode. Serial port change will not occur until settings are saved and a soft reset occurs.

### ***Other Considerations***

The modem does not support the auto-baud detection function. Characters received with parity errors are ignored by the modem with no indication to the host.

### ***Related Topics***

Software Reset

## **View Active Profile**

### ***Description***

This command displays the current active configuration state of most modem data registers.

### ***Format***

|      |                     |
|------|---------------------|
| AT&V | View active profile |
|------|---------------------|

### ***Validity***

Valid in AT Command and Program modes.

### ***Other Considerations***

None

### ***Related Topics***

None



### Description

### ***Format***

### **Validity**

## Other Considerations

## Related Topics

1-46

## Destination IP Address/Port

### **Description**

This command is used to store the default IP address for the remote host. When the modem is directed to establish a session using TCP, or send UDP packets, without specifying an IP address, the IP address specified by register S53 is used at the destination IP. The addition of a preceding “T” or “P” is used to define a default mode of operation when one is not supplied with the ATD command. The ‘port value’ is the TCP/UDP port number used to identify the application in the remote host to be used for the connection-oriented service.

### **Format**

ATS53?                      Query destination IP Addr /Port

ATS53=T1.2.3.4/1    Set the destination IP Addr/Port

Where:            <mode> = Optional access mode for remote host

                    T = TCP (default).

                    P = UDP

                    <address> = IP address: xxx.xxx.xxx.xxx

                    <port> = TCP/UDP port number [1 - 65535]

Example        ATS53=166.140.73.2/2100

                    IP = 166.140.73.2

                    Port = 2100

### **Validity**

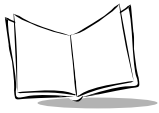
Valid in either AT Command or Program modes. The value specified is stored immediately in NVM.

### **Other Considerations**

If set to a non- zero string, this port number is attached to all transmitted packets in UDP-Data mode.

### **Related Topics**

TCP mode, UDP mode, Default mode



## Multiple Destination Addresses

### **Description**

Multiple destination addresses are like telephone “speed dials”. This command is used to store up to 12 destination addresses (A-L). When setting the destination addresses, individuals can optionally set the protocol, IP address, and IP port. The addition of a preceding “T” or “P” is used to define the protocol. The ‘port value’ is the TCP/UDP port number used to identify the application in the remote host to be used for the connection-oriented service. The syntax is identical to that used when setting S53.

The default protocol is TCP, the default address is 0.0.0.0 and the default port is 1. When upgrading from an older software version, the B-L registers will have 0.0.0.0 for an IP address, and 0 for a port number.

Restoring the factory defaults (&F) has no effect on the destination addresses.

The new destination addresses does not override or interfere with conventional dialing.

**Format**

|  |  |
|--|--|
| ATS53?   | Query destination A IP Addr /Port using S53    |
| ATS53=T1.2.3.4/1                                       | Set the destination A IP Addr/Port using S53   |
| AT&ZT1.2.3.4/1   | Set the destination A IP Addr/Port using &Z    |
| ATDEST=T1.2.3.4/1                                      | Set the destination A IP Addr/Port using DEST  |
| ATDESTA=T1.2.3.4/1                                     | Set the destination A IP Addr/Port using DESTA |
| ATDEST[destination address]=[mode]xxx.xxx.xxx.xxx/port |  |

Where:

- <destination address> = Optional destination letter  
A-L (12 speed dials, A is default)
- <mode> = Optional access mode for remote host  
T = TCP (default).  
P = UDP
- <address> = IP address: xxx.xxx.xxx.xxx
- <port> = TCP/UDP port number [1 - 65535]

ATDEST?                      Query all destination addresses (A-L)

Example ATDESTL=166.140.73.2/2100

Protocol = TCP (default)

IP = 166.140.73.2

Port = 2100

**Validity**

Commands are valid in either AT Command or Program modes. The value specified is stored immediately in NVM.

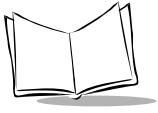
**Other Considerations**

The secondary function of defining multiple destination addresses, is to block UDP calls. Incoming UDP calls are accepted only if:

1. All destination addresses are set to 0.0.0.0, or
2. The sender's IP address matches one of the destination addresses.

Once a UDP session has been established, packets are only accepted from the caller's IP address.





## ***Related Topics***

Dial (Connection Setup)

## Debug Mode

### ***Description***

This command sets the modem into debug mode, sending debug information out the serial port. The debug information is generated by the “Radio Resource Manager” (RRM) portion of the modem’s internal software. This piece of code oversees the operation of the modem, monitoring the physical connection, channel management and data transport. Debug information is generated only while the modem is in AT Command mode. Once the modem enters a data mode, the debug information stream is suspended since this would interfere with the data transfer operation.

An alternative to the debug mode is to use the MSCI protocol and monitor the modem’s operation interactively. The MSCI protocol requires a PPP or SLIP link to be used and then sends special UDP messages directly to the modem. The modem responds to the UDP messages returning the requested modem operation data.

### ***Format***

|        |                  |
|--------|------------------|
| AT#X=1 | Enter debug mode |
| AT#X=0 | Exit debug mode  |

### ***Validity***

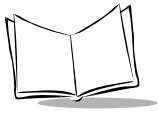
Valid in AT Command mode only.

### ***Other Considerations***

Debug mode cannot be entered in Program mode since the modem is disconnected from the network and the RRM is not running.

### ***Related Topics***

None



## **Auto Answer (TCP Listen)**

### **Description**

Register S0 is used to put the modem into a state where the modem will accept a TCP session request from a remote server or another modem. The modem can remain in AT Command mode while the modem is waiting for a session request to be received.

The session activation process begins when the host asserts DTR (if DTR operation is selected) to inform the modem that it can accept the session request.

The modem will issue a "RING" string to the host to indicate that a session has been initiated. The modem may also generate a CMOS and/or a RS-232 RING signal coincident with sending the RING string if programmed to do so. The IP address port number, stored in register S53, is used as a qualifier for the session request.

### **Format**

|        |                          |
|--------|--------------------------|
| ATS0?  | Auto Answer Query        |
| ATS0=1 | Set Auto Answer mode ON  |
| ATS0=0 | Set Auto Answer mode OFF |

### **Validity**

Auto answer mode can be set in either AT Command or Program mode. Setting changes to auto answer are saved immediately.

### **Other Considerations**

None

### **Related Topics**

Register S53

## Connection Establishment Time-out

### Description

When initiating a session request as a remote client, attempting to talk to a server, a time-out limit for establishing the connection can be specified by setting register S7 to the appropriate value. When a TCP session request is sent out by the modem, the server being called will respond with either an acceptance or busy message. If the server does so before the time-out limit is reached, the modem will respond with the acceptance string "CONNECT" or the declining string "BUSY". The server will usually return a "BUSY" message when it is overloaded and cannot accept further sessions. If the server being called does not respond in the time allowed, the modem will respond with an ERROR message to indicate that it could not establish a session.

### Format

|                        |  |
|------------------------|--|
| ATS7?                  | Connection Timeout value                                       |
| General Command format | ATS7=<time-out>  |
| Where: <time-out> =    | time-out value in seconds [0 - 255]                            |
| Default                | 60 seconds   |
| Example command        | ATS7=45 programs a value of 45 seconds for the time-out value. |

### Validity

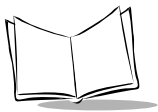
This command is valid only in Program mode. The value must be saved with the AT&W command.

### Other Considerations

None

### Related Topics

None



## Data Forwarding Idle Time-out

### Description

When using the internal stack either UDP or TCP, the data being sent to the modem is automatically encapsulated in an IP packet using the preset protocol. The packet size may vary depending upon the rate at which the data characters are received. If the data is received in a very sporadic manner, the modem will assemble and send a packet after an idle period has elapsed, no data is received in this interval. This keeps the data moving, retaining some time relevance instead of waiting for a specific number or a full buffer. The modem will also send a packet if a return character is encountered in the data stream.

The timer value is programmable from 0.1 to 25.5 seconds in  $1/10^{\text{th}}$  of a second resolution.

### Format

|                            |   |
|----------------------------|---|
| ATS50?                     | Data Forwarding Idle Time-out   |
| General command format     | ATS50=<time-out value>  |
| Where:                     | <time-out value> = Time-out value in $1/10^{\text{th}}$ seconds [0 - 255] |
| Example command            | ATS50=15 the time out value is set to 1.5 seconds                         |
| Default factory setting is | 0.5 seconds   |

### Validity

None

### Other Considerations

For most applications, data is sent in bursts, with each burst of data having relevance within the application. To define the length of each packet, it is recommended to send the data in bursts followed by a return. Packet length will vary as both UDP and TCP include overhead information in each packet. Typically TCP will include a 40 byte header while UDP uses less than 20 bytes for header information. UDP is generally used to reduce data transmission costs but requires the application to handle lost packets and retries.

### Related Topics

None

## Data Forwarding Idle Character

### ***Description***

When using the internal stack either UDP or TCP, the data being sent to the modem is automatically encapsulated in an IP packet using the preset protocol. The packet size may vary depending upon the rate at which the data characters are received. If the data is received in a very sporadic manner, the modem will assemble and send a packet after a specific character is encountered in the data stream. A normal idle character configuration would be a CR or NL character. This register will configure which idle character to forward information on.

### ***Format***

|          |  |
|----------|--|
| ATS51?   | Query Data Forwarding Idle Character           |
| ATS51=0  | Disabled Data Forwarding Idle Character        |
| ASS51=aa | Data Forwarding Idle Character values of 1-255 |

### ***Validity***

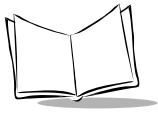
None

### ***Other Considerations***

None

### ***Related Topics***

None



## Data Forwarding Escape Character

### Description

When using the internal stack either UDP or TCP, the data being sent to the modem is automatically encapsulated in an IP packet using the preset protocol. When sending raw 8 bit data, a Forward Character may need to be “Escaped” to ensure the packet is not fragmented by the modem.

In this mode the Forward Character is treated as a special control character and is not transmitted unless it is explicitly escaped by adding the escape character before the forward character. Similarly, the Escape Character is also treated as a special control character and is not transmitted unless it is explicitly escaped.

For example, if “A” is the Forward Character and “B” is the Escape Character:

“BABABAA” will translate to a packet with “AAA” as the payload.

“BBBBBBBA” will translate to a packet with “BBB” as the payload.

“BABBBCA” will translate to a packet with “ABC” as the payload, but in this case, using the escape in front of the “C” character is redundant. This illustrates the transparency of the escape character.

Notice in all the above examples, the Forward Character was not part of the payload. This behavior differs from using the Forward Character alone. (AT#S51=0) In that case, the forward character is transmitted when packet is terminated. Below is an example of transmitting the Forward Character at the end of a transmission.

“1234BAA” will translate to a packet with “1234A” as the payload.

### Format

|           |  |
|-----------|--|
| AT#S51?   | Query Data Forwarding Escape Character           |
| AT#S51=0  | Disabled Data Forwarding Escape Character        |
| AS#S51=aa | Data Forwarding Escape Character values of 1-255 |

### Validity

None

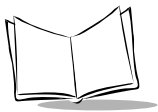
### Other Considerations

None

***Related Topics***

None





## UDP Half Open Mode

### **Description**

Once the modem is configured to operate in the half-open mode, it can accept AT commands from the keyboard, it can also receive UDP packets through the RF channels for the duration specified by the user without performing and ATD command.

The modem can accept UDP packets from any destination. But once it receives a packet, it locks onto that destination and automatically goes into the regular UDP mode. It stays in that mode until either the DTR is dropped, the escape sequence is sent or the Half-Open timer expires. The timer restarts every time a packet is received or sent. For example, if the timer is set to 30, the Monitor will stay in the UDP mode until 30 seconds after the last UDP packet is received or sent. Once the modem exits active UDP, it returns to the Half-Open mode.

If the destination address is set to a nonzero value, everything will work the same as the above except that it will only accept UDP packets from that specific destination and ignore the rest.

### **Format**

|         |                        |
|---------|------------------------|
| ATS82=0 | regular mode           |
| ATS82=1 | not used (reserved)    |
| ATS82=2 | Half-Open mode enabled |

Query:       ATS82?

Command:    ATS82=<mode>

Where <mode> 0 = Regular mode

              1 = Not used (reserved)

              2 = Half-Open mode

### **Validity**

This command can only be issued in command mode.

***Other Considerations***

Register S83 is used as the half-open timer. Setting this register to a non-zero value permits the automatic UDP stack to remain active for that amount of time (measured in seconds).

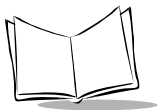
ATS83?                      Query UDP Open Timeout

ATS83=60                    Set UDP Open Timeout

sets the timer to 60 seconds.

***Related Topics***

None



## Status Reporting

### Description

The CDPD Status Reporting feature provides a status code to be automatically issued each time the modems connection status changes. The status message is encoded using a string of five letters. Each letter position indicates the current status of a particular condition or phase in the modems operation.

|        |   |  |
|--------|---|--|
| A or I | RSSI, received signal strength intensity,<br>A = >-100 dBm<br>I = <-100 dBm | "A" indicates a signal strength in excess of -100 dBm while an "I" indicates a signal strength below -100 dBm. It is generally found that modem operation is most reliable when the signal strength is above - 100 dBm.  |
| B or J | Current forward channel error rate<br>B = < 3%<br>J = > 3%                  | The second letter is used to indicate the current error rate on the forward channel (modem receiver). The letter "B" indicates an error rate lower than 3%, which is considered acceptable in most applications since it can be easily corrected within the Reed Solomon coding scheme. The letter "J" is used to indicate an error rate above 3%. Errors above 3% can cause delays in data reception and may require retransmission of data between the modem and the base station. |
| C or K | Found CDPD Service<br>C = Service found<br>K = No Service yet               | The third letter is used to indicate that the modem has found a cellular channel with CDPD service. The modem indicates the existence of the available channel using a "C". Until a channel is found the modem will issue a "K" in the third letter position. Should the modem not establish a connection it will hunt for another channel, putting out a "K" until a new channel is found.  |
| D or L | Registration indicator<br>D = Registered<br>L = Not Registered              | The fourth letter is the registration indicator. A "D" indicates that the modem has successfully acquired a channel and registered with the network. Data modes can then be used. An "L" in this position indicates that the modem has not yet registered.   |

|        |   |   |
|--------|---|---|
| E or M | Scan Mode<br>E = Set on Channel<br>M = Scanning | The fifth and final letter is used to indicate when the modem is scanning and when the modem is fixed on a channel. An "E" indicates that the modem is fixed on a channel while an "M" indicates the modem is searching for channels. As defined within the CDPD specification the modem will periodically scan other channels trying to find a stronger signal or one that is not as heavily used. |
|--------|---|---|

**Format**

|          |                                  |
|----------|----------------------------------|
| ATS103?  | To determine the current setting |
| ATS103=1 | To enable status reporting       |
| ATS103=0 | To disable status reporting      |

**Validity**

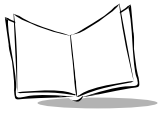
The status reporting can be enabled or disabled in either AT Command or Program modes. Changes made in AT Command mode and not saved with the AT&W command in Program mode will not be retained after power down.

**Other Considerations**

Status reporting, if enabled, will continue to operate in PPP and SLIP modes but will be suspended in TCP and UDP modes.

**Related Topics**

None



## Local IP Address/Port

### Description

Since the modem connects directly to the Internet, it needs to have an IP address to define where data destined for it can be sent. The two methods for defining IP addresses are static and dynamic. Dynamic IP addresses are assigned to the modem each time the modem connects to the network. Dynamic IP addressing poses several disadvantages with messaging services. These difficulties are overcome with Static IP addressing which is used by the modem. Register S110 is reserved for specifying the IP address for the modem. The optional 'port extension' is the TCP/UDP port number used to further identify the host application for the connection-oriented service.<sup>1</sup>

The IP address must be specified before the modem can register with the network. Please contact your network provider to receive your IP address. This number is assigned to the modem and must remain unique; you cannot load the same IP address into more than one modem and have them work. The IP address cannot be ported or transferred to another modem without alerting your issuing carrier of the change and the associated Electronic Identifier (EID) numbers of the modems.

Once registered on the Network, the EID and IP must remain in the same modem until the Network is told to "Trust enable" the modem or "Reset Authentication Parameters" for the modem. During initial registration of the modem, first time registration, the typical process has the Network accepting the modem's EID without checking it and henceforth using that value along with the IP and authentication keys. This will remain in effect until the Network administrator is instructed to change the IP, EID or reset the credentials.

### Format

|                         |  |
|-------------------------|--|
| ATS110?                 | IP Address and Port                      |
| ATS110=<Address>/<port> | To set the IP address                    |
| Where:                  | <address> = IP address: xxx.xxx.xxx.xxx  |
|                         | <port> = TCP/UDP port number [1 - 65535] |
| Example command         | ATS110=207.107.0.35/2014                 |
|                         | IP address is 207.107.0.35               |
|                         | Port number is 2014                      |

This port number is used for "listening" in UDP-Data mode.

*1. This address/port combination is used when the modem opens the TCP port for listening.*

***Validity***

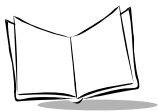
The IP address can only be changed in Program mode.

***Other Considerations***

An IP address consists of 4 numbers, 0 to 255, separated by dots (periods). For IP addresses that contain zero as one of the numbers, you must enter the zero as part of the IP address as shown in the example above. An IP address must have four numbers to be valid. Numbers must be limited to 0 to 255 in value. Check with your carrier before making any changes to your IP address setting.

***Related Topics***

None



## Service ID Preference

### Description

In addition to being able to set the side preference, and specifying the cellular channel side used by the modem, the user can also specify the preferred carrier that the connection should be made with. Parts of the information broadcast by the network may include three pieces of information used to identify the carrier. These identifiers are the Service Provider Identifier (SPI) the Service Provider Network Identifier (SPNI) and the Wide Area Service Identifier (WASI).

All of these parameters do not need to be sent by the carrier. Each carrier configures their network to use some or all of these to identify themselves in the various regions of the country where they operate. Some settings are specific to each region while others are fixed for the entire country. Please contact your carrier before setting these values.

The Service ID Preference settings work in conjunction with register S116. Unless register S116 is set properly, the values of register 111 may not have the desired effect.

### Format

|                            |  |
|----------------------------|--|
| ATS111?                    | Query Service ID Preferences   |
| ATS111=<SPI>/<SPNI>/<WASI> | Set Service ID Preferences   |
| Acceptable range of values | 0 to 65535   |
| Don't care value setting   | 0  |
| Example                    | ATS111=0/1206/12300<br>SPI = Don't care<br>SPNI = 1206<br>WASI = 12300 |

### Validity

None

### Other Considerations

For version 1.0 networks (in the process of being phased out) the Service Provider Identifier should be set to 0 if service provider ID preferences are used.

### Related Topics

None

## Channel Scan Mode

### *Description*

The modem modems can be programmed to scan for available CDPD channels in three different modes. Each mode has different operating characteristics and is targeted for specific applications.

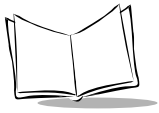
Channel scan mode 0 has the modem performing an initial scan of all cellular channels associated with the selected side preference (see AT\N). Service is initially obtained on the CDPD channel with the highest RSSI. This mode was the first mode developed and was the default mode until mode 2 was developed. New issue modems default to mode 2 operation.

Channel scan mode 1 has the modem using only those cellular channels defined in the channel scan list, regardless of which side they are on. Service is initially obtained on the CDPD channel with the highest RSSI. This is useful in restricting the modem to obtaining service on only a selection of channels. Once service is obtained, automatic handoffs may occur sending the modem to a channel not present in the channel list. If the modem loses the channel, it will only re-scan those channels present in the channel list.

Channel scan mode 2 has the modem using the channel list as a “Hot List” scanning those channels first before scanning outside the list. If service cannot be found on a channel contained in the channel list the modem will perform a wide scan in an effort to locate a suitable channel. If a channel is found which is not present in the list, it is appended to the list for future use. The modem automatically updates and maintains the channel list.

The addition of mode 2 operation also expanded the channel list from 16 to 32 entries. The use of the “Hot List”, offers the advantage of faster connection times since there is a good chance that the channel list will contain an active channel. Because the modem maintains this list itself, there is no need for the operator to initialize the modem channel list, the modem will do this itself. When the modem has filled the 32 location list the software will overwrite the oldest entry in the list and continue rewriting old values with new ones.





## ***Format***

|          |  |
|----------|--|
| ATS112?  | To determine the current channel scan mode |
| ATS112=0 | Any channel                                |
| ATS112=1 | Hot List Only                              |
| ATS112=2 | Hybrid                                     |

## ***Validity***

The channel scan mode can only be altered in Program mode.

## ***Other Considerations***

To optimize performance for mobile applications which use many channels and may roam from city to city, it may be advantageous to clear the channel scan list when entering a new area. This would eliminate channels that are not active in one city from affecting the operation of the modem. Doing this will result in a longer time for primary initialization of the modem as it refills the channel list.

## ***Related Topics***

None

## Channel List

### **Description**

Register S113 is used to contain the channel list. This is the list of cellular channels on which the modem may use to search for CDPD service, depending on the setting of S112. Up to 32 channel numbers may be entered. If no channel numbers are entered, the modem will scan the entire CDPD channel set associated with the side preference.

### **Format**

ATS113? Channel List query

ATS113=<chan1>,<chan2>,etc. Set channel list

Where: <chan1-32> = All valid CDPD channels [1-799, 991-1023]

To zero the channel list ATS113=

No value is entered

### **Validity**

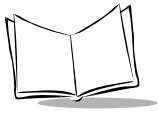
The channel scan list can only be altered in Program mode.

### **Other Considerations**

A channel number of zero is not valid.

### **Related Topics**

None



## Service ID Preference

### **Description**

Register S116 is reserved for the service ID preference mode.

### **Format**

|          |                             |
|----------|-----------------------------|
| ATS116?  | Query Service ID preference |
| ATS116=0 | To only use S111 service ID |
| ATS116=1 | To prefer S111 service ID   |
| ATS116=2 | To not use S111 service ID  |
| ATS116=3 | To use any service ID       |

Default setting 3, use any service

### **Validity**

This command is valid in Program mode only.

### **Other Considerations**

Contact your carrier before altering this register value.

### **Related Topics**

None

## CDPD Operating Version

### **Description**

The CDPD specification has gone through two revisions; the first established version 1.0 networks using dedicated channels. The second version introduced channel hopping and maintained dedicated channels.

### **Format**

|           |                           |
|-----------|---------------------------|
| ATS117?   | CDPD Operating Version    |
| ATS117=10 | To set it for Version 1.0 |
| ATS117=11 | To set it for Version 1.1 |

### **Validity**

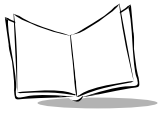
This command is valid in Program mode only.

### **Other Considerations**

Version 1.0 systems are quickly being replaced with version 1.1 systems. Please check with your local carrier before altering this value.

### **Related Topics**

None



## Wireline Compatibility

### **Description**

In order to accommodate certain host computer systems and their expected responses from the modem, a register is provided which enables the trailing line feed character to be stripped off. The default setting for the modem is to send the line feed, which is contrary to what some wire-line modems do. Standard modems operate in the same manner as the modem. When set to suppress the line feed character, the modem will send no leading line feed on terse responses and only one response for an ATD command entry.

### **Format**

|          |                                      |
|----------|--------------------------------------|
| ATS210?  | Query Wireline Compatibility setting |
| ATS210=0 | To enable the line feed character    |
| ATS210=1 | To suppress the line feed character  |

### **Validity**

This command is valid in Program mode only.

### **Other Considerations**

None

### **Related Topics**

None

## Set DTR Control

### *Description*

For applications or situations where hardware control of the modem is not possible, DTR control can be over-riden and the host can avoid the necessity of adding extra control lines. Negating DTR control poses a problem for exiting a data mode as the normal manner is to de-assert DTR to exit. To exit a data mode while DTR control is off, the escape sequence can be used.

### *Format*

|  |  |
|--|--|
| ATS211?  | Query DTR control setting                |
| ATS211=0   | To set DTR control ON                    |
| ATS211=1   | To set DTR control OFF                   |
| ATS211=2   | Always assert DSR                        |
| ATS211=4   | Dropping DTR gracefully powers off modem |
| ATS211=8   | DSR Control asserted after registration  |
| 0: Default behavior (not 4)  |  |
| 1: Ignore DTR  |  |
| 2: Always assert DSR   |  |
| 4: Asserting DTR does nothing. Dropping DTR gracefully powers off modem.         |  |
| 8: Delay assertion of DSR (when entering data modes) until modem has registered. |  |

### *Validity*

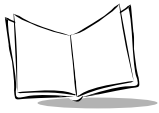
This command is valid in Program mode only.

### *Other Considerations*

As stated above, when DTR control is over-riden, the only way to exit from a data mode is with the escape sequence. When using TCP auto answer, once a session tear down command is received from the remote host, the modem will revert to AT Command mode. This transition from data mode to AT Command mode was initiated remotely, not locally.

### *Related Topics*

DTR Mode Setting, DSR Mode control



## DTR Mode Setting

### **Description**

The DTR control can be used to power off the modem in situations where it is desired. This setting is similar to that of setting register S211 to 4. That is, when DTR is de-asserted, the modem will terminate any current data mode session, perform a system de-registration and power itself off. This setting can also configure the unit to ignore DTR, or identical to setting S211 to 1.

### **Format**

|       |   |
|-------|---|
| AT&D? | Queries DTR mode setting                    |
| AT&D0 | ignore DTR transitions (S211 = 1)           |
| AT&D1 | normal operation (default)                  |
| AT&D2 | de-asserted DTR powers modem off (S211 = 4) |

### **Validity**

None

### **Other Considerations**

None

### **Related Topics**

DTR Control

## DSR Control Setting

### **Description**

This setting provides more complete control of the DSR configuration. The DTR mode and control settings provide inferred control of the DSR pin, but this control register allows more specific control of the DSR configuration.

### **Format**

|        |   |
|--------|---|
| AT&S?  | To query the current DSR control setting            |
| AT&S 0 | No control of DSR. It is asserted all of the time   |
| AT&S1  | Control of DSR is enabled after modem registration. |
| AT&S2  | Normal operation of DSR. Asserted when data mode.   |

### **Validity**

This register is available only in AT Command mode.

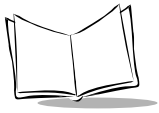
### **Other Considerations**

This register may perform corresponding configuration of the S211 register to reflect any changes here. As an example, if the current S211 is 2 and this register is set to 1, the S211 will be returned to a value of 8.

### **Related Topics**

None





## TCP Timer

### **Description**

When using TCP, a session is initiated by one party calling and the other party accepting or declining the session request. Once a session is established, the two parties listen only to one another (unless multiple sessions are permitted). After a session is completed and both parties want to disengage, a session tear down message is sent from one to the other. Both parties tear down the stack and are then available to set up another session with someone else. In the event that a tear down message is not received by a modem, an idle timer is available which will tear down the session after a predetermined interval of inactivity by either party. The values setting for this timer is specified in the TCP Timer register, TCPT.

### **Format**

|                                |                                  |
|--------------------------------|----------------------------------|
| ATTCP?                         | Query TCP Timer setting          |
| ATTCP=value [0 to 255 minutes] | To set the timer value (minutes) |
| ATTCP=0                        | To disable the timer             |

### **Validity**

None

### **Other Considerations**

A setting of 0 indicates the timer is not used. The minimum setting is 1 minute. It should be noted that when using a sleep mode modem, care should be taken in the selection of an appropriate value, as sleep intervals may create a longer interval of inactivity.

### **Related Topics**

None

## Identity Registers

### **Description**

The identity registers are used to identify the modem to the host. These read only registers present the following information:

The modem's Electronic Identifier Number (EID)

The Software Version, creation date and time

The copyright header

The modem manufacturer

The model and hardware revision number

### **Format**

|      |   |
|------|---|
| ATI0 | To determine the EID                            |
| ATI1 | To determine sw version & copyright information |
| ATI2 | To determine the manufacturer                   |
| ATI3 | To determine the hardware version               |

### **Validity**

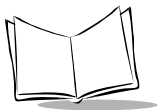
This command is valid in AT Command and Program modes.

### **Other Considerations**

None

### **Related Topics**

None



## Query Network Connection Status

### Description

The command to determine the current network connection status is used to determine if it is acceptable for the host to go into a data mode and reliably exchange data over the CDPD network. The status message returned is encoded using a string of five letters. Each letter position indicates the current status of a particular condition or phase in the modem's operation.

|        |   |  |
|--------|---|--|
| A or I | RSSI, received signal strength intensity,<br>A = >-100 dBm<br>I = <-100 dBm | "A" indicates a signal strength in excess of -100 dBm while an "I" indicates a signal strength below -100 dBm. It is generally found that modem operation is most reliable when the signal strength is above -100 dBm.   |
| B or J | Current forward channel error rate<br>B = < 3%<br>J = > 3%                  | The second letter is used to indicate the current error rate on the forward channel (modem receiver). The letter "B" indicates an error rate lower than 3%, which is considered acceptable in most applications since it can be easily corrected within the Reed Solomon coding scheme. The letter "J" is used to indicate an error rate above 3%. Errors above 3% can cause delays in data reception and may require retransmission of data between the modem and the base station. |
| C or K | Found CDPD Service<br>C = Service found<br>K = No Service yet               | The third letter is used to indicate that the modem has found a cellular channel with CDPD service. The modem indicates the existence of the available channel using a "C". Until a channel is found the modem will issue a "K" in the third letter position. Should the modem not establish a connection it will hunt for another channel, putting out a "K" until a new channel is found.  |
| D or L | Registration indicator<br>D = Registered<br>L = Not Registered              | The fourth letter is the registration indicator. A "D" indicates that the modem has successfully acquired a channel and registered with the network. Data modes can then be used. An "L" in this position indicates that the modem has not yet registered.   |

|        |   |   |
|--------|---|---|
| E or M | Scan Mode<br>E = Set on Channel<br>M = Scanning | The fifth and final letter is used to indicate when the modem is scanning and when the modem is fixed on a channel. An “E” indicates that the modem is fixed on a channel while an “M” indicates the modem is searching for channels. As defined within the CDPD specification the modem will periodically scan other channels trying to find a stronger signal or one that is not as heavily used. |
|--------|---|---|

**Format**

ATS57?                                      To determine current network status

**Validity**

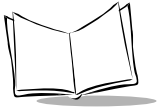
This command is valid in AT Command mode only.

**Other Considerations**

Because the modem is disconnected from the network in Program mode, this command will return an ERROR code if used in program mode.

**Related Topics**

None



## Registration Process

### **Background**

Registration involves 4 message exchanges, all of which have to be successful:

| <u>M-ES</u> | <u>MD-IS</u> |                                  |
|-------------|--------------|----------------------------------|
| TEI REQ     | ->           |                                  |
|             | <-           | TEI ASSIGN (MDLP TEI assignment) |
| SABME       | ->           |                                  |
|             | <-           | UA (MDLP link reset)             |
|             | <-           | IKE                              |
| EKE         | ->           | (SNDP key exchange)              |
| ESH         | ->           |                                  |
|             | <-           | ISC (MNRP registration)          |

This is the system's response to a registration request, and is basically an accept or deny (refer to Table 507-6 in the CDPD specification for all possible responses). The modem will simply pass the information ("insufficient credentials" in this case) along to the user.

Different MD-IS manufacturers may treat the same condition differently, and may return different responses in their ISC's. The CDPD specification provides a substantial amount of guidance but some aspects are left to the discretion of the implementor.

## Last Network Registration Error Code

### Description

Should the modem fail to register within a sizable window of opportunity, typical times vary from 3 to 5 seconds for a “Hot List” match to 30 seconds for a “Wide Scan” match, it may have encountered a network registration error. To determine if this is the case, the network registration error register can be read to see if there is a non-zero value. If the value is zero, then the modem has yet to attempt to register on a valid channel as it has yet to find a channel or form a link to the network.

For non-zero values consult the table below.

| Response | Meaning  |
|----------|--|
| 1        | No particular reason given   |
| 2        | MD-IS not capable of handling the M-ES at this time  |
| 3        | NEI is not authorized to use this subnetwork   |
| 4        | M-ES gave insufficient authentication credentials  |
| 5        | M-ES gave unsupported authentication credentials   |
| 6        | NEI has exceeded usage limitations   |
| 7        | Service denied on this subnetwork; service may be obtained on alternate Service Provider network |
| 8-255    | Reserved   |

For further assistance if a non-zero value is present, please contact your carrier and provide them with this information.

### Format

ATS200?

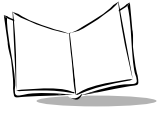
To determine last registration error

### Validity

Valid for AT Command mode only.

### Other Considerations

Most Network Registration problems are due to a mismatch of the authentication credentials. These values are stored in both the modem and the Network MDIS Information



database. If these values get out of sync, registration may not be possible. Problems can be experienced when trying to register on an alternate carrier through an “interop” agreement link. Because the modems use the internet for communications, information may be slow in arriving at the intended destination or may be lost along the way. Interop links introduce additional delays in delivering registration information that can result in temporary failure to register. This situation should typically not persist for more than 2 minutes.

### ***Related Topics***

None

## Authentication Parameter

### **Description**

The Authentication Parameters can be set to zero using the AUTH command. This command is only used if the network equipment requires the modem to start service using a zero key value. If this command is entered after the modem has successfully registered on the network, the authentication parameters will not match the value stored on the network and the modem will not be able to re-register with the network.

### **Format**

|        |                                      |
|--------|--------------------------------------|
| ATAUTH | To reset authentication keys to zero |
|--------|--------------------------------------|

### **Validity**

This command is valid for AT Command mode only.

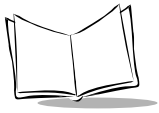
### **Other Considerations**

None

### **Related Topics**

None





## Query Current RSSI Value

### **Description**

To determine the current Receive Signal Strength Intensity, RSSI, value for the current channel being scanned, register S202 can be read. The RSSI value is presented as the relative signal strength above the modem noise floor. The absolute value is determined by adding the relative value from register S202 to the noise floor value of  $-115$  dBm.

It is important to remember that the modem can be scanning while this inquiry is made, thus the value read back may not be valid for the channel that is later retrieved from the current channel register.

### **Format**

ATS202?

To determine the current RSSI value

### **Validity**

This command is valid for AT Command mode only.

### **Other Considerations**

None

### **Related Topics**

None

### Query Current Block Error Rate (BLER)

### Description

The modem maintains statistics on its performance and operation. One of the parameters measured and maintained is the block error rate. This measurement is derived by examining the Reed Solomon algorithm, that part of the modem's software that can detect and correct errors in the data stream. Data errors that cannot be corrected result in a retransmission of the bad segment while errors that can be corrected do not result in data retransmissions. The modem measures the errors and, based upon an error rate threshold, then uses this measurement to decide when to change channels. The block error rate can rise to 3% before the effect becomes noticeable by the user. The block error rate is updated approximately every second or two when the modem is connected to the network.

### ***Format***

ATS203? To determine the current Block Error Rate

The response will be in the form of a percentage [0 to 100%]

## Validity

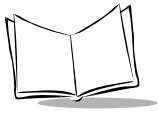
This command is valid for AT Command mode. For use in data modes, the MSCI protocol is preferred.

## Other Considerations

None

## Related Topics

None



## Current RF Channel in use

### Description

To determine the current channel that the modem is currently locked to, the contents of register S204 can be read. This value represents the cellular channel number and does not, by itself, indicate that this is a CDPD channel, a voice channel or even if there is any RF signal being received. Because the modem periodically scans for better channels trying to improve service, the channel number returned may not be a valid CDPD channel. The modem will eventually scan all channels on the desired side or sides, even those which are not CDPD enabled. This results in the channel value being returned by the modem may have been one which was being scanned when the command was accepted by the modem. This means that the user must take care in interpreting the channel number as being a CDPD channel as it may not be.

### Format

ATS204?

To determine the current channel

### Validity

This command is valid in AT Command mode only.

### Other Considerations:

**Table 1-1. Frequency and Channel Assignments**

| Mobile Transmit | Base Transmit   | Channel    | Use     | Band |
|-----------------|-----------------|------------|---------|------|
| 824.04 – 825.00 | 869.04 - 870.00 | 991 - 1023 | Voice   | A    |
| 825.03 – 834.36 | 870.03 - 879.36 | 1 - 312    | Voice   | A    |
| 834.39 – 834.99 | 879.39 - 879.99 | 313 - 334  | Control | A    |
| 835.02 – 835.62 | 880.02 - 880.62 | 335 - 356  | Control | B    |
| 835.65 – 844.98 | 880.65 - 889.98 | 357 - 666  | Voice   | B    |
| 845.01 – 846.48 | 890.01 - 891.48 | 667 - 716  | Voice   | A    |
| 846.51 – 848.97 | 891.51 - 893.97 | 717 - 799  | Voice   | B    |

### Related Topics

None

## Cell Site ID in Use

### **Description**

The CDPD Network is composed of a multitude of cellular towers transmitting their signals over a portion of the total coverage area. By reusing frequencies, a greater density of coverage can be maintained and more calls supported. To make each tower identifiable to remote terminals (modems), an identifying ID number is sent in the forward data stream. This number, [0 to 65535] is useful in reporting problems to the cellular carrier when the cellular signal is in question.

### **Format**

|         |                                      |
|---------|--------------------------------------|
| ATS205? | To determine the current Cellular ID |
|---------|--------------------------------------|

### **Validity**

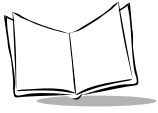
This command is valid in AT Command mode only.

### **Other Considerations**

None

### **Related Topics**

None



## Area Color Code in Use

### **Description**

The CDPD Network is composed of a multitude of cellular towers transmitting their signals over a portion of the total coverage area. By reusing frequencies, a greater density of coverage can be maintained and more calls supported. To distinguish the same channel frequency used on two towers, carriers assign each one a different color code. The color code is a number from zero to seven. This information assists the network in routing the information being sent to the modem through the right cell site tower.

### **Format**

|         |                                     |
|---------|-------------------------------------|
| ATS206? | To determine the current color code |
|---------|-------------------------------------|

### **Validity**

None

### **Other Considerations**

None

### **Related Topics**

None

## SPI, SPNI and WASI

### **Description**

Once a receiver is successfully synchronized to a channel, the mobile device waits for a channel stream identification message. These messages are broadcast periodically by the MDDBS and do not require the use of a network-layer routing protocol. These messages are broadcast on the forward channel stream approximately every 5 seconds.

Information from this stream can be used to determine “where” the unit is operating and with who’s service.

- SPI (Service Provider Identifier): Number assigned for each carrier
- SPNI (Service Provider Network Identifier): Regions in which the service providers have domains. Represents one of many individual CDPD networks managed under the authority of a particular licensed carrier of CDPD service
- WASI (Wide Area Service Provider): Used as a marketing identifier to indicate if an arrangement of multiple carriers are acting together to provide service for that area.

### **Format**

|         |                               |
|---------|-------------------------------|
| ATSPI?  | To determine the current SPI  |
| ATSPNI? | To determine the current SPNI |
| ATWASI? | To determine the current WASI |

### **Validity**

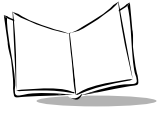
This command is valid in AT Command mode only and when modem is registered.

### **Other Considerations**

None

### **Related Topics**

None



## Power Level Query

### **Description**

The Power Level query will return the current transmit power level being used by the modem on the current CDPD system. This power level is a product of the proposed power level and received signal strength values at the modem.

### **Format**

|         |                                      |
|---------|--------------------------------------|
| ATS207? | To determine the current power level |
|---------|--------------------------------------|

### **Validity**

None

### **Other Considerations**

None

### **Related Topics**

None

## Symbol Error Rate Query

### ***Description***

A percentage rate of symbol errors encountered by the modem on the Forward channel is provided to assist in identifying sub-optimal signal conditions. The value returned is a percentage representing the number of symbol errors per 100.

### ***Format***

|         |   |
|---------|---|
| ATS208? | To query the current Symbol Error Rate. |
|---------|---|

### ***Validity***

None

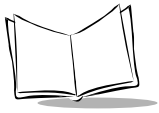
### ***Other Considerations***

None

### ***Related Topics***

None





## Power Product

### **Description**

The Power Product is a CDPD system parameter that ultimately determines the power level used by the modem for transmissions. This value is transmitted by the CDPD system and can be reported in this register.

### **Format**

ATS209?

To query the current power product

### **Validity**

This register is read-only.

### **Other Considerations**

None

### **Related Topics**

None

## Dial (Connection Setup)

### Description

In wire-line modems a connection is made when the modem is instructed to dial a telephone number for the desired computer service. This dial command ATD provides the user with the means of using tone dialing (ATDT), or pulse dialing (ATDP). For wireless Internet modems using CDPD technology, the ATD command is used to initiate a session with a remote Internet server using either TCP/IP or UDP. Instead of a phone number, an IP address is used instead. It is here that the use of the Internet makes CDPD easy to use as there are no area codes, no country codes, no need to access an outside line. All IP addresses currently use a fixed length series of four numbers separated by dots.

Frequently accessed IP addresses can be stored using Multiple Destination Addresses. Destination addresses can be programmed with Protocol, IP address and port number.

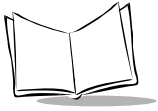
The Dial Connection Setup command causes the modem to establish a connection with the host at the specified IP address/port. For any fields that are left blank, values are taken from those stored in the default destination register. The modem will not process this command if the DTR line is not asserted (i.e. an ERROR response is issued). It is recommended that the host application make sure the modem is connected to the network before issuing a Dial command.

### Format

|                         |   |
|-------------------------|---|
| ATDT<IPaddress>/<port#> | To initiate a TCP Session                         |
| ATDP<IPaddress>/<port#> | To initiate a UDP Connection                      |
| ATDN<Ipaddress>         | To initiate a Telnet Session. Port 23 is assumed. |
| ATD                     | To use the Default Register                       |
| IPaddress format        | XXX.XXX.XXX.XXX                                   |
|                         | where XXX is a number [0 to 255]                  |
|                         | port# format XXXXX                                |
|                         | where XXXXX is a number [0 to 65535]              |

### Examples

|             |  |
|-------------|--|
| TCP Connect | ATDT166.1.109.3 (no port given, 0 assumed) |
|             | IP = 166.1.109.3                           |
|             | Port = 0                                   |



UDP Connect  
number specified)

ATDP166.1.109.3/55000 (Port

IP = 166.1.109.3

Port = 55000

Default Connection

ADT (S53=P166.1.109.3/55000)

Same effect as above

Multiple Destination Addresses dialing:

|      |   |
|------|---|
| ATD  | Dial using register A/S53/&Z parameters |
| ATDA | Dial using register A/S53/&Z parameters |
| ATDB | Dial using register B parameters        |
| ATDC | Dial using register C parameters        |
| ATDD | Dial using register D parameters        |
| ATDE | Dial using register E parameters        |
| ATDF | Dial using register F parameters        |
| ATDG | Dial using register G parameters        |
| ATDH | Dial using register H parameters        |
| ATDI | Dial using register I parameters        |
| ATDJ | Dial using register J parameters        |
| ATDK | Dial using register K parameters        |
| ATDL | Dial using register L parameters        |

### ***Validity***

This command is valid for AT Command mode only.

### ***Other Considerations***

None

### ***Related Topics***

Multiple Destination Addresses

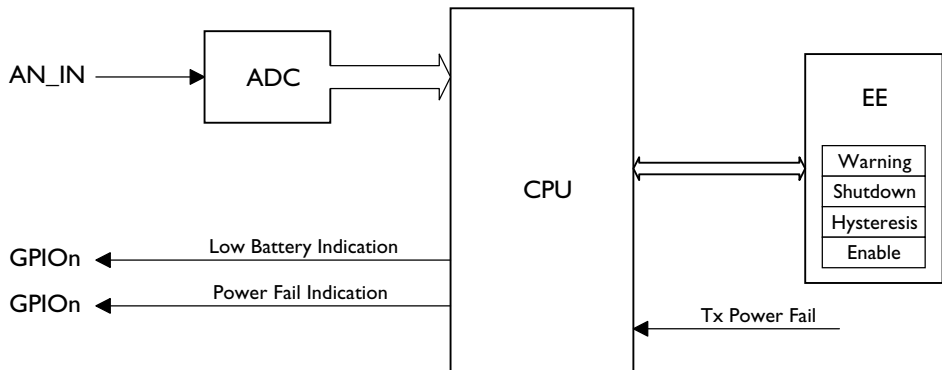
## ADC Monitoring

### Description

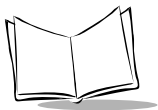
It is anticipated that many of the users of the modem will wish to do so in a mobile environment, and thus one where the supply voltage may not be constant. To that end, a power condition control system has been provided.

A block diagram of the battery/power condition system is shown below. It contains:

- A method of voltage measurement on the modem. This is represented by the AN\_IN input, which is routed on the board to the input of ADC channel 1.
- A method of reading the voltage measurement from the modem. This is effectively the reading of the ADC channel 1.
- A method of identifying when the measurement crosses a threshold. The ability to read the voltage is matched with the entry in the EE device representing a warning ADC value. If the voltage read from the ADC is lower than this EE warning value, the warning indication is asserted.
- A method of specifying the hysteresis associated with the measurements. Once the warning indication has been asserted, it will only be de-asserted once the ADC measurement is  $\geq$  Warning + Threshold.
- A method of modem shutdown when a critical voltage measurement is reached. If the voltage read from the ADC is lower than the EE shutdown value, the modem will initiate a de-registration and shut off.
- A method of enabling/disabling this monitoring feature. All of these features can be enabled/disabled with an entry in the EE.



Given that the monitoring functions have been enabled, the signals associated with these functions can be selectively enabled on any of the GPIO pins on the interface connector.



Obviously, if the associated signals with this feature are not provided on the interface, external devices will not see any of the warnings and must simply identify when the modem has shutdown.

Signal Name: Low Battery Indication

Asserted when the first threshold is reached. After assertion, it will be de-asserted only if the voltage measurement is  $\geq$  low battery threshold + hysteresis count

### **Format**

|              |   |
|--------------|---|
| AT#ADM?      | Queries the current ADC monitoring mode setting |
| AT#ADM=0     | No ADC monitoring                               |
| AT#ADM=1     | Enable ADC monitoring mode                      |
| AT#ADT?      | Query ADC monitoring thresholds                 |
| AT#ADT=x,y   | Set the thresholds for the ADC monitor.         |
| AT#ADH=x     | Sets the hysteresis value                       |
| AT#ADN=x,y,z | Sets the hysteresis count values.               |
| AT#ADC?      | Queries the current AN_IN reading.              |
| AT#ADV=r     | Sets a calibration voltage of the ADC.          |

For the most part, all ADC measurements will be provided in volts. The idea is that once the ADC readings have been calibrated such that the firmware knows what ADC value represents what actual input voltage, all other ADC measurements can now be converted to voltage.

The ADV command forces calibration of the ADC to the currently applied voltage to its input and associates the parameter voltage to this ADC reading. For instance, a 4.10 volt reference voltage could be applied to the AN\_IN pin and then the following command "AT#ADV=4.10" would be sent in program mode. Upon receipt of this command, the raw ADC reading would be sampled and averaged for 10 readings and the result saved and associated with the voltage of 4.10 volts. All other ADC functions can now use voltage values based on this calibrated point and a mathematical relationship.

In the case of the thresholds, the values entered will represent the ADC voltage at which the Low Battery Indication (x) and the modem shutdown (y) will occur, respectively. The hysteresis value entered is a representation of how much the voltage reading must rise once the Low Battery Indication has been given before the Low Battery Indication will be

de-asserted. The counts indicate the number of measurements (with a 1 second period) over the three transition points that must be observed before a valid transition is identified. This ensures that minor transgressions are not identified as failures until they have been qualified through the use of the counts. The three counts represent the additional qualification of transitions from good->low (x), low->off (y), and low->good (z) in the command "AT#ADN=x,y,z".

There will be cases where the AN\_IN measurement would be useful to customers/users as an extra ADC measurement block, but where the power condition monitoring use of the readings are not desired. In this case, the configuration would be to disable the ADC monitoring mode (AT#ADM=0) but still use the AT#ADC? queries to identify the voltage at the ADC directly. The host software is then free to use this reading however they wish.

Example:

As an example of how this may be used, we will assume the following conditions:

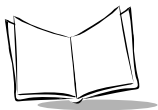
- the supply voltage on the board is externally connected to the AN\_IN pin on the connector
- an LED is connected to GPIO 2, which we want to use for Low Voltage indications
- we wish for the Low Voltage indication to trigger at 3.5V, from a regulated 4.0V regulator
- we wish to initiate a shutdown of the modem if the modem identifies a voltage of 3.3V
- we wish to de-assert any Low Voltage indication if the voltage rises to 3.6V
- we wish for 5 counts of each voltage to be observed before we accept the transition.

## **Configuration**

In order to use these features, we must perform some configuration of the system to reflect our desires.

The order of events to configure the system is as follows:

|                  |  |
|------------------|--|
| AT+APROG,NRM6812 | *enter program mode                                    |
| AT#ADV=4.0       | *assumes that the voltage input currently is 4.0 volts |
| AT#ADT=3.5,3.3   | * configures the warning and shutdown thresholds       |
| AT#ADH=0.10      | * configures the hysteresis to be 3.6V-3.5V or 0.10V   |



|              |   |
|--------------|---|
| AT#ADN=5,5,5 | * configures the hysteresis counts to be 5 readings   |
| AT#ADM=1     | * enables the low voltage monitor                     |
| ATIO2=10     | * enables the Low Battery Indication signal on GPIO2. |
| AT&W         | * saves all settings.                                 |

This completes all configuration functions associated with the desired power monitoring system that we defined. The system will now perform the following monitoring:

If voltage is  $\geq 3.5V$ , no indications

If voltage is  $3.3V \leq v \leq 3.5$  for 5 counts, low battery indication is given and LED lights

If voltage rises above 3.6V for 5 counts then, low battery indication is removed and LED turns off

If voltage falls below 3.3V, unit powers off.

### **Validity**

This command is valid for AT Command mode only.

Once the monitoring functions have been enabled, the shutdown functions will operate. However, the signals associated with the warnings will only appear on the interface if the Programmable GPIO pins have been configured to report the associated signals.

### **Other Considerations**

The voltage measurement is also available through MSCI commands.

### **Related Topics**

General Purpose IO, Program Mode, Save Profile command

## Ping Command

### *Description*

The Ping command causes the modem to transmit a single ICMP packet of the specified size to the ICMP/PING entity of the specified address. The data sent is a simple random pattern that the targeted destination will return in the same format as it was sent. If the packet is returned, then the path from the modem to the destination address location is intact. If the message is not returned then the path may not be intact or the destination address may not be able to respond. The Ping command is a very useful tool in trouble shooting problems and confirming the modems operation.

Upon issuing the Ping command the modem will send the ICMP Ping message to the destination address.

The modem will wait for a return message. If the destination address returns the Ping message before 20 seconds has elapsed, an OK result code is emitted. If the Ping message is not returned in less than 20 seconds, an ERROR result code is emitted. Additional PING commands must not be issued if a PING command is already in progress, you must wait for either the OK or the ERROR response.

The ping command can be used to send messages up to 128 bytes in length by adding a forward slash and a number, 1 to 128, afterwards. If no forward slash is included the Ping message will be 32 bytes in length.

### *Format*

|                                  |   |
|----------------------------------|---|
| ATPING<XXX.XXX.XXX.XXX>/<Length> | To send a ICMP Ping message                         |
| IPaddress format                 | XXX.XXX.XXX.XXX<br>where XXX is a number [0 to 255] |
| Length value range               | [1 to 128]  |

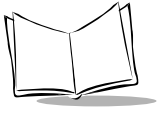
### *Validity*

None

### *Other Considerations*

In earlier versions of the modem software a BUSY result code was emitted upon transmitting the ICMP Ping message. There is currently no trace route function within the modem. This function is resident in Windows 95 and can be run using PPP or SLIP and the external stack.





***Related Topics***

None

## Power Boost

### **Description**

This feature provides support for an external 3watt booster.

### **Format**

|        |   |
|--------|---|
| ATAC?  | To query the configuration                          |
| ATAC=0 | To turn off 3 watt booster support                  |
| ATAC=1 | Configuration for 3 watt booster compatible antenna |

### **Validity**

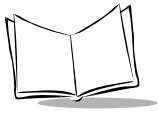
None

### **Other Considerations**

There is also an input signal that can be configured to provide this selection as well.

### **Related Topics**

None



## Message Waiting

### **Description**

This command turns on the Message Waiting signal if it exists.

### **Format**

|        |  |
|--------|--|
| ATMW?  | To query the state of the signal       |
| ATMW=1 | To turn on the Message Waiting signal  |
| ATMW=0 | To turn off the Message Waiting signal |

### **Validity**

Obviously, this feature is only valid if there is an output pin associated with this signal.

### **Other Considerations**

None

### **Related Topics**

None

## Internal MRU Setting

### **Description**

This feature defines the maximum negotiated MRU size during a PPP session. In many host systems, the host stack will configure a default MRU size from its own defaults, but this may not be the optimum size for the CDPD network. Further, some implementations of host TCP/IP stack do not allow the modification of this default by the users. Therefore, in order to properly support these stacks in a wireless CDPD environment, the ability to dictate the negotiated MRU size to an optimum value regardless of host configuration will be supported in this register.

### **Format**

AT#MRU?                      To query the current setting

AT#MRU=xxx                Set the MRU value

By default, the MRU recommended by the CDPD system is approximately 512 bytes.

To set the default MRU size to 512, you would enter the following:

AT+VPROG,NRM6812   - enter PROGRAM mode of operation

AT#MRU=512                - set the value to 512

AT&W                        - to save it

### **Validity**

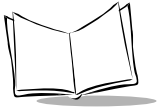
This value is configurable in PROGRAM mode only.

### **Other Considerations**

None

### **Related Topics**

None



## TCP Suspension Enable

### **Description**

This allows any TCP session to be suspended.

### **Format**

|          |                             |
|----------|-----------------------------|
| ATTCPX?  | Query TCP suspend enable    |
| ATTCPX=0 | Disable TCP suspend feature |
| ATTCPX=1 | Enable TCP suspend feature  |

### **Validity**

None

### **Other Considerations**

None

### **Related Topics**

None

**Call Progress Result Mode**

***Description***

None

***Format***

|      |                                   |
|------|-----------------------------------|
| ATX? | Query the call progress selection |
|------|-----------------------------------|

|        |                                 |
|--------|---------------------------------|
| ATX=xx | Set the call progress selection |
|--------|---------------------------------|

***Validity***

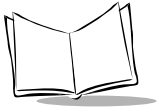
None

***Other Considerations***

None

***Related Topics***

None



## **Answer**

### **Description**

This feature represents of the normal ATA answer command. In this system, the ATA will be sent by the host to release any pending push messages, which would have asserted the Ring Indication line of the modem interface.

### **Format**

|     |                             |
|-----|-----------------------------|
| ATA | To answer a Ring Indication |
|-----|-----------------------------|

### **Validity**

None

### **Other Considerations**

None

### **Related Topics**

None

## Telnet Echo

### **Description**

A command to assist in Telnet terminal emulation. This command and the associated S register determine how characters are echoed, either locally, remotely or with no echo.

### **Format**

|         |                      |
|---------|----------------------|
| ATS60?  | Queries echo mode    |
| ATS60=0 | No echo              |
| ATS60=1 | Local echo (default) |
| ATS60=2 | Remote echo          |

### **Validity**

None

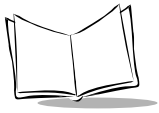
### **Other Considerations**

None

### **Related Topics**

None





## Modem Identification

### **Description**

This feature allows another AT command to query the Modem ID or EID value.

### **Format**

|      |                   |
|------|-------------------|
| ATI  | Queries modem EID |
|      | or                |
| ATI0 | Queries modem EID |

### **Validity**

None

### **Other Considerations**

None

### **Related Topics**

The ATI0 command can be used for the same function.

## Friends Mode

### *Description*

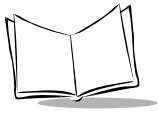
In “Friends” mode, the modem can be configured to reject all messages received that do not originate from a “friendly” IP address. Up to 10 “friendly” IP addresses can be entered. Once a series of “friendly” IP addresses or ranges have been entered, enabling “Friends” mode will block reception of data except from IP addresses in the list. If a message arrives that is not from a “friend” and “Friends” mode has been enabled, the message will be silently discarded.

### *Format*

|              |   |
|--------------|---|
| ATFM=0       | “Friends” mode disabled                                 |
| ATFM=1       | “Friends” mode enabled                                  |
| ATFM?        | Queries the “Friends” mode setting                      |
| ATFn=a.b.c.d | Sets entry n in “Friends” list to be IP address a.b.c.d |
| ATF?         | Queries all 10 entries in the “Friends” list.           |

In the “Friends” list, entries are indexed from 0 so valid entry positions are 0-9.

When defining IP addresses, 255 can be used as a wildcard.



As an example, suppose that you wish to only accept messages from IP 125.125.125.128 and from any IP in the 210.180.45 subnet. This could be configured with the following commands:

```
ATF1=125.125.125.128
```

```
OK
```

```
ATF2=210.180.45.255
```

```
OK
```

```
ATF?
```

```
0=125.125.125.128
```

```
1=210.180.45.255
```

```
2=0.0.0.0
```

```
3=0.0.0.0
```

```
4=0.0.0.0
```

```
5=0.0.0.0
```

```
6=0.0.0.0
```

```
7=0.0.0.0
```

```
8=0.0.0.0
```

```
9=0.0.0.0
```

```
OK
```

```
ATFM=1
```

```
OK
```

### ***Validity***

This security feature is only available in the TCP and UDP PAD modes, and the AT command mode. This security feature is NOT available when a PPP or SLIP data mode is used.

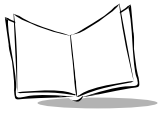
The “Friends” mode feature can be configured in both AT mode or Program mode. Modifications to the “Friends” list are saved immediately, regardless of mode.

### ***Other Considerations***

None

***Related Topics***

None



## Stack Check

### **Description**

This feature allows users to query the number of unused bytes on the stack. This query is useful in diagnosing stack related problems. It is assumed that this command will not be normally used by users, but may be useful for Customer Service personnel. The value returned is a decimal representation of the number of unused bytes on the stack.

### **Format**

|       |  |
|-------|--|
| ATSC? | Queries the number of bytes unused in the stack. |
|-------|--|

### **Validity**

None

### **Other Considerations**

None

### **Related Topics**

None

## Quiet Mode

### **Description**

This feature allows for Quiet mode of AT operation. In this mode, there are no responses sent to the host for any AT command entered.

### **Format**

|      |   |
|------|---|
| ATQ? | Queries the current setting of Quiet Mode |
| ATQ0 | Disables Quiet Mode (normal responses)    |
| ATQ1 | Enables Quiet Mode                        |

### **Validity**

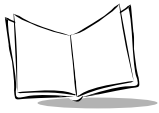
The “Quiet” mode setting can be set in either AT or Program mode. However, if set in AT mode, the setting is temporary and will be reset at the next power cycle.

### **Other Considerations**

None

### **Related Topics**

Echo and Verbose Mode of AT Responses.



## Registration Mode

### Description

This feature allows control of whether or not the modem will attempt to register upon initialization and to control when it will attempt registration at other times.

When registration mode is set to automatic, the modem will begin attempting to become registered on the CDPD network as soon as it is initialized. When registration mode is manual, the modem will wait until commanded to register before making such attempts. The modem can be commanded to register directly by executing the ATO command, or by entering one of PPP or SLIP data modes (ATVPPP or ATVSLIP respectively). The modem can be commanded to deregister if registered and to cease attempting to register by executing the ATH3 command. It can also be commanded to deregister and cease attempts to register by exiting PPP or SLIP mode IF it was not trying to register prior to entering that mode. That is, if it started to register because it entered the data mode, it will stop trying to register when it leaves that mode.

### Format

|           |  |
|-----------|--|
| ATREGMD?  | Queries the current setting of Registration Mode   |
| ATREGMD=0 | Sets automatic registration mode   |
| ATREGMD=1 | Sets manual registration mode  |
| ATREGST?  | Queries current registrations status:<br>0 = not currently attempting to register, 1 = currently registered, or attempting to register |
| ATO       | Begin attempting to register if not already doing so   |
| ATH3      | Deregister if registered and cease further attempts to register.   |

### Validity

ATREGMD can only be changed in program mode and only has effect at modem initialization time. The other commands are only effective in AT mode.

### Other Considerations

None

### Related Topics

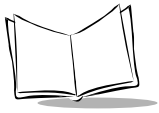
None

## Fixed Parameters

The following behaviors are fixed for the modem.

| Behavior              | Setting                     | Equivalent AT Command |
|-----------------------|-----------------------------|-----------------------|
| Online Mode Echo      | Disabled                    | ATF0                  |
| Extended Result Codes | Enable all                  | ATX2                  |
| Transmit Control      | Automatic timed             | AT\T1                 |
| Subscriber Identity   | modem supports only one NEI | AT\S0                 |





## Unsupported Commands

The following commands (listed in CDPD Part 2014) are not supported by the modem. If these commands, or any other AT command not described above, are received, the modem will return an ERROR response.

|      |                                |
|------|--------------------------------|
| ATF  | Online Mode Echo               |
| AT\F | Set Data Forwarding Operation  |
| AT\M | Manual Transmit Control        |
| AT\R | Network Registration Control 6 |
| AT\S | Set Subscriber Identity        |
| AT\T | Automatic Transmit Control     |
| AT&C | DCD mode                       |

## Unsupported Functions

The following functions (listed in CDPD Part 2014) are not supported by the modem. The commands are supported such that if they are received during operation, an OK response will be returned but they perform no real functions. These commands are primarily supported to ensure backward compatibility with previously released AT Command sets of our product.

|        |   |
|--------|---|
| ATS102 | Pending Data Disposition                |
| ATS114 | Set Channel Quality Override Mode       |
| ATS115 | Set Channel Quality Override Parameters |

## Modem Status / Configuration Interface

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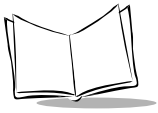
### Overview

For some of Novatel's integrated products, there is a desire to interleave status and configuration information with application data across the modem interface. For older modem software loads, interleaving is not possible. Status and configuration information are communicated in command mode, and application data is communicated in one of the other modes (SLIP, PPP, TCP, UDP).

To achieve interleaving, some changes are required in the modem software. This chapter describes some of these changes and offer some implementation guidance. Specific topics addressed include:

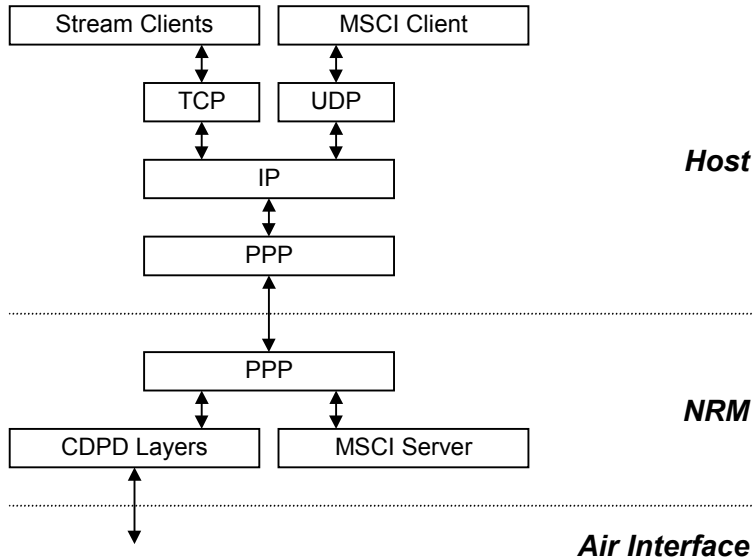
- the communication model
- the Modem Status / Configuration Interface (MSCI) protocol.

The content of this document represents the current understanding of the author, the current state of the modem software, may contain some inaccuracies, and is subject to change.



## Communication Model

The communication stack is shown below:



The serial interface between the host and the modem shall be managed using PPP. Stream Clients (such as e-mail or browser applications) must rely on the host stack for TCP/IP functionality. The MSCI Client must rely on datagram socket services to establish a connection with the MSCI Server.

Communications between the MSCI Client and Server shall be unbalanced. Three different types of data can be supported by the MSCI protocol.

- **Status information.** This must be polled for by the MSCI Client and shall not be issued in an unsolicited fashion by the MSCI Server
- **Configuration information.** This can be polled for or modified by the MSCI Client
- **Commands.** Select modem operations can be requested by the MSCI Client.

## ***MSCI Protocol***

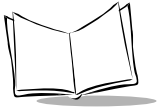
A simple application protocol is used for communications between the MSCI Client and Server.

### **General Frame Format**

| <b>1 octet</b>   | <b>n octets</b> |
|------------------|-----------------|
| Function<br>Code | Arguments       |

Function Code: Codes which may be used by the MSCI Client:

- 0x00:** Identification request
- 0x02:** Status request
  
- 0x04:** Informal parameter read request
- 0x06:** Informal parameter write request
- 0x80:** Formal parameter read request
- 0x82:** Formal parameter write request
  
- 0x07:** NVRAM write and reset request (AT&W)
- 0x09:** NVRAM write request
- 0x0B:** LED write (ATMW)
- 0x0C:** Power down (ATH4)
- 0x0D:** Set Horn
- 0x0E:** Honk Horn
  
- 0x10:** Release push message
- 0x11:** Delete push message (ATS254)
- 0x12:** Release all push messages
  
- 0x20:** Send PING (ATPING)
- 0x21:** Clear SND CP Counters
- 0x22:** Set up autonomous status reporting



**0x25:** Enable / disable the inband IP logger

**0x28:** Enable registration attempts

**0x29:** Disable registration attempts

**0x30:** Query ADC Voltage (AT#ADC?)

**0x32:** Out-of-service sleep mode parameter read

**0x34:** Out-of-service sleep mode parameter write

**0x90:** NVM Table Read

**0x92:** NVM Table Write

Codes which may be used by the MSCI Server:

**0x01:** Identification response

**0x03:** Status response

**0x05:** Informal parameter read response

**0x08:** Command response

**0x23:** Autonomous status report

**0x33:** Out-of-service sleep parameter read response

**0x81:** Formal parameter read response

**0x83:** Formal parameter write response

**0x91:** NVM Table Read Response

**0x93:** NVM Table Write Response

**0xF0:** Invalid request

Arguments: Variable. Details are included in the description of each Function Code.

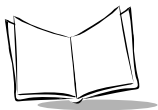
A checksum (or CRC) has been omitted from the frame. It has been assumed that the communication link is reliable and that lower protocol layers will ensure accuracy:

- UDP     checksum
- IP       header checksum
- PPP     negotiated FCS.

## Parameters

Many of the MSCI function codes associate with the reading and writing of modem parameters. Specific parameters can be identified by both a block ID number (single octet) and a parameter ID number (single octet). Block ID numbers have been defined to group parameters logically.

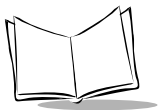
| Block ID    | Group Description                        |
|-------------|--|
| <b>0x00</b> | Configurable general CDPD parameters     |
| <b>0x01</b> | Configurable connection parameters       |
| <b>0x02</b> | Configurable line parameters             |
| <b>0x03</b> | Configurable general CDPD parameters (2) |
| <b>0x40</b> | Diagnostic parameters                    |

**Block ID 0x00: Configurable General CDPD Parameters**

| <b>Parm ID</b> | <b>Octets</b>     | <b>Description</b>   |
|----------------|-------------------|--|
| <b>0x00</b>    | 2<br>LSB first    | Side Preference (AT\N)<br>1: A only<br>2: B only<br>3: A preferred<br>4: B preferred   |
| <b>0x01</b>    | 4*2<br>LSB first  | Local IP Address (ATS110)<br>1.2.3.4 coded as 1,0, 2,0, 3,0, 4,0   |
| <b>0x02</b>    | 2<br>LSB first    | Local IP Port (ATS110)<br>1 - 65535  |
| <b>0x03</b>    | 1                 | Service ID Mode (ATS116)<br>0: Only use Service ID<br>1: Prefer Service ID<br>2: Don't use Service ID<br>3: Obtain service on any Service ID |
| <b>0x04</b>    | 3*2<br>LSB first  | Service ID (ATS111)<br>SPI: 0-65535, 0: Don't care<br>SPNI: 0-65535, 0: Don't care<br>WASI: 0-65535, 0: Don't care                           |
| <b>0x05</b>    | 1                 | Channel List Mode (ATS112)<br>0: Do not use Channel List<br>1: Use Channel List<br>2: Use hot Channel List                                   |
| <b>0x06</b>    | 32*2<br>LSB first | Channel List (ATS113)  |
| <b>0x07</b>    | 1                 | Reserved   |
| <b>0x08</b>    | 7                 | Reserved   |
| <b>0x09</b>    | 2<br>LSB first    | CDPD Version (ATS117)<br>10: Version 1.0<br>11: Version 1.1  |
| <b>0x0A</b>    | 4*1<br>MSB first  | Server Assigned DNS Address 1 (AT#DNS)<br>Used for PPP IPCP Negotiation  |

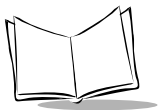
| Parm ID     | Octets           | Description   |
|-------------|------------------|---|
| <b>0x0B</b> | 4*1<br>MSB first | Server Assigned DNS Address 2 (AT#DNS)<br>Used for PPP IPCP Negotiation |



**Block ID 0x01: Configurable Connection Parameters**

| <b>Parm ID</b> | <b>Octets</b>    | <b>Description</b>   |
|----------------|------------------|--|
| <b>0x00</b>    | 1                | TCP Listen (ATS0)<br>0: Auto answer OFF<br>1: Auto answer ON   |
| <b>0x01</b>    | 4*2<br>LSB first | Remote IP Address (AT&Z)<br>1.2.3.4 coded as 1,0, 2,0, 3,0, 4,0  |
| <b>0x02</b>    | 2<br>LSB first   | Remote IP Port (AT&Z)<br>1 - 65535   |
| <b>0x03</b>    | 1                | TCP Establishment Timeout (ATS7)<br>0 - 255 seconds  |
| <b>0x04</b>    | 1                | Data Forwarding Idle Timeout (ATS50)<br>0 - 255 tenths of seconds  |
| <b>0x05</b>    | 1                | Data Forwarding Idle Character (ATS51)<br>0: Forwarding disabled<br>1-255  |
| <b>0x06</b>    | 1                | TCP Suspend (ATTCPX)<br>0: Suspension not allowed<br>1: Suspension allowed   |
| <b>0x07</b>    | 1                | DTR / DSR Functionality (ATS211)<br>0x00: DTR/DSR function normally<br>0x01: Pretend DTR is always set<br>0x02: Always assert DSR<br>0x04: Power down on falling DTR<br>0x08: Delay DSR assertion until registered |
| <b>0x08</b>    | 1                | TCP Idle Timeout (ATTCP)<br>0: Idle timeout disabled<br>1 - 255 minutes  |
| <b>0x09</b>    | 1                | Registration Mode (ATREGMD)<br>0: Attempt to Register on Power Up<br>1: Wait until commanded to Register   |
| <b>0x0A</b>    |                  | UDP server mode  |
| <b>0x0B</b>    |                  | UDP server timeout   |

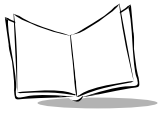
| <b>Parm ID</b> | <b>Octets</b>    | <b>Description</b>  |
|----------------|------------------|---|
| <b>0x0C</b>    |                  | Destination A mode  |
| <b>0x0D</b>    | 1                | Destination B mode:<br>0: TCP<br>1: UDP<br>2: Telnet            |
| <b>0x0E</b>    | 4*2<br>LSB first | Destination B IP address<br>1.2.3.4 coded as 1,0, 2,0, 3,0, 4,0 |
| <b>0x0F</b>    | 2<br>LSB first   | Destination B IP Port<br>1 - 65535                              |
| <b>0x10</b>    |                  | Destination C mode  |
| <b>0x11</b>    |                  | Destination C IP address  |
| <b>0x12</b>    |                  | Destination C port  |
| <b>0x13</b>    |                  | Destination D mode  |
| <b>0x14</b>    |                  | Destination D IP address  |
| <b>0x15</b>    |                  | Destination D port  |
| <b>0x16</b>    |                  | Destination E mode  |
| <b>0x17</b>    |                  | Destination E IP address  |
| <b>0x18</b>    |                  | Destination E port  |
| <b>0x19</b>    |                  | Destination F mode  |
| <b>0x1A</b>    |                  | Destination F IP address  |
| <b>0x1B</b>    |                  | Destination F port  |
| <b>0x1C</b>    |                  | Destination G mode  |
| <b>0x1D</b>    |                  | Destination G IP address  |
| <b>0x1E</b>    |                  | Destination G port  |
| <b>0x1F</b>    |                  | Destination H mode  |
| <b>0x20</b>    |                  | Destination H IP address  |
| <b>0x21</b>    |                  | Destination H port  |
| <b>0x22</b>    |                  | Destination I mode  |



| Parm ID | Octets | Description  |
|---------|--------|--|
| 0x23    |        | Destination I IP address   |
| 0x24    |        | Destination I port   |
| 0x25    |        | Destination J mode   |
| 0x26    |        | Destination J IP address   |
| 0x27    |        | Destination J port   |
| 0x28    |        | Destination K mode   |
| 0x29    |        | Destination K IP address   |
| 0x2A    |        | Destination K port   |
| 0x2B    |        | Destination L mode   |
| 0x2C    |        | Destination L IP address   |
| 0x2D    |        | Destination L port   |
| 0x2E    | 1      | Data Forwarding Escape Character<br>0: Escaper character disabled<br>1-255 |

**Block ID 0x02: Configurable Line Parameters**

| <b>Parm ID</b> | <b>Octets</b>  | <b>Description</b>   |
|----------------|----------------|--|
| <b>0x00</b>    | 2<br>LSB first | Flow Control (AT\Q)<br>0: No flow control<br>2: HW flow control (RTS / CTS)        |
| <b>0x01</b>    | 2<br>LSB first | Baud Rate (AT&L)<br>0: 1200<br>1: 2400<br>2: 4800<br>3: 9600<br>4: 19200<br>5: 300 |
| <b>0x02</b>    | 1              | Data Bits (AT&L)<br>7: 7 bits<br>8: 8 bits   |
| <b>0x03</b>    | 2<br>LSB first | Parity (AT&L)<br>0: Odd<br>1: Even<br>2: None<br>3: Mark                           |
| <b>0x04</b>    | 1              | Stop Bits (AT&L)<br>1: 1 bit<br>2: 2 bits  |



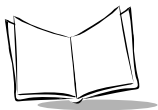
## Block ID 0x03: Configurable General CDPD Parameters (2)

| Parm ID | Octets | Description  |
|---------|--------|--|
| 0x00    | 1      | Sleep Mode (AT#ZZ)<br>0: Disabled<br>1: Long Mode Sleep<br>2: Short Mode Sleep |
| 0x01    | 1      | Push Mode (ATS250)<br>0: Disabled<br>1: Enabled                                |
| 0x02    | 1      | * Ignition Sense Mode (AT#IGS)   |
| 0x03    | 1      | * Ignition Sense Delay (AT#IGSD)   |

\* These parameters apply to Anvil only.

**Block ID 0x40: Diagnostic Parameters**

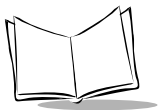
| <b>Parm ID</b> | <b>Octets</b>    | <b>Description</b>   |
|----------------|------------------|--|
| <b>0x00</b>    | 6                | EID (AT10)   |
| <b>0x01</b>    | n                | Firmware Revision<br>NULL terminated string (AT11)   |
| <b>0x02</b>    | n                | Manufacturer<br>NULL terminated string (AT12)  |
| <b>0x03</b>    | n                | Equipment Model<br>NULL terminated string (AT13)   |
| <b>0x10</b>    | 5*1              | Network Status (ATS57)<br>RSSI: 0: Low 1: OK<br>BLER: 0: High 1: OK<br>Link: 0: None 1: Established<br>Registered: 0: No 1: Yes<br>Channel: 0: Searching 1: Acquired |
| <b>0x11</b>    | 1                | Last Network Registration Error (ATS200)<br>Refer to Table 507-6 in CDPD Specification   |
| <b>0x12</b>    | 1                | Current RSSI (ATS202)<br>Value in dBm in excess of -113 dBm  |
| <b>0x13</b>    | 1                | Current Forward BLER (ATS203)<br>0 - 100%  |
| <b>0x14</b>    | 2<br>LSB first   | Current Channel (ATS204)<br>1 - 799, 991 - 1023  |
| <b>0x15</b>    | 2<br>LSB first   | Current Cell Site ID (ATS205)<br>0 - 65535   |
| <b>0x16</b>    | 1                | Current Area Color Code (ATS206)<br>0 - 7  |
| <b>0x17</b>    | 3*2<br>LSB first | Current Service ID<br>SPI: 0-65535<br>SPNI: 0-65535<br>WASI: 0-65535   |



| Parm ID     | Octets         | Description  |
|-------------|----------------|--|
| <b>0x18</b> | 1              | Current RRM State<br>0: Inactive<br>1: Wide Area Scan<br>2: Wide Area Search<br>3: Quality Check<br>4: Channel Acquired<br>5: Reference Scan<br>6: Channel Search<br>7: Directed Hop<br>8: Sleep<br>9: RSSI Channel Scan |
| <b>0x19</b> | 1              | Current Power Level (ATS207)<br>Refer to CDPD Spec. Table 401-2  |
| <b>0x1a</b> | 1              | Current Power Product (ATS209)<br>Refer to CDPD Spec. Part 405, 4.2.3.6  |
| <b>0x1b</b> | 1              | Current Reverse BLER<br>0 - 100%<br>255: No transmissions since last request   |
| <b>0x1c</b> | 4<br>LSB first | Current TEI<br>16-134217727<br>0: Not assigned   |
| <b>0x1d</b> | 1              | Attempting to Register Status (ATREGST)<br>0: Not currently trying to register<br>1: Currently trying to register or currently registered  |

| <b>Parm ID</b> | <b>Octets</b>           | <b>Description</b>   |
|----------------|-------------------------|--|
| <b>0x1e</b>    | 1                       | Current mode<br>0: Reset<br>1: AT Mode<br>2: Program Mode<br>3: Diagnostics Mode<br>4: TCP PAD mode<br>5: UDP PAD mode<br>6: SLIP mode<br>7: PPP mode<br>8: Wait mode<br>9: Passthrough mode (Merlin only) |
| <b>0x1f</b>    | 1                       | Number of free buffers   |
| <b>0x20</b>    | 2*2<br>2*4<br>LSB first | SNDCP Activity Counters (from IP)<br>Rx Packets: 0-65535<br>Tx Packets: 0-65535<br>Rx Bytes: 0-4294967295<br>Tx Bytes: 0-4294967295  |
| <b>0x21</b>    | 1                       | Percent MDBS Busy<br>0 – 100   |
| <b>0x30</b>    | 1                       | Number of queued push messages (ATS251)<br>0 – 255   |
| <b>0x31</b>    | 4<br>LSB first          | First queued push message: address from (ATS252)<br>a.b.c.d  |
| <b>0x32</b>    | 2<br>LSB first          | First queued push message: port to (ATS252)<br>0 – 65535   |
| <b>0x33</b>    | 1                       | First queued push message: message type (ATS253)<br>0: UDP<br>1: TCP   |
| <b>0x40</b>    | 1                       | RTS Hardware State<br>0: RTS Deasserted<br>1: RTS Asserted   |





| Parm ID     | Octets | Description   |
|-------------|--------|---|
| <b>0x41</b> | 1      | CTS Hardware State<br>0: CTS Deasserted<br>1: CTS Asserted                      |
| <b>0x42</b> | 1      | DTR Hardware State<br>0: DTR Deasserted<br>1: DTR Asserted                      |
| <b>0x43</b> | 1      | DSR Hardware State<br>0: DSR Deasserted<br>1: DSR Asserted                      |
| <b>0x44</b> | 2      | * Horn Parameters<br>First Octet: Horn enable state<br>Second Octet: Horn state |

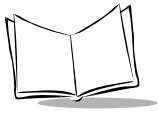
\* These parameters apply to Anvil only.

**Function Code 0x00: Identification Request**

This function code may be used by the MSCI Client to request modem identification information from the MSCI Server. The MSCI Server responds to this message with an *Identification Response (Function Code 0x01)*.

| 1 octet                  |
|--------------------------|
| Function<br>Code<br>0x00 |

Note that no arguments are required for this function code.



## Function Code 0x01: Identification Response

This function code is used by the MSCI Server to respond to *Identification Requests* (Function Code 0x00) from the MSCI Client.

| 1 octet                  | n octets  |
|--------------------------|-----------|
| Function<br>Code<br>0x01 | Arguments |

Arguments:

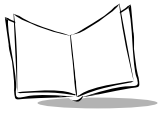
| Value                        | Octets | Description                   |
|------------------------------|--------|-------------------------------|
| <b>EID</b>                   | 6      | (Block ID 0x40, Parm ID 0x00) |
| <b>Firmware<br/>Revision</b> | n      | (Block ID 0x40, Parm ID 0x01) |
| <b>Equipment<br/>Model</b>   | n      | (Block ID 0x40, Parm ID 0x03) |

**Function Code 0x02: Status Request**

This function code may be used by the MSCI Client to request modem status information from the MSCI Server. The MSCI Server responds to this message with a *Status Response* (Function Code 0x03).

| 1 octet                  |
|--------------------------|
| Function<br>Code<br>0x02 |

Note that no arguments are required for this function code.



## Function Code 0x03: Status Response

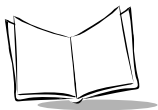
This function code is used by the MSC1 Server to respond to *Status Requests* (Function Code 0x02) from the MSC1 Client.

| 1 octet                  | 21 octets |
|--------------------------|-----------|
| Function<br>Code<br>0x03 | Arguments |

Arguments:

| Field                          | Octets         | Description   |
|--------------------------------|----------------|---|
| <b>CDPD Status</b>             | 1              | (Similar Block ID 0x40, Parm ID 0x10)<br>Mask containing 3 bits<br>0x01: TRUE if channel acquired<br>0x02: TRUE if link established<br>0x04: TRUE if registered |
| <b>Link Status</b>             | 1              | Contains same information as bit 0x02 in the <i>CDPD Status</i> field.  |
| <b>Last Registration Error</b> | 1              | (Block ID 0x40, Parm ID 0x11)   |
| <b>RRM State</b>               | 1              | (Block ID 0x40, Parm ID 0x18)   |
| <b>Current Area Color Code</b> | 1              | (Block ID 0x40, Parm ID 0x16)   |
| <b>Current Channel</b>         | 2<br>MSB first | (Similar Block ID 0x40, Parm ID 0x14)   |
| <b>Current RSSI</b>            | 1              | (Block ID 0x40, Parm ID 0x12)   |
| <b>Current BLER</b>            | 1              | (Block ID 0x40, Parm ID 0x13)   |
| <b>Reserved</b>                | 1              |   |
| <b>Current Power Level</b>     | 1              | (Block ID 0x40, Parm ID 0x19)   |

| Field                        | Octets           | Description   |
|------------------------------|------------------|---|
| <b>Current Service ID</b>    | 3*2<br>MSB first | (Similar Block ID 0x40, Parm ID 0x17)<br>SPI: 0-65535<br>WASI: 0-65535<br>SPNI: 0-65535 |
| <b>Current Cell Site ID</b>  | 2<br>MSB first   | (Similar Block ID 0x40, Parm ID 0x15)   |
| <b>Current Power Product</b> | 1                | (Block ID 0x40, Parm ID 0x1a)   |
| <b>Reserved</b>              | 1                |   |



## Function Code 0x04: Informal Parameter Read Request

This function code may be used by the MSCI Client to request modem parameter information from the MSCI Server. The MSCI Server responds to this message with an *Informal Parameter Read Response (Function Code 0x05)*.

| 1 octet                  | 2 octets  |
|--------------------------|-----------|
| Function<br>Code<br>0x04 | Arguments |

Arguments:

| Field               | Octets | Description   |
|---------------------|--------|---|
| <b>Block ID</b>     | 1      | Limited (not all blocks supported)<br>0 - 3   |
| <b>Parameter ID</b> | 1      | Two options are available<br>255: Request entire block<br>Other: Request single parameter |

## Function Code 0x05: Informal Parameter Read Response

This function code is used by the MSCI Server to respond to *Informal Parameter Read Requests (Function Code 0x04)* from the MSCI Client.

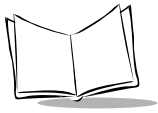
| 1 octet               | n octets  |
|-----------------------|-----------|
| Function Code<br>0x05 | Arguments |

Arguments:

| Field                   | Octets | Description                                  |
|-------------------------|--------|--|
| <b>Block ID</b>         | 1      | 0 - 3  |
| <b>Parameter ID</b>     | 1      | 0 - 254                                      |
| <b>Parameter Length</b> | 1      | Size of the <i>Parameter Value</i> in octets |
| <b>Parameter Value</b>  | n      |  |

It is important to note that if an entire block was requested in the *Informal Parameter Read Request (Function Code 0x04)*, then the argument block repeats.





## Function Code 0x06: Informal Parameter Write Request

This function code may be used by the MSCI Client to modify modem parameters via the MSCI Server. The MSCI Server responds to this message with a *Command Response* (Function Code 0x08).

| 1 octet               | n octets  |
|-----------------------|-----------|
| Function Code<br>0x06 | Arguments |

Arguments:

| Field            | Octets | Description                                  |
|------------------|--------|--|
| Block ID         | 1      | 0 - 3  |
| Parameter ID     | 1      | 0 - 254                                      |
| Parameter Length | 1      | Size of the <i>Parameter Value</i> in octets |
| Parameter Value  | n      |  |

It is important to note that:

- More than one value can be written at a time by repeating the argument block
- This function code changes parameter values in RAM. To permanently save values, follow this request with an *NVRAM Write and Reset Request* (Function Code 0x07) or an *NVRAM Write Request* (Function Code 0x09).

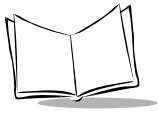
## Function Code 0x07: NVRAM Write and Reset Request

This function code may be used by the MSCI Client to request that the MSCI Server save all current parameter values in NVRAM and reset. The MSCI Server issues no response.

| 1 octet                  |
|--------------------------|
| Function<br>Code<br>0x07 |

Note that:

- No arguments are required for this function code
- Resetting the modem ensures that all parameter changes made using *Informal Parameter Write Requests (Function Code 0x06)* or *Formal Parameter Write Requests (Function Code 0x82)* will be put into effect.



## Function Code 0x08: Command Response

This function code is used by the MSCI Server to respond to general requests from the MSCI Client.

| 1 octet               | 2 octets  |
|-----------------------|-----------|
| Function Code<br>0x08 | Arguments |

Arguments:

| Field                | Octets | Description  |
|----------------------|--------|--|
| <b>Function Code</b> | 1      | Identifies the last request<br>0x06: Informal Parameter Write<br>0x0B: LED Write<br>0x20: Send PING<br>0x21: Clear SNDCCP Counters         |
| <b>Status</b>        | 1      | Result of the last request<br>0: OK<br>1: Invalid Block ID<br>2: Invalid Parameter ID<br>3: Invalid Parameter Length<br>4: Busy<br>5: Fail |

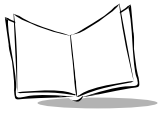
## Function Code 0x09: NVRAM Write Request

This function code may be used by the MSCI Client to request that the MSCI Server save all current parameter values in NVRAM. The MSCI Server issues no response.

| 1 octet                  |
|--------------------------|
| Function<br>Code<br>0x09 |

Note that:

- No arguments are required for this function code
- Parameter changes made using *Informal Parameter Write Requests (Function Code 0x06)* or *Formal Parameter Write Requests (Function Code 0x82)* might not be put into effect until the modem is reset. Writing the NVRAM (using this function code) only guarantees that the changes have been permanently saved. To reset the modem, use *NVRAM Write and Reset Request (Function Code 0x07)* instead.



## Function Code 0x0B: LED Write

This function code may be used by the MSCI Client to request that the MSCI Server modify the state of a general purpose LED. The MSCI Server responds to this message with a *Command Response (Function Code 0x08)*.

| 1 octet                  | 1 octet   |
|--------------------------|-----------|
| Function<br>Code<br>0x0B | Arguments |

Arguments:

| Field     | Octets | Description                          |
|-----------|--------|--------------------------------------|
| LED State | 1      | Desired LED state<br>0: OFF<br>1: ON |

Note that this command is valid for the Minstrel only.

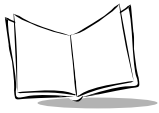
**Function Code 0x0C: Power Down**

This function code may be used by the MSCI Client to request that the MSCI Server turn off the modem. The MSCI Server issues no response.

| 1 octet                  |
|--------------------------|
| Function<br>Code<br>0x0C |

Note that:

- No arguments are required for this function code
- The modem will attempt to shut down gracefully before power is turned off. This can take up to 10 seconds.



## Function Code 0x0D: Set Horn

This function code may be used by the MSCI Client to request that the MSCI Server modify the state of the horn. The MSCI Server responds to this message with a *Command Response (Function Code 0x08)*.

| 1 octet                  | 1 octet   |
|--------------------------|-----------|
| Function<br>Code<br>0x0D | Arguments |

Arguments:

| Field      | Octets | Description                           |
|------------|--------|---------------------------------------|
| Horn State | 1      | Desired Horn state<br>0: OFF<br>1: ON |

Note that this command is valid for the Anvil only.

## Function Code 0x0E: Honk Horn

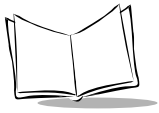
This function code may be used by the MSCI Client to request that the MSCI Server honk the horn. The MSCI Server issues no response.

| 1 octet                  |
|--------------------------|
| Function<br>Code<br>0x0E |

Note that:

- No arguments are required for this function code
- Note that this command is valid for the Anvil only.





## **Function Code 0x10: Release PUSH Message**

This function code may be used by the MSCI Client to request that the MSCI Server release the first message (if there is one) from the push queue to the host. The MSCI Server issues no response.

| 1 octet                  |
|--------------------------|
| Function<br>Code<br>0x10 |

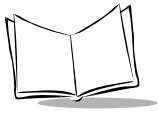
Note that no arguments are required for this function code.

**Function Code 0x11: Delete Top PUSH Message**

This function code may be used by the MSCI Client to request that the MSCI Server delete the first message (if there is one) from the push queue. This message is not forwarded to the host. The MSCI Server issues no response.

| 1 octet                  |
|--------------------------|
| Function<br>Code<br>0x11 |

Note that no arguments are required for this function code.



## Function Code 0x12: Release all Push Messages

This function code may be used by the MSCI Client to request that the MSCI Server release all push messages (if there are any) from the push queue and forward them to the host. The MSCI Server issues no response.

| 1 octet                  |
|--------------------------|
| Function<br>Code<br>0x12 |

Note that no arguments are required for this function code.

## Function Code 0x20: Send PING

This function code may be used by the MSCI Client to request that the MSCI Server issue a PING. The MSCI Server responds to this message with a *Command Response (Function Code 0x08)*.

| 1 octet               | 10 octets |
|-----------------------|-----------|
| Function Code<br>0x20 | Arguments |

Arguments:

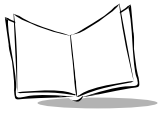
| Field               | Octets           | Description   |
|---------------------|------------------|---|
| <b>PING Address</b> | 4*2<br>LSB first | Destination IP Address<br>1.2.3.4 coded as 1,0, 2,0, 3,0, 4,0 |
| <b>PING Length</b>  | 2<br>LSB first   | Message size in bytes<br>4 - 100                              |

Note that it may take several seconds to receive the response. Codes that can be expected in the response include:

**OK:** The PING was successfully sent and received.

**FAIL:** The PING could not be sent, or timed out.

**BUSY:** The modem is still waiting for a previous attempt to complete.



## Function Code 0x21: Clear SNDCP Counters

This function code may be used by the MSCI Client to request that the MSCI Server clear the SNDCP Counters (*Block ID 0x40, Parm ID 0x20*). The MSCI Server responds to this message with a *Command Response (Function Code 0x08)*.

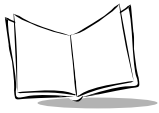
| 1 octet                  |
|--------------------------|
| Function<br>Code<br>0x21 |

Note that no arguments are required for this function code.

**Function Code 0x22: Setup Autonomous Status Reporting**

This function code may be used by the MSCI Client to request modem status information from the MSCI Server to be delivered by the modem on a periodic basis. The MSCI Server responds to this message with one or more *Autonomous Status Reports* (Function Code 0x23).

| 1 octet                  | 1 octet                      | 1 octet      |
|--------------------------|------------------------------|--------------|
| Function<br>Code<br>0x22 | Repeat Interval<br>(seconds) | Repeat Count |



## Function Code 0x23: Autonomous Status Report

This function code is used by the MSC1 Server to respond to *Setup Autonomous Status Reporting* (Function Code 0x22) from the MSC1 Client.

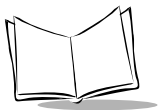
| 1 octet            | 34 octets |
|--------------------|-----------|
| Function Code 0x23 | Arguments |

Arguments:

| Field                          | Octets         | Description   |
|--------------------------------|----------------|---|
| <b>CDPD Status</b>             | 1              | (Similar Block ID 0x40, Parm ID 0x10)<br>Mask containing 5 bits<br>0x01: TRUE if channel acquired<br>0x02: TRUE if link established<br>0x04: TRUE if registered<br>0x08: TRUE if RSSI OK<br>0x10: TRUE if BLER OK |
| <b>Last Registration Error</b> | 1              | (Block ID 0x40, Parm ID 0x11)   |
| <b>RRM State</b>               | 1              | (Block ID 0x40, Parm ID 0x18)   |
| <b>Current Area Color Code</b> | 1              | (Block ID 0x40, Parm ID 0x16)   |
| <b>Current Channel</b>         | 2<br>MSB first | (Similar Block ID 0x40, Parm ID 0x14)   |
| <b>Current RSSI</b>            | 1              | (Block ID 0x40, Parm ID 0x12)   |
| <b>Current BLER</b>            | 1              | (Block ID 0x40, Parm ID 0x13)   |
| <b>Current Reverse BLER</b>    | 1              | (Block ID 0x40, Parm ID 0x1B)   |
| <b>Current Power Level</b>     | 1              | (Block ID 0x40, Parm ID 0x19)   |

| Field                                    | Octets                  | Description   |
|--|-------------------------|---|
| <b>Current Service ID</b>                | 3*2<br>MSB first        | (Similar Block ID 0x40, Parm ID 0x17)<br>SPI: 0-65535<br>WASI: 0-65535<br>SPNI: 0-65535 |
| <b>Current Cell Site ID</b>              | 2<br>MSB first          | (Similar Block ID 0x40, Parm ID 0x15)   |
| <b>Current Power Product</b>             | 1                       | (Block ID 0x40, Parm ID 0x1a)   |
| <b>Reserved</b>                          | 1                       |   |
| <b>SNDCP Activity Counters (from IP)</b> | 2*2<br>2*4<br>MSB first | (Block ID 0x40, Parm ID 0x20) except for byte order reversal                            |
| <b>Percent MDBS Busy</b>                 | 1                       | (Block ID 0x40, Parm ID 0x21)   |
| <b>Current TEI</b>                       | 4<br>LSB First          |   |
| <b>Analog Input Voltage</b>              | 2                       | (Same as response to function code 0x30, Query ADC Value)                               |





## Function Code 0x25: Inband IP Logger

This function code may be used by a host client to request that the modem provide copies of all IP messages to a logging process in that host client. The MSCI Server responds to this message with a *Command Response (Function Code 0x08)*.

| 1 octet                  | 1 octet  |
|--------------------------|----------|
| Function<br>Code<br>0x25 | Argument |

Argument:

| Field                | Octets | Description   |
|----------------------|--------|---|
| <b>Logger Enable</b> | 1      | 0: Disable the logger function<br>1: Enable the logger function |

Note that the IP and UDP headers for the message containing this function also contain important information. The Inband Logger will send the copies of the modem's message traffic to the IP address indicated in the source address field of the IP header. (The aforementioned address must be the same as the Modem's address. In other words, logging can only be done to the local host. If this is not the case, the logging will not be turned on.) The Source port in the UDP header is the port to which the logging messages will be sent.

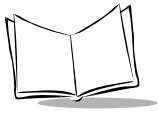
Return codes:

**OK:** This command always returns OK.

The logger sends out copies of the modem's traffic encapsulated within UDP messages. The structure of the UDP payload is as follows:

| Field                    | Octets         | Description   |
|--------------------------|----------------|---|
| <b>Direction</b>         | 1              | Indicates the direction of the logged message:<br>0: Reverse channel, towards the network<br>1: Forward channel, towards the host |
| <b>Free buffer count</b> | 2<br>MSB First | Current number of free dynamic buffers within the modem.  |

| Field                 | Octets | Description   |
|-----------------------|--------|---|
| <b>Log Info</b>       | 1      | Indicates the source of the logged message from within the modem:<br>1: SNDCP_REASSEMBLY<br>2: SNDCP_RECV_UNITDATA<br>3: IPSEND_IND<br>5: IPSEND_REQ<br>6: RECV_PPP<br>7: POLL_SLIP |
| <b>Logged message</b> | n*1    | Variable number of bytes containing the IP header, TCP or UDP header, and the payload of the message being logged.  |



## Function Code 0x28: Enable Registration Attempts

This function code may be used by the MSCI Client to request that the modem resume attempting to register on the CPDP network. If the modem is currently in the process of halting its attempts to connect to the network it will return a busy indication. Otherwise, if it is able to start attempting to register or it is already attempting to register or it is already registered, it will return OK. The MSCI Server responds to this message with a *Command Response (Function Code 0x08)*.

| 1 octet                  |
|--------------------------|
| Function<br>Code<br>0x28 |

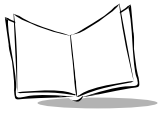
Note that no arguments are required for this function code.

**Function Code 0x29: Disable Registration Attempts**

This function code may be used by the MSCI Client to request that the modem cease attempting to register on the CPDP network. If the modem is currently in the process of halting its attempts to connect to the network it will return a busy indication. Otherwise, it will return OK. The MSCI Server responds to this message with a *Command Response (Function Code 0x08)*.

| 1 octet                  |
|--------------------------|
| Function<br>Code<br>0x29 |

Note that no arguments are required for this function code.



## Function Code 0x30: Query ADC Value

This function code may be used by the MSCI Client to request that the MSCI Server retrieve and return the current ADC reading. The MSCI Server responds to this message with a *Command Response (Function Code 0x08)* where the Status portion of the response contains two 8 bit values representing the calibrated voltage at the ADC pin. These two values represent the form of Y.X volts. For example, a value of 3.68 volts would be returned as two values 0x03 and 0x44.

| 1 octet                  |
|--------------------------|
| Function<br>Code<br>0x30 |

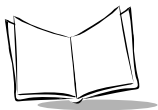
Note that no arguments are required for this function code.

**Function Code 0x32: Read Out-of-service Sleep Parameters**

This function code may be used by the MSCI Client to request that the MSCI Server retrieve and return the current out-of-service sleep parameters. The MSCI Server responds to this message with an *Out-of-service Sleep Parameters Response (Function Code 0x33)*.

| 1 octet                  |
|--------------------------|
| Function<br>Code<br>0x32 |

Note that no arguments are required for this function code.



## Function Code 0x33: Out-of-service Sleep Parameters Response

This function code is used by the MSCI Server to respond to *Read Out-of-service Sleep Parameters (Function Code 0x32)* from the MSCI Client.

| 1 octet               | n octets  |
|-----------------------|-----------|
| Function Code<br>0x33 | Arguments |

This message is always ten bytes in length.

Arguments:

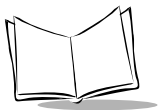
| Field                              | Octets         | Description   |
|------------------------------------|----------------|---|
| <b>Out-of-Service Sleep Enable</b> | 1              | 0: The modem will not sleep during periods of no CPDP service coverage.<br>1: The modem will sleep during such periods. |
| <b>Sleep Cycle Time</b>            | 2<br>LSB First | Duration of one sleep / wake cycle in seconds.  |
| <b>Brief Scan Period</b>           | 2<br>LSB First | Duration of the wake period in seconds for a brief scan.  |
| <b>Complete Scan Period</b>        | 2<br>LSB First | Duration for the wake period in seconds for a complete scan.  |
| <b>Complete Scan Cycle Length</b>  | 2<br>LSB First | Number of sleep / wake cycles necessary to see 1 complete scan and n-1 brief scans.                                     |

The approximate timing of the out-of-coverage sleep operation is shown in the following table. Note that the scan periods may be extended slightly (in the order of 10 seconds worst

case) depending on specific system timing relationships at the time the attempt to sleep is made.

| Phase   | Duration   | Duration   |
|---|--|--|
| <b>Registered in Coverage</b>                 | Indeterminate  |  |
| <b>Registered out of Coverage</b>             | Dependant on other cellular coverage. Typically under 3 minutes. |  |
| <b>Search for CDPD Service to Register On</b> | Complete Scan Period   | (Sleep Cycle Time) *<br>(Complete Scan Cycle Length) |
| <b>Sleep</b>                                  | (Sleep Cycle Time) – (Complete Scan Period)                      |  |
| <b>Search for CDPD Service to Register On</b> | Brief Scan Period  |  |
| <b>Sleep</b>                                  | (Sleep Cycle Time) – (Brief Scan Period)                         |  |
| <b>Search for CDPD Service to Register On</b> | Brief Scan Period  |  |
| <b>...brief scan... sleep repeats</b>         | Sleep Cycle Time   |  |
| <b>Search for CDPD Service to Register On</b> | Complete Scan Period   |  |
| <b>Sleep</b>                                  | (Sleep Cycle Time) – (Complete Scan Period)                      |  |
| <b>Search for CDPD Service to Register On</b> | less than (Brief Scan Period)                                    |  |
| <b>Registered in Coverage</b>                 | Indeterminate  |  |





## Function Code 0x34: Write Out-of-service Sleep Parameters

This function code is used by the MSCI Server to respond to *Read Out-of-service Sleep Parameters (Function Code 0x32)* from the MSCI Client.

| 1 octet               | n octets  |
|-----------------------|-----------|
| Function Code<br>0x34 | Arguments |

This message is always either two or ten bytes in length. The two byte length message contains the function code and enable byte only. This is used to change the enable state without changing the timing parameters. The ten byte length message is used to change the enable state and all of the timing parameters.

Arguments:

| Field                              | Octets         | Description   |
|------------------------------------|----------------|---|
| <b>Out-of-Service Sleep Enable</b> | 1              | 0: The modem will not sleep during periods of no CPDP service coverage.<br>1: The modem will sleep during such periods. |
| <b>Sleep Cycle Time</b>            | 2<br>LSB First | Duration of one sleep / wake cycle in seconds.  |
| <b>Brief Scan Period</b>           | 2<br>LSB First | Duration of the wake period in seconds for a brief scan.  |
| <b>Complete Scan Period</b>        | 2<br>LSB First | Duration for the wake period in seconds for a complete scan.  |
| <b>Complete Scan Cycle Length</b>  | 2<br>LSB First | Number of sleep / wake cycles necessary to see 1 complete scan and n-1 brief scans.                                     |

For a description of the timing parameters relationship, see function code 0x33, *Out-of-service Sleep Parameters Response*.

## Function Code 0x80: Formal Parameter Read Request

This function code may be used by the MSCI Client to request modem parameter information from the MSCI Server. The MSCI Server responds to this message with a *Formal Parameter Read Response (Function Code 0x81)*.

| 1 octet               | 2 octets       | n*2 octets |
|-----------------------|----------------|------------|
| Function Code<br>0x80 | Message Length | Arguments  |

It is similar in use to the *Informal Parameter Read Request (Function Code 0x04)* but offers:

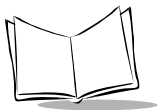
- better error checking
- the ability to ask for more than one parameter at a time
- the ability to ask for parameters from any block.

The *Message Length* specifies the size of the argument block in octets and is encoded LSB first.

Arguments:

| Field               | Octets | Description  |
|---------------------|--------|--|
| <b>Block ID</b>     | 1      | Any of the defined blocks<br>0 - 3, 0x40   |
| <b>Parameter ID</b> | 1      | An entire block can not be requested at present (will be changed). This value must correspond to a specific parameter<br>0 - 254 |

More than one parameter can be requested at a time by repeating the argument block. At present, a maximum of **10** parameters can be requested at a time.



## Function Code 0x81: Formal Parameter Read Response

This function code is used by the MSCI Server to respond to *Formal Parameter Read Requests (Function Code 0x80)* from the MSCI Client.

| 1 octet               | 2 octets       | n octets  |
|-----------------------|----------------|-----------|
| Function Code<br>0x81 | Message Length | Arguments |

The *Message Length* specifies the size of the argument block in octets and is encoded LSB first.

Arguments:

| Field            | Octets | Description  |
|------------------|--------|--|
| Block ID         | 1      | 0 - 255  |
| Parameter ID     | 1      | 0 - 255  |
| Parameter Status | 1      | Can be one of the following:<br>0: OK<br>1: Invalid Block or Parm ID |
| Parameter Length | 1      | Size of the <i>Parameter Value</i> in octets                         |
| Parameter Value  | n      |  |

It is important to note that if more than one parameter was requested in the *Formal Parameter Read Request (Function Code 0x80)*, then the argument block repeats. Also note that if the *Parameter Status* indicates that an error was encountered, the *Parameter Length* will be 0 and no *Parameter Value* shall be supplied.

## Function Code 0x82: Formal Parameter Write Request

This function code may be used by the MSCI Client to modify modem parameters via the MSCI Server. The MSCI Server responds to this message with a *Formal Parameter Write Response (Function Code 0x83)*.

| 1 octet               | 2 octets       | n octets  |
|-----------------------|----------------|-----------|
| Function Code<br>0x82 | Message Length | Arguments |

It is similar in use to the *Informal Parameter Write Request (Function Code 0x06)*.

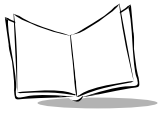
The *Message Length* specifies the size of the argument block in octets and is encoded LSB first.

Arguments:

| Field                   | Octets | Description                                  |
|-------------------------|--------|--|
| <b>Block ID</b>         | 1      | 0 - 3  |
| <b>Parameter ID</b>     | 1      | 0 - 254                                      |
| <b>Parameter Length</b> | 1      | Size of the <i>Parameter Value</i> in octets |
| <b>Parameter Value</b>  | n      |  |

It is important to note that:

- More than one value can be written at a time by repeating the argument block
- This function code changes parameter values in RAM. To permanently save values, follow this request with an *NVRAM Write and Reset Request (Function Code 0x07)* or an *NVRAM Write Request (Function Code 0x09)*.



## Function Code 0x83: Formal Parameter Write Response

This function code is used by the MSCI Server to respond to *Formal Parameter Write Requests (Function Code 0x82)* from the MSCI Client.

| 1 octet                  | 2 octets          | n*3 octets |
|--------------------------|-------------------|------------|
| Function<br>Code<br>0x83 | Message<br>Length | Arguments  |

The *Message Length* specifies the size of the argument block in octets and is encoded LSB first.

Arguments:

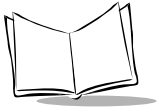
| Field                   | Octets | Description  |
|-------------------------|--------|--|
| <b>Block ID</b>         | 1      | 0 - 255  |
| <b>Parameter ID</b>     | 1      | 0 - 255  |
| <b>Parameter Status</b> | 1      | Can be one of the following:<br>0: OK<br>1: Invalid Block ID<br>2: Invalid Parameter ID<br>3: Invalid Parameter Length |

It is important to note that if more than one parameter was specified in the *Formal Parameter Write Request (Function Code 0x82)*, then the argument block repeats.

## Function Codes 0x90 – 0x93: NVM Table Access Routines

These functions require detailed knowledge of modern software internals and are not intended for use outside of the development lab under controlled conditions.

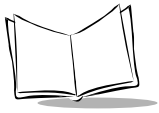
```
//
// The Table Read Command message is formatted as follows:
//
//          1 byteRead Tables command
//          1 byteNumber of tables in the list
//          ntables * 1 byteIndividual table numbers
//
// The Table Read Response message is formatted as follows:
//
//          1 byte          Read Tables response
//          2 bytes         Size of the message
//                          (including command and size bytes)
//          1 byte          Number of tables in the response
//          ntables *
//          1 byteTable number
//          1 byteStatus code
//          2 bytesSize of the tables
//          table size * 1 byteContents of the table
//          (including dummy and checksum)
//
//
// In the event of some errors the response message will be formatted as
follows:
//
//          1 byte  MSCI_FC_INVALID
//          1 byte  MSCI_FC_TABLE_READ
//          1 byte  reason code
```



```
//  
//  
// The Table Write Command message is formatted as follows:  
//  
//          1 byte   Write Tables command  
//          2 bytes  Size of the message  
//                      (including command and size bytes)  
//          1 byte   Number of tables in the response  
//          ntables *  
//          1 byte   Table number (MUST BE VALID)  
//          1 byte   Status code (MUST BE ZERO)  
//          2 bytes  Size of the tables (MUST BE CORRECT)  
//                      tablesize * 1 byteContents of the table  
//                      (including dummy and checksum)  
//                      (CHECKSUM MUST BE GOOD)  
//  
// NOTE: The write command is identical to a read response (with all of the table  
reads  
//          successful) except for the value of the command byte. This  
makes it easy to turn  
//          a saved read into a write in order to reset parameters.  
//  
// The Table Write Response message is formatted as follows:  
//  
//          1 byte   Write Tables response  
//          1 byte   Status Code  
//  
// In the event of some errors the response message will be formatted as follows:
```

```
//  
//          1 byte   MSCI_FC_INVALID  
//          1 byte   MSCI_FC_TABLE_WRITE  
//          1 byte   reason code  
//
```





## Function Code 0xF0: Invalid Request

This function code is used by the MSCI Server to respond to those MSCI Client requests which it has problems dealing with.

| 1 octet                  | 2 octets  |
|--------------------------|-----------|
| Function<br>Code<br>0xF0 | Arguments |

Arguments:

| Field         | Octets | Description   |
|---------------|--------|---|
| Function Code | 1      | 0 - 255   |
| Error         | 1      | Can be one of the following:<br>1: Unknown function code<br>2: Invalid message length |

## Implementation Notes

There are a number of implementation specific points that need to be kept in mind.

### IP Address and Port

A special IP address and port are used by the modem software to identify packets that need to be routed to the MSCI Server. At one time, the address used to be target specific. However, since version T\*05-12, the following addresses have been available in all targets.

|             |                                     |
|-------------|-------------------------------------|
| IP Address: | 255.255.255.255(from Contact, Sage) |
| IP Address: | 223.255.255.255(from Minstrel)      |
| IP Address: | 239.239.239.239(from OEM)           |
| IP Address: | 10.0.0.1                            |

IP Port:4950

Modem software loads up to and including T\*05-07 weren't concerned with the value of the IP port; anything could be used. For more recent versions though, the port is required.

### Communications

The number of stop bits can be specified, but the serial drivers have yet to actually do anything with this value.

### Writing Parameters

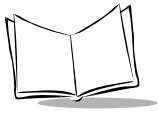
Blocks **0x00**, **0x01**, **0x02** and **0x03** can be used to modify a number of communication specific parameters. Some care needs to be taken by developers. Many of these values should be fixed for proper integration and should not be made accessible to the average user.

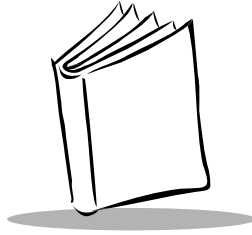
### Future Development

Even though a number of commonly used values are accessible through the MSCI protocol, the list is by no means final. It is possible for Novatel to define new blocks or add support for other values in the future.

### Packet Lengths

For the *Formal Parameter Function Codes (0x80 - 0x83)*, packet lengths are limited to about **100** octets. This may be increased in the future if deemed important. For now, limit the number of parameters ( $\leq 10$ ) in requests so that responses are kept reasonably small.





## Chapter 2

### WWAN

## GSM Radio Overview

---

### ***Opening a Direct Serial Connection***

This section reviews WWAN functionality and how it is controlled by sending AT commands to the modem using a direct serial connection.

Use the Serial Manager to open a direct serial connection to the modem. Once connected, use the SrmSend function to send the AT commands to the modem. Use the SrmReceive function to read responses from the modem.

Use 'uGSM' as the port in the SrmOpen call as shown in the code example below. Close the port when you are done sending AT commands to the modem.

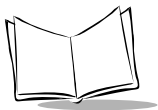
---

**Note:** *Use a single quote, case sensitive command.*

---

```
/*  
 * Open Connection to the Modem  
 */  
sysErr=SrmOpen('uGSM',19200, &ModemPortId);
```

Refer to the Palm OS SDK for details about all the Serial Manager Functions.



## ***Determining the Installed Modem and Driver Version in the SPT 1734/1834***

This section provides an overview of the GSM radio network's operation, including the network's components and its use of radio to transmit data. The SPT 1734/1834 terminal is just one component of a GSM network, and is referred to as a Mobile Unit (MU). The SPT 1734/1834 terminal is one of many mobile devices that may belong to a GSM network. In this manual, the term "SPT 1734/1834" is used instead of the general term "mobile unit."

With the advent of the SPT 1734/1834, there are now two different modems - Wavecom or Ubinetics - that can be installed in the unit. Due the anticipated variation in operation between the two modems, it is advantageous for GSM-aware applications to be able to determine which modem is installed in the SPT 1734/1834 terminal. If an application can determine this information at run time, it will not be necessary to develop 2 applications, one for each modem.

Using user defined serial driver control code, apps can determine the installed modem and driver revision on your SPT 1734/1834 devices.

Symbol uses the PalmOS® Serial manager SrmControl function, with the user defined serial driver control code to provide a mechanism, to obtain information from the modem driver at run time. Refer to the Palm OS® SDK Reference and the Palm OS® Programmer Companion for information on the serial manager function calls.

---

**Note:** *The structure and constants that are listed are defined in the UserControl.h file.*

---

### ***Palm OS Prototype:***

```
Err SrmControl (UInt16 portId, UInt16 op, void *valueP, UInt16 *valueLenP);
```

|           |   |
|-----------|---|
| PortId    | Obtained when the serial port is opened.  |
| Op        | srmCtlUserDef as defined in SerialMgr.h.  |
| ValueP    | A Control Block pointer. The control block is defined later.                            |
| ValueLenP | A pointer to value length and will have meaning depending on the control block command. |

**Symbol Defined Control Block:**

All commands sent to the driver via the user defined control will use the driver info control block.

```
/*
 * Info Control Block
 */
typedef struct _modemInfoCB {
    UInt16      cmd;
    UInt16      reserved1;
    UInt16      retVal;
    UInt16      retVal2;
    void        *paramPtr;
} modemInfoCB;
```

Information is passed to the driver in the cmd field of the control block. Information is passed back from the driver in the retVal and optionally in the retVal2 and paramPtr fields of the control block.

There are currently 2 commands defined for the user defined control function:

```
/*
 * Control Block Commands
 */
#define MI_GET_MODEM_TYPE          1
#define MI_GET_DRIVER_VER         2
```

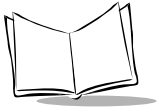
**Modem Info Command:**

When the cmd field of the control block is MI\_GET\_MODEM\_TYPE, the driver will respond with a value in the retVal field that will indicate the modem type.

There are currently 2 modem types supported:

```
#define UBINETICS_MODEM          1
#define WAVECOM_MODEM           2
```

Optionally, if paramPtr field of the control block is NON-NULL and the valueLenP of the SrmControl function references a value > 0, then the user control function will copy a string to the paramPtr location describing the modem.



## Example Function Calls:

### 1) No info string wanted:

```
GetModemType()
{
    driverInfoCB CtlB;
    UInt16 retLen = 0;

    CtlB.cmd = DI_GET_MODEM_TYPE;
    CtlB.paramPtr = NULL;

    SrmControl (PortId, srmCtlUserDef,&CtlB, &retLen);
}
```

On return from SrmControl CtlB.retVal will be either:

UBINETICS\_MODEM  
WAVECOM\_MODEM

### 2) Info string requested

```
GetModemType()
{
    driverInfoCB CtlB;
    char infoStr[80];
    UInt16 retLen = 80;

    CtlB.cmd = DI_GET_MODEM_TYPE;
    CtlB.paramPtr = infoStr;

    SrmControl (PortId, srmCtlUserDef ,&CtlB, &retLen);
}
```

As above, on return from SrmControl, CtlB.retVal will be either:

DI\_UBINETICS\_MODEM  
DI\_WAVECOM\_MODEM

Additionally there will a string, describing the modem, copied into infoStr.

For example, the Wavecom GSM Modem.

**Driver Info Command:**

When the cmd field of the control block is MI\_GET\_DRIVER\_VER, the driver will respond with values in the retVal and retVal2 fields that will indicate the major and minor revision of the driver software.

Optionally, if paramPtr field of the control block is NON-NULL and the valueLenP of the SrmControl function references a value > 0, then the user control function will copy a string to the paramPtr location describing the driver software revision.

**Example Function Calls:**

## 1) No info string wanted:

```
GetDriverVersion()
{
    driverInfoCB CtlB;
    UInt16 retLen = 0;

    CtlB.cmd = MI_GET_DRIVER_VER;
    CtlB.paramPtr = NULL;

    SrmControl (PortId, srmCtlUserDef,&CtlB, &retLen);
}
```

On return from SrmControl CtlB.retVal will contain the major revision of the driver software. CtlB.retVal2 will contain the minor revision of the driver software.

## 2) Info string requested

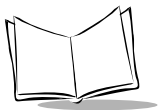
```
GetDriverVersion()
{
    driverInfoCB CtlB;
    char infoStr[80];
    UInt16 retLen = 80;

    CtlB.cmd = MI_GET_DRIVER_VER;
    CtlB.paramPtr = infoStr;
}
```

As above, on return from SrmControl CtlB.retVal and CtlB.retVal2 will contain the major and minor revision level of the driver software. Additionally there will a string, describing the driver firmware revision, copied into infoStr.

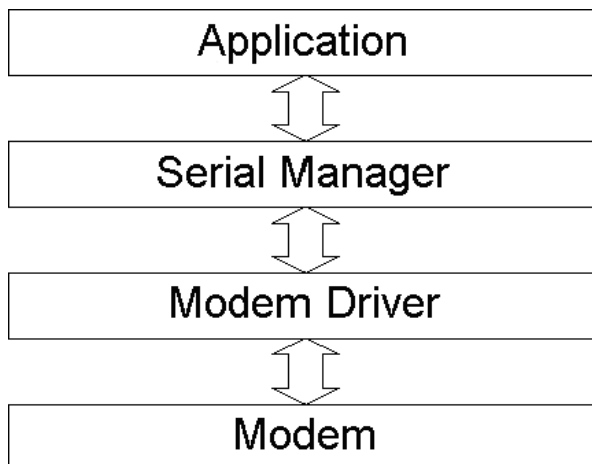
Ex: Ubinetics Modem Driver Version 1.8





## Low Voltage and Battery Considerations

The following is the software architecture for communicating to / through a GSM modem in an SPT 1734/1834 terminal.



There are several low voltage and battery fail conditions that the application programmer must be aware of. In order for these conditions to be handled so the application does not enter endless loops or run with invalid port identifiers, it is important to check return codes for all serial manager functions.

Specifically these conditions are:

- Condition 1 - The battery voltage is too low to turn on the modem
- Condition 2 - The battery voltage becomes too low to continue operating the modem
- Condition 3 - The battery has been dislodged or replaced while the modem is active

The serial driver is aware of these conditions and ensures that communications is not attempted with a powered off modem. It is the responsibility of the application developer to examine all return codes from serial manager calls.

**Condition 1 - The battery voltage is too low to turn on the modem**

The application to serial manager SrmOpen call opens the serial port and powers on the modem. The SrmOpen function updates a port id that used by the application in subsequent serial operations. If the battery voltage is below 3.65 Volts, the serial driver will not power on the modem, and will return an error code. If the SrmOpen returns any error code the application can assume that the port has not been opened, the port Id is invalid and the port cannot be used.

**Condition 2 - The battery voltage becomes too low to continue operating the modem**

There is a background task on the Palm that monitors the battery voltage. If the battery voltage falls below 3.50 Volts, power to the modem is removed. The serial driver is aware of this condition. Evidence of this condition is returned, via error codes returned to the application on any subsequent serial interface function call: SrmGetStatus SrmControl, SrmWrite, and SrmRead. Specifically, the response to the SrmGetStatus command will indicate Break Asserted and the absence of CTS RTS and DSR.

Additionally, a system event (WanLowBatteryEvent) is generated when the voltage becomes too low to operate the modem.

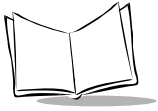
On any return error on these serial interface functions the application should close the serial port via the SrmClose call.

**Condition 3 - The battery has been dislodged or replaced while the modem is active**

If the battery is dislodged or replaced the modem will shut down due to the power loss. The serial driver monitors this condition and will prevent communication with the powered down modem, which could cause system lock up. Evidence of this condition is returned to the application, via error codes returned on any subsequent serial interface function call: SrmGetStatus SrmControl, SrmWrite, and SrmRead. Specifically, the response to the SrmGetStatus command will indicate Break Asserted and the absence of CTS RTS and DSR.

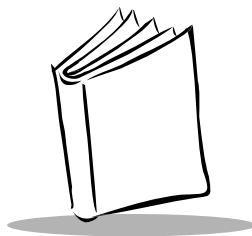
Additionally, a system event (WanBatteryErrorEvent) is generated after the battery error has been detected.

The WanBatteryEvents are defined in the SymbolEvents.h header file which is part of the SPT SDK.



On any return error on these serial interface functions the application should close the serial port via the SrmClose call.

If the application wishes to communicate via the modem it must close and re-open the serial driver via the SrmClose and SrmOpen calls.



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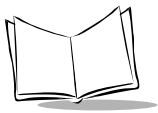
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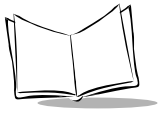
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## *SPT 173X/SPT 183X WAN Developer's Guide*

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