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SM-56 Security Modem

Table of Contents

Product Description

Thank you for your purchase or interest in the DCB SM-56 modem. If you are taking the time to read this introduction, you are probably still in the evaluation phase, trying to understand what the SM-56 is and how it can be applied to your particular application. This introduction will describe the SM-56, discuss where it is applicable and also where it is not applicable. It will try to explain some of the limitations so that you can make an appropriate design decision.

The SM-56 is a special purpose modem designed to enhance the security of remote dial-in access. Many of us still rely on using a modem, attached directly to the serial port of some device, to remotely access and manage that device. Unfortunately, the device may have little or no security. Anyone who stumbles across the phone number to the modem, could attempt to gain access. However, improving security in the end-device may be impossible or prohibitively expensive. By shifting security to the modem, it is a simple matter of replacing your current modem with an SM-56.

The SM-56 behaves very much like a typical modem. It responds to the AT command set and can answer and originate calls. However, it has the ability to inject additional security methods before allowing communication through to the end-device. These methods include user name and password authentication, one-time pass-code authentication, dial-back, and encryption based authentication. These features can be enabled manually in the modem, without any special configuration required by the end-device.

Another feature of SM-56 is an Ethernet interface that can take the place of the RS-232 serial port. Instead of dialing in and connecting to a device attached to the serial port, you can instead be connected via Telnet to an Ethernet device. This would allow dial-in access to a device that only supports Telnet access. It also supports a Telnet server which will allow you to Telnet to the modem for the purpose of dialing out.

The SM-56 has the ability to log all incoming connections. If user authentication is enabled, it will keep track of each user, the amount of time connected and the amount of data transferred. It will also log all failed authentication attempts. It can even be configured to dial-out a special number in the event of repeated failed authentication attempts, as a indication that an unauthorized user may be trying to break in.

The SM-56 achieves this added functionality by taking a real v92 modem and inserting a CPU in the path between the modem and serial or Ethernet interface. The CPU actually emulates a virtual modem on the DTE side, then controls the real modem based on the commands received.

The SM-56 has several limitations due to its design. Fax and voice features, typically found in a v92 modem, can not be supported. Also, the SM-56 adds a large amount of latency to the data stream. It can add as much as 70 milliseconds to the first character. For typical console type applications, this added latency is not noticeable. However, if used in a SCADA polling application, it may be necessary to adjust the polling rate to account for the additional delay.

Configuration Examples

Setting Defaults and Protecting High S-Registers

The SM-56 modem has a number of non-standard S-Registers which are used to hold the security and Ethernet configuration. These S-Registers are all located in registers 96 and above. One of the problems in using the SM-56 with software packages that automatically configure the modem is that the software typically resets the modem to factory defaults using the &F, &F0, or &F1 command as a first step. Additionally, the software may not have the ability to configure the non-standard features. To work around this, the SM-56 has a feature where the high S-Registers are not modified by the &F, &F0, &F1 commands. This allows the non-standard features to be configured and stored manually.

The following examples will step through configuring most of the non standard features. When dealing with an SM-56 in an unknown state, it is best to first issue a factory reset that will reset all features. The following commands show how to achieve this:

```
AT&F2          ; Proprietary factory reset command, resets all S-Registers
               ; and configuration items to factory defaults.


AT+P1          ; Protect high S-Registers
```

Encrypted Connection

The method used to encrypt a dial-up connection is proprietary to the SM-56. So, in order to implement an encrypted connection, an SM-56 is required at each end. Once configuration is complete, dial-out can be performed manually or under software control. The status LED on the front of the modem will illuminate after the connection is established to indicate the modems are operating in encrypted mode.

Answer End

```
AT+P0                    ; Unprotect high S-Registers.
AT&F0                    ; Load factory default profile 0.
ATS0=1                   ; Answer on first ring.
AT+K=123456789abcdef ; Set encryption key.  Choose your own key or use
                         ; AT+K! to generate a random key.
AT+E1                    ; Enable encryption mode.
AT+P1                    ; Protect high S-Registers.
AT+H1                    ; Optional – hide key so that it can not be
                         ; read from modem.
AT&W0                    ; Store the configuration to user profile 0
AT&Y0                    ; Select profile 0 as the power-up default
```

Originate End

```
AT+P0                    ; Unprotect high S-Registers.
AT&F0                    ; Load factory default profile 0.
AT+K=123456789abcdef ; Set encryption key.  Must match answer key.
AT+E1                    ; Enable Encryption Mode
AT+P1                    ; Protect high S-Registers.
AT+H1                    ; Optional – hide key so that it can not be
                         ;   read from modem.
AT&W0                    ; Store the configuration to user profile 0
AT&Y0                    ; Select profile 0 as the power-up default

ATD<phone_number>    ; Dial remote modem – once connected, all data
                         ; will be encrypted.  Status LED will illuminate
                         ; to indicate encrypted connection.
```

Configuring the Ethernet Interface

This example will show how to configure the Ethernet Interface with a static IP address. The default IP address is 192.168.0.11.

```
AT+IP=192.168.0.25          ; Set the IP address to 192.168.0.25
AT+SM=255.255.255.0         ; Set the subnet mask to 255.255.255.0
AT+GW=192.168.0.1           ; Optional, set default gateway address to
                            ;  192.168.0.1  If no gateway is present, set
                            ;  the gateway to 0.0.0.0
AT+DNS=192.168.0.1          ; Optional, set DNS server address to
                            ;  192.168.0.1  If no DNS server is present,
                            ;  set dns to 0.0.0.0
AT+N1                       ; Enable the Ethernet Interface
AT&W0                       ; Save the configuration to profile 0.
AT&Y0                       ; Select profile 0 as power-up default
AT+P1                       ; Optional, protect the high S-Registers,
                            ;  where the IP configuration is stored, from
                            ;  future &f0 and &f1 commands.
```

To verify and test the IP configuration:

```
AT&V3                       ; Display Network Status

AT+PING=192.168.0.1         ; Attempt to ping a host.
```

Dial-In User Authentication Example

This example will show how to configure 4 dial-in users, each showing a different type of action. Upon dialing in, the user will be prompted for a user name and password. Upon successful authentication, the indicated action will be performed.

```
AT&F2                   ; Load factory defaults and clear user table.
                        ; Note: if you are building upon another
                        ;   configuration you will not want to do &f2


ATS0=1                  ; Answer on first ring.
AT+A1                   ; Enable user-authentication mode.
AT+P1                   ; Protect high S-Registers.
AT&W0                   ; Store the configuration to user profile 0
AT&Y0                   ; Select profile 0 as the power-up default



AT+USER0=Fred,secret123
                        ; Name,Password
                        ; Normal user, pass-through to serial port


AT+USER1=Sally,pass456,dial 9,555-1234
                        ; Name, Password,dial(back)<phone number>
                        ; Modem will hangup and dial-back


AT+USER2=Bob,secret,telnet 192.168.0.51 3000
                        ; Name, Password,telnet <IP address> <port>
                        ; Modem will telnet to 192.168.0.51 port 3000


AT+USER3=TheBoss,password,admin
                        ; Administrative user, modem will enter online
                        ; command mode.
```

One-Time Pass-Code Example

This example will show how to configure the modem for one-time pass-code authentication. The modem will generate a list of 80 pass-codes. When a dial-in user connects to the modem, he will be prompted for one of the pass-codes. The modem will use each pass-code only once.

```
AT&F0                ; Load factory defaults
ATS0=1               ; Answer on first ring.
AT+PA1               ; Enable pass-code authentication mode.
AT+P1                ; Protect high S-Registers.
AT&W0                ; Store the configuration to user profile 0
AT&Y0                ; Select profile 0 as the power-up default

AT+PCODE             ; Generate the pass-codes.  The modem will only
                     ;   display the list once.  Capture and store
                     ;   the list to a file for later reference.


                     ; To generate a new list, repeat the command.
```

Interface Specification

RS-232 Interface

Pin	Signal	Direction
1	DTR	input
2	Tx Data	input
3	Rx Data	output
4	RLSD (DCD)	output
5	GND	
6	Not used	
7	CTS	output
8	RTS	input
9	Not used	

Cables

Cables to provide a standard 25 pin or 9 pin DCE interface are included with the modem. Connect the PC Direct adapter to the modem and use the patch cord and Remote PC adapters to connect to the DTE device.

To connect a PC to the serial interface for initial configuration, use the two 9-pin adapters and a patch cord.

Switches and Indicators

DTE Baud Rate Configuration

The SM-56 does not support auto-baud on the DTE interface. DIP switches 2, 3, and 4 located on rear of the modem are used to set the baud rate.

SW2	SW3	SW4	Baud Rate
Down	Down	Down	1200
Up	Down	Down	2400
Down	Up	Down	9600
Up	Up	Down	19200
Down	Down	Up	38400
Up	Down	Up	57600
Down	Up	Up	115200

Note: SW1 is a hard reset switch. It must be in the down position for the modem to operate.

Front Panel Indicators

LED indicators located on the front of the modem are as follows:

PWR   Power ON indicator
STATUS   Encrypted Connection in progress

Modem B
    RD   Receive Data
    TD   Transmit Data
    CD   Carrier Detect, modem is on-line
    DTR Data Terminal Ready

Serial A
    A   Transmit Data
    B   Receive Data

AT Commands, S-Registers, and Result Codes

Introduction

The AT commands are used to control the operation of your modem. They are called *AT* commands because the characters **AT** must precede each command to get the *AT*tention of the modem.

AT commands can be issued only when the modem is in command mode or online command mode. The modem is in *command mode* whenever it is not connected to another modem. The modem is in *data mode* whenever it is connected to another modem and ready to exchange data. *Online command mode* is a temporary state in which you can issue commands to the modem while connected to another modem. To put the modem into online command mode from data mode, you must issue an *escape sequence* (**+++**) followed immediately by the *AT* characters and the command, e.g., **+++** to hang up the modem. To return to data mode from online command mode, you must issue the command **ATO**.

To send AT commands to the modem, you must use a communications program, such as HyperTerminal in Windows, or some other available terminal program. You can issue commands to the modem either directly, by typing them in the terminal window of the communications program, or indirectly, by configuring the operating system or communications program to send the commands automatically. Fortunately, communications programs make daily operation of modems effortless by hiding the commands from the user. Most users, therefore, need to use AT commands only when reconfiguring the modem, e.g., to turn autoanswer on or off.

The format for entering an AT command is **AT***Xn*, where *X* is the command, and *n* is the specific value for the command, sometimes called the command *parameter*. The value is always a number. If the value is zero, you can omit it from the command; thus, **AT&W** is equivalent to **AT&W0**. Most commands have a *default* value, which is the value that is set at the factory. The default values are shown in the "AT Command Summary" (See below).

You must press ENTER (depending on the terminal program it could be some other key) to send the command to the modem. Any time the modem receives a command, it sends a response known as a *result code*. The most common result codes are *OK*, *ERROR*, and the *CONNECT* messages that the modem sends to the computer when it is connecting to another modem. See "Result Codes" at the end of this chapter for a table of valid result codes.

You can issue several commands in one line, in what is called a command *string*. The command string begins with **AT** and ends when you press ENTER. Spaces to separate the commands are optional; the command interpreter ignores them. The most familiar command string is the *initialization string*, which is used to configure the modem when it is turned on or reset, or when your communications software calls another modem.

Escape Code Sequence +++

When the modem has established a connection and has entered online data mode, it is possible to break into the data transmission in order to issue further commands to the modem in an online command mode. This is achieved by the DTE sending to the modem a sequence of three ASCII characters specified by S-Register S2. The default character is '+'. The maximum time allowed between receipt of the last character of the three-escape character sequence from the DTE and sending of the OK result code to the DTE is controlled by the S12 register.

Warning: If you plan to use the escape code sequence, it is best that you use a different escape code character in each modem. Consider the typical case where you have a *terminal - modem - modem – computer* arraignment, and the computer is echoing characters. Escape character pass through the modems. When you enter "**+++**" from the terminal to place the local modem in online command mode, the "**+++**" characters are also sent to the remote modem and echoed back by the Computer. This will cause the remote modem to also enter online command mode. However there is no way to return the remote modem to online data mode.

Remote Escape Code Sequence ---

When the modem has established a connection and has entered online data mode, it is possible to break into the data transmission from the remote side of the connection in order to issue further commands to the modem in an online command mode. This is achieved by the remote sending a sequence of three ASCII characters specified by S-Register S104. The default character is '-'. The maximum time allowed between receipt of the last character of the three-escape character sequence and sending of the Remote: OK result code is controlled by the S105 register. Remote escape may optionally be password protected (see +RPASS) command.

Warning: If you plan to use the remote escape code sequence, it is best that you use a different escape code character in each modem. Consider the typical case where you have a *terminal - modem - modem – computer* arraignment, and the computer is echoing characters. Escape character pass through the modems. When you enter "---" from the terminal to place the remote modem in online command mode, the "---" characters are echoed back by the Computer and will be received by the local modem. This will cause both modems to enter remote online command mode. Once this happens, you will lose the ability to command either modem. Manually disconnecting the call is the only way to break out of this condition.

AT Command Summary

Command	Description	Page
&C	RLSD (DCD) Option	21
&D	DTR (Data Terminal Ready) Option	22
&F	Restore Factory Configuration (Profile)	18
&G	Select Guard Tone	26
&K	Flow Control	22
&M	Connection Mode	32
&P	Select Pulse Dial Make/Break Ratio	26
&Q	Connection Mode	32
&R	RTS/CTS (Request to Send/Clear to Send) Option	22
&S	DSR (Data Set Ready) Override	22
&V	Display Current Configuration and Stored Profiles	26
&V1	Display Last Connection Statistics	27
&V2	Display Current Configuration and Stored Profiles	26
&V3	Display Ethernet Status	28
&V4	Display DHCP Status	28
&W	Store Current Configuration	18
&Y	Designate a Default Reset Profile	18
&Zn=	Store Telephone Number	18
%C	Enable/Disable Data Compression	30
%E	Line Quality Monitor and Auto-Retrain	30
%L	Report Line Signal Level	28
%Q	Report Line Signal Quality	28
%U	Select µ-Law or A-Law Codec Type	31
+A	Enable/Disable User Authentication	33
+ALERT	Enable/Disable Alert Action	33
+ALERTA	Set Alert Action	33
+AUDIT	Display Usage Statistics	35
+DBMSG	Set Dial-Back Message	33
+DNS	Set DNS Address	38
+E	Enable/Disable Encryption	34
+GCI	Country of Installation	17

+GW	Set Gateway Address	38
+H	Hide Encryption Key	34
+IP	Set IP Address	38
+K	Set Encryption Key	34
+LOG	Display Activity Log	35
+MS	Modulation Selection	29
+NAME	Set Modem Name	35
+P	Protect S-Registers 96 – 255 from &F command	35
+PA	Enable/Disable One-time Pass-code Authentication	36
+PCODE	Generate One-time Pass-code List	36
+PING	Set Subnet Mask	38
+RPASS	Set Remote ESC Password	36
+RX	Firmware Upload	40
+SM	Set Subnet Mask	38
+TA	Enable/Disable Telnet Authentication	36
+TP	Set Telnet Port	39
+USER	Set User	37
+ZAUDIT	Clear Usage Statistics	35
+ZLOG	Clear Activity Log	35
A	Answer	24
B	Communication Standard Setting – CCITT or Bell	31
D	Dial	23
E	Command Echo	20
H	Hang-up (Disconnect)	24
I	Identification	17
L	Speaker Volume	25
M	Speaker Control	25
N	Automode Enable	31
O	Return to Online Data Mode	25
P	Set Pulse Dial Default	24
Q	Quiet Result Code Control	20
S*n*	Read/Modify S-Register	19

T	Set Tone Dial Default	24
V	Result Code Form	20
W	Connect Message Control	20
X	Extended Result Codes	21
Z	Soft Reset and Restore Profile	17

Generic Modem Control Commands

Soft Reset and Restore Profile

Command:	Z
Description:	Causes the modem to perform a soft reset and restore (recall) the configuration profile. If no value is specified, zero is assumed.
Default:	None
Values:	Number corresponding to the selected profile:
	Z0 Soft reset and restore stored profile 0.
	Z1 Soft reset and restores stored profile 1.
Result Codes:	OK
	Otherwise ERROR

Identification

Command:	I
Description:	Causes the modem to reports the requested result according to the command parameter.
Default:	None
Defined Values:	I0 Reports product code (e.g., 56000).
	I1 Reports the least significant byte of the stored checksum (e.g., *12AB*).
	I2 Checks ROM and verifies the checksum. Reports OK or ERROR.
	I3 Reports ROM Code Revision-Modulation (e.g., 2109-V90).
	I4 Reports OEM defined identifier string.
	I5 Reports Country Code parameter (see +GCI).
	I6 Reports modem data pump model and internal code revision.
Result Codes:	OK
	Otherwise ERROR

Country of Installation

Command:	+GCI
Description:	This extended syntax command selects and indicates the country of installation for the modem. This parameter selects the settings for any operational parameters that need to be adjusted for national regulations or telephone networks.
Default:	If the modem is specified for use in only one country, that country code is the default. Otherwise, the default is defined by the OEM. Factory default is B5 (United States).
Report Commands:	+GCI? Reports the current country code.
	+GCI=? Displays the list of available country codes.
Set Command:	+GCI=*nn* Set country code, see following table.

Country	Code	Country	Code	Country	Code
Argentina	07	Greece	FD	Netherlands	FD
Australia	09	Hong Kong	99	New Zealand	7E
Austria	FD	Hungary	FD	Norway	FD
Belgium	FD	Iceland	FD	Philippines	B5
Canada	B5	Indonesia	99	Portugal	FD
China	B5	Ireland	FD	Slovak Republic	FD
Cyprus	FD	Italy	FD	Spain	FD
Czech Republic	FD	Japan	00	Sweden	FD
Denmark	FD	Korea	B5	Switzerland	FD
Finland	FD	Liechtenstein	FD	Taiwan	FE
France	FD	Luxembourg	FD	United Kingdom	FD
Germany	FD	Mexico	B5	United States	B5

Restore Factory Configuration (Profile)

Command: &F

Description: The modem loads the factory default configuration (profile). The factory defaults are identified for each command and in the S-Parameter descriptions. A configuration (profile) consists of a subset of S-Parameters. Since the SM-56 contains a set of non-standard S-Registers, used for security, the &F command can be limited to reset only the standard S-Registers by using the +H command.

Default: None

Values: &F0 Restore factory configuration 0.

            &F1 Restore factory configuration 1.

            &F2 Restore factory configuration for all S-Registers, overriding +H1 command. Also clears configuration items not stored in S-Registers, such as the user table, remote escape password, prompts, and alert action. It does not reset +H (hide key) and +P(protect high S-Register) state.

Result Codes: OK

            ERROR if the modem is connected.

Designate a Default Reset Profile

Command: &Y

Description: Selects which user profile will be used after a hard reset.

Default: None

Defined Values: &Y0 The modem will use profile 0.

            &Y1 The modem will use profile 1.

Result Codes: OK

            ERROR if invalid parameter.

Store Current Configuration

Command: &W

Description: Saves the current (active) configuration (profile), including S-Parameters, in one of the two user profiles in NVRAM as denoted by the parameter value.

            The current configuration is comprised of a list of storable parameters illustrated in the **&V** command. These settings are restored to the active configuration upon receiving a **Z** command or at power up (see **&Y** command).

Default: 0

Defined Values: &W0 Store the current configuration as profile 0.

            &W1 Store the current configuration as profile 1.

Result Codes: OK

            Otherwise ERROR

Store Telephone Number

Command: &Z*n*=*x*

Description: The modem can store up to four telephone numbers and each telephone number dial string can contain up to 31 digits.

Default: None

Defined Values: <string> Dial string from 0 to 31 characters.

Result Codes: OK For <value> =3, and <string> =31 digits.

            ERROR If <value> > 3, <string> > 31 digits.

Read/Modify S-Register

Report Command:	S*n*?
Set Command:	S*n*=*value*
Description:	The S command is used to display or set the value of an S-Register. There are 256 S-Registers indexed from 0 to 255. Each S-Register is 8-bits wide and may hold a value between 0 and 255.
Result Codes:	OK .
	ERROR.

DTE-Modem Interface Commands

The parameters defined in this section control the operation of the interface between the DTE and modem.

Command Echo

Command:	E
Description:	The modem enables or disables the echo of characters to the DTE. The parameter value, if valid, is written to S14 bit 1.
Default:	1
Defined Values:	E0 Disables command echo.
	E1 Enables command echo.
Result Codes:	OK
	Otherwise ERROR

Quiet Result Code Control

Command:	Q
Description:	Enables or disables the sending of result codes to the DTE. The parameter value, if valid, is written to S14 bit 2.
Default:	0
Defined Values:	Q0 Enables result codes to the DTE.
	Q1 Disables result codes to the DTE.
Result Codes:	OK
	Otherwise ERROR

Result Code Form

Command:	V
Description:	Selects the sending of short-form or long-form result codes to the DTE. The parameter, if valid, is written to S14 bit 3.
Default:	1
Defined Values:	V0 Enables short-form (terse) result codes. Line feed is not issued before a short-form result code.
	V1 Enables long-form (verbose) result codes.
Result Codes:	OK
	Otherwise ERROR

Connect Message Control

Command:	W
Description:	This command, in conjunction with S95 bits 0, 2, 3, and 5 (bits 2, 3, and 5) , control the format of CONNECT messages. The actual result code messages reported reflect the W command setting and the S95 bit settings. The W parameter value, if valid, is written to S31 bits 2 and 3.
Default:	0
Defined Values:	W0 Upon connection, the modem reports only the DTE speed (e.g., CONNECT 19200). Subsequent responses are disabled.
	W1 Upon connection, the modem reports the modulation, line speed, the error correction protocol, and the DTE speed, respectively. Subsequent responses are disabled.
	W2 Upon connection, the modem reports the DCE speed (e.g., CONNECT 14400). Subsequent responses are disabled.
Result Codes:	OK
	Otherwise ERROR

Extended Result Codes

Command:	X
Description:	Selects the subset of the result code messages used by the modem to inform the DTE of the results of commands. Blind dialing is enabled or disabled by country parameters. If the user wishes to enforce dial tone detection, a "W" can be placed in the dial string (see D command). The information below is based upon the default implementation of the X results table.
Default:	4
Defined Values:	X0 Disables reporting of busy tones unless forced otherwise by country requirements; send only OK, CONNECT, RING, NO CARRIER, ERROR, and NO ANSWER result codes. Blind dialing is enabled/disabled by country parameters. If busy tone detection is enforced and busy tone is detected, NO CARRIER will be reported. If dial tone detection is enforced or selected and dial tone is not detected, NO CARRIER will be reported instead of NO DIAL TONE. The value 000b is written to S22 bits 6, 5, and 4, respectively.
	X1 Disables reporting of busy tones unless forced otherwise by country requirements; send only OK, CONNECT, RING, NO CARRIER, ERROR, NO ANSWER, and CONNECT XXXX (XXXX = rate). Blind dialing enabled/disabled by country parameters. If busy tone detection is enforced and busy tone is detected, NO CARRIER will be reported instead of BUSY. If dial tone detection is enforced or selected and dial tone is not detected, NO CARRIER will be reported instead of NO DIAL TONE. The value 100b is written to S22 bits 6, 5, and 4, respectively.
	X2 Disables reporting of busy tones unless forced otherwise by country requirements; send only OK, CONNECT, RING, NO CARRIER, ERROR, NO DIAL TONE, NO ANSWER, and CONNECT XXXX. If busy tone detection is enforced and busy tone is detected, NO CARRIER will be reported instead of BUSY. If dial tone detection is enforced or selected and dial tone is not detected, NO DIAL TONE will be reported instead of NO CARRIER. The value 01b is written to S22 bits 6, 5, and 4, respectively.
	X3 Enables reporting of busy tones; send only OK, CONNECT, RING, NO CARRIER, ERROR, NO ANSWER, and CONNECT XXXX. Blind dialing is enabled/disabled by country parameters. If dial tone detection is enforced and dial tone is not detected, NO CARRIER will be reported. The value 110b is written to S22 bits 6, 5, and 4, respectively.
	X4 Enables reporting of busy tones; send all messages. The value 111b is written to S22 bits 6, 5, and 4, respectively.
Result Codes:	OK
	Otherwise ERROR

RLSD (DCD) Option

Command:	&C
Description:	The modem controls the RLSD output in accordance with the parameter supplied. The parameter value, if valid, is written to S21 bit 5.
Default:	1
Defined Values:	&C0 RLSD remains ON at all times.
	&C1 RLSD follows the state of the carrier.
Result Codes:	OK
	Otherwise ERROR

DTR (Data Terminal Ready) Option

Command:	&D
Description:	Interprets the ON to OFF transition of the DTR signal from the DTE in accordance with the parameter supplied. The parameter value, if valid, is written to S21 bits 3 and 4. Also, see S25.
Default:	2
Defined Values:	&D0 DTR is ignored (assumed ON). Allows operation with DTEs, which do not provide DTR.
	&D1 DTR drop is interpreted by the modem as if the asynchronous escape sequence had been entered. The modem returns to asynchronous Command State without disconnecting.
	&D2 DTR drop will cause the modem to hang up. Auto-answer is inhibited.
	&D3 DTR drop causes the modem to perform a soft reset as if the Z command were received. The &Y setting determines which profile is loaded.

Flow Control

Command:	&K
Description:	Defines the DTE/DCE (terminal/modem) flow control mechanism. The parameter value, if valid, is written to S39 bits 0, 1, and 2.
Default:	3
Defined Values:	0 Disables flow control.
	3 Enables RTS/CTS flow control.
	4 Enables XON/XOFF flow control.
Result Codes:	OK
	Otherwise ERROR

RTS/CTS (Request to Send/Clear to Send) Option

Command:	&R
Description:	This selects how the modem controls CTS. CTS operation is modified if hardware flow control is selected (see &K command). The SM-56 does not support synchronous operation. In asynchronous mode the behavior of CTS is identical for &R0 and &R1. This command is implemented for compatibility.
Default:	None
Defined Values:	&R0 CTS is normally ON and will turn OFF only if required by flow control.
	&R1 CTS is normally ON and will turn OFF only if required by flow control.
Result Codes:	OK
	Otherwise ERROR

DSR (Data Set Ready) Override

Command:	&S
Description:	Selects how the modem will control DSR. The SM-56 does not have a DSR signal. This command is provided for compatibility.
Default:	0
Defined Values:	&S0 DSR will remain ON at all times.
	&S1 DSR will become active after answer tone has been detected and inactive after the carrier has been lost.
Result Codes:	OK
	Otherwise ERROR

Call Control Commands

Dial

Command: D

Description: Directs the modem to go on-line, dial according to the string entered and attempt to establish a connection. If no dial string is supplied, the modem will go on-line and attempt the handshake in originate mode.

Note: If the ATD command is issued before the S1 register has cleared, the modem will respond with the NO CARRIER result code.

The modem will behave as a data modem and will attempt to connect to another data modem. The modem will have up to the period of time specified by register S6 or S7 to wait for carrier and complete the handshake. If this time expires before the modem can complete the handshake, the modem will go on-hook with the NO CARRIER response. This command will be aborted in progress upon receipt of any DTE character before completion of the handshake.

Dial Modifiers

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

Defined Values: Character string <string> corresponding to the selected option(s).

0-9 DTMF digits 0 to 9.

* The 'star' digit (tone dialing only).

The 'gate' digit (tone dialing only).

A-D DTMF digits **A**, **B**, **C**, and **D**. Some countries may prohibit sending of these digits during dialing.

L Re-dial last number: the modem will re-dial the last valid telephone number. The **L** must be immediately after the **D** with all the following characters ignored).

P Select pulse dialing: Pulse Dialing is used in the dialed numbers that follow until a **T** command is encountered. Affects current and subsequent dialing. Some countries prevent changing dialing modes after the first digit is dialed.

T Select tone dialing: Tone Dialing is used in the dialed numbers that follow until a **P** is encountered. Affects current and subsequent dialing. Some countries prevent changing dialing modes after the first digit is dialed.

R This command will be accepted, but not acted on.

S=n Dial the number stored in the directory (n = 0 to 3). (See &Z.)

! Flash: the modem will go on-hook for a time defined by the value of S29. Country requirements may limit the time imposed.

W Wait for dial tone: the modem will wait for dial tone before dialing the digits following "W". If dial tone is not detected within the time specified by S7 (US) or S6 (W-class), the modem will abort the rest of the sequence, return on-hook, and generate an error message.

@ Wait for silence: the modem will wait for at least 5 seconds of silence in the call progress frequency band before continuing with the next dial string parameter. If the modem does not detect these 5 seconds of silence before the expiration of the call abort timer (S7), the modem will terminate the call attempt with a NO ANSWER message. If busy detection is enabled, the modem may terminate the call with the BUSY result code. If answer tone arrives during execution of this parameter, the modem handshakes.

& Wait for credit card dialing tone before continuing with the dial string. If the tone is not detected within the time specified by S7 (US models) or S6 (W-class models), the modem will abort the rest of the sequence, return on-hook, and generate an error message.

, Dial pause: the modem will pause for a time specified by S8 before dialing the digits following ",".

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

^   Toggles calling tone enable/disable: applicable to current dial attempt only.

( )   Ignored: may be used to format the dial string.

-       Ignored: may be used to format the dial string.

<space>   Ignored: may be used to format the dial string.

<i>   Invalid character: will be ignored.

>   If enabled by country specific parameter, the modem will generate a grounding pulse on the EARTH relay output.

Set Tone Dial Default

Command:	T
Description:	Forces DTMF dialing until the next P dial modifier or P command is received. The modem will set an S-Parameter bit to indicate that all subsequent dialing should be conducted in tone mode. The DP command will override this command. Clears S14 bit 5. This command may not be permitted in some countries. (See P.)
Result Code:	OK

Set Pulse Dial Default

Command:	P
Description:	Forces pulse dialing until the next T dial modifier or T command is received. Sets S14 bit 5. As soon as a dial command is executed which explicitly specifies the dialing mode for that particular call (e.g., ATDT...), this command is overridden so that all future dialing will be tone dialed. (See T command.) This command may not be permitted in some countries.
Result Code:	OK

Answer

Command:	A
Description:	The modem will go off-hook and attempt to answer an incoming call if correct conditions are met. Upon successful completion of answer handshake, the modem will go on-line in answer mode. This command may be affected by the state of Line Current Sense, if enabled. (Most countries do not require Line Current Sense.) Operation is also dependent upon country-specific requirements.
	The modem will enter the Connect state after exchanging carrier with the remote modem. If no carrier is detected within a period specified in register S7, the modem hangs up. Any character entered during the connect sequence will abort the connection attempt.

Hang-up (Disconnect)

Command:	H
Description:	Initiates a hang up sequence. This command may not be available for some countries due to PTT restrictions.
Default:	None

Defined Values:	H0	The modem will release the line if the modem is currently on-line. Country specific, modulation specific, and error correction protocol specific (S38) processing is handled outside of the H0 command.
	H1	If on-hook, the modem will go off-hook and enter command mode. For US models, the modem will remain off-hook. For global models, the modem will return on-hook after a period of time determined by S7.
Result Codes:	OK	
	Otherwise ERROR	

Return to Online Data Mode

Command:	O	
Description:	Determines how the modem will enter the online data mode. If in the online command mode, the modem enters the online data mode with or without a retrain. If in the off-line command mode (no connection), the modem reports ERROR.	
Default:	None	
Defined Values:	O0	Enters on-line data mode without a retrain.
		Handling is determined by the Call Establishment task. Generally, if a connection exists, this command connects the DTE back to the remote modem after an escape (+++).
	O1	Enters on-line data mode with a retrain before returning to on-line data mode.
	O2	Fast retrain without speed change (used for diagnostic purpose only).
	O3	Renegotiate rate without speed change (used for diagnostic purpose only.
	O4	Renegotiate rate down one speed (used for diagnostic purpose only).
	O5	Renegotiate rate up one speed (used for diagnostic purpose only).
Result Codes:	OK	
	Otherwise ERROR (or if not connected)	

Speaker Volume

Command:	L	
Description:	Sets the speaker volume control. The parameter value, if valid, is written to S22 bits 0 and 1. This command is implemented for compatibility. The SM-56 hardware does not support volume control.	
Default:	1	
Defined Values:	L0	Low volume.
	L1	Low volume. (Default.)
	L2	Medium volume.
	L3	High volume.
Result Codes:	OK	
	Otherwise ERROR	

Speaker Control

Command:	M	
Description:	Selects when the speaker will be on or off. The parameter value, if valid, is written to S22 bits 2 and 3.	
Default:	1	
Defined Values:	M0	Speaker is always off.
	M1	Speaker is on during call establishment, but off when receiving carrier. (Default.)
	M2	Speaker is always on.
	M3	Speaker is off when receiving carrier and during dialing, but on during answering.
Result Codes:	OK	
	Otherwise ERROR	

Select Guard Tone

Command:	&G
Description:	Causes the modem to generate the guard tone selected by this command (DPSK modulation modes only). The parameter value, if valid, is written to S23 bits 6 and 7.
	This command may not be permitted in some countries.
Default:	0
Defined Values:	&G0 Disables guard tone. (Default.)
	&G1 Disables guard tone.
	&G2 Selects 1800 Hz guard tone.
Result Codes:	<value> = 0 to 2
	Otherwise ERROR

Select Pulse Dial Make/Break Ratio

Command:	&P
Description:	Determines the make/break ratio used during pulse dialing. The default is country-dependent. The parameter value, if valid, is written to S28 bits 3 and 4.
Default:	0
Defined Values:	&P0 Selects 39%-61% make/break ratio at 10 pulses per second.
	&P1 Selects 33%-67% make/break ratio at 10 pulses per second.
	&P2 Selects 39%-61% make/break ratio at 20 pulses per second.
	&P3 Selects 33%-67% make/break ratio at 20 pulses per second.
Result Codes:	OK
	Otherwise ERROR

Display Current Configuration and Stored Profiles

Command:	&V
Alternate Command:	&V2
Description:	Reports the current (active) configuration, the stored (user) profiles, and the four stored telephone numbers. The &V2 command also includes SM-56 proprietary commands.
Result Code:	OK
Example:	AT&V
	ACTIVE PROFILE:
	B1 E1 L1 M1 N0 QO T V1 W0 X4 Y0 &C1 &D2 &G0 &J0 &K3 &Q5 &R1 &S0 &T5 &X0
	S00:000 S01:000 S02:043 S03:013 S04:010 S05:008 S06:002
	S07:050 S08:002 S09:006
	S10:014 S11:095 S12:050 S18:000 S25:005 S26:001 S36:007
	S38:020 S46:138
	S48:007 S95:000
	STORED PROFILE 0:
	B1 E1 L1 M1 N0 QO T V1 W0 X4 Y0 &C1 &D2 &G0 &J0 &K3 &Q5 &R1 &S0 &T5 &X0
	S00:000 S02:043 S06:002 S07:050 S08:002 S09:006 S10:014
	S11:095 S12:050 S18:000
	S36:007 S40:104 S41:195 S46:138 S95:000
	STORED PROFILE 1:
	B1 E1 L1 M1 N0 QO T V1 W0 X4 Y0 &C1 &D2 &G0 &J0 &K3 &Q5 &R1 &S0 &T5 &X0
	S00:000 S02:043 S06:002 S07:050 S08:002 S09:006 S10:014
	S11:095 S12:050 S18:000
	S36:007 S40:168 S41:195 S46:138 S95:000

TELEPHONE NUMBERS:
0 = 1 =
2 = 3 =
OK.

Display Last Connection Statistics

Command:	&V1
Description:	Displays the last connection statistics in the following format (shown with typical results):

TERMINATION REASON	LOCAL REQUEST
LAST TX rate	26400 BPS
HIGHEST TX rate	26400 BPS
LAST RX rate.	49333 BPS
HIGHEST RX rate	49333 BPS
PROTOCOL	LAPM
COMPRESSION	V42Bis
Line QUALITY	038
Rx LEVEL	015
Highest Rx State	67
Highest TX State	67
EQM Sum	00B4
Min Distance	0000
RBS Pattern	00
Rate Drop	00
Digital Loss	2000
Local Rtrn Count	00
Remote Rtrn Count	00
Flex 9481814347C4	

RBS Pattern: Shows which bits are being robbed in the least significant 6 bytes, e.g., 03 indicates 2 robbed bits in bit positions 0 and 1.

Digital Loss: Shows if a pad was encountered and if so, what was the digital loss. 2000 means 0dB.

Flex: Shows V.8bis information as follows:
  First byte: Octet 13 (second byte of manufacturer id, 94 = 56K)
  Second byte: Octet 14 (Licensee code: 81 = Conexant)
  Third byte: Octet 15 (manufacturer's product capabilities)
  Fourth byte: Octet 16 (56K version number)
  Fifth byte: Octet 17 (Conexant pump code version number)
  Sixth byte: Octet 18 (x-law and controller version number)

Bit 6   Forced/Not forced A-Law/μ-Law
       0 = Forced A-Law/μ-Law.
       1 = Not forced A-Law/μ-Law.
Bit 5   Select A-Law or μ-Law
       0 = Select A-Law.
       1 = Select μ-Law.
Bit 4:0 Controller version

Display Ethernet Status

Command: &V3

Description: Display Ethernet Status (shown with sample results):

```
--Network Status--
eth0      Link encap:Ethernet  HWaddr 00:06:3B:00:50:C1
          inet addr:192.168.0.11  Bcast:192.168.0.255 Mask:255.255.255.0
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:17047 errors:0 dropped:0 overruns:0 frame:0
          TX packets:9 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          Base address:0x840
```

Display DHCP Status

Command: &V4

Description: Display DHCP Status (shown with sample results):

```
--DHCP Info--
IPADDR=192.168.0.102
NETMASK=255.255.255.0
NETWORK=192.168.0.0
BROADCAST=192.168.0.255
GATEWAY=192.168.0.1
DNS=192.168.0.1
DHCPSID=192.168.0.1
DHCPGIADDR=0.0.0.0
DHCPSIADDR=192.168.0.1
DHCPCHADDR=00:06:3B:00:50:C1
DHCPSHADDR=00:02:B6:34:52:74
DHCPSNAME=
LEASETIME=86400
RENEWALTIME=43200
REBINDTIME=75600
```

Report Line Signal Level

Command: %L

Description: Returns a value, which indicates the received signal level. The value returned is a direct indication (DAA dependent) of the receive level at the MDP, not at the telephone line connector. For example, 009 = -9 dBm, 043 = -43 dBm, and so on.

Result Codes: OK

Report Line Signal Quality

Command: %Q

Description: Reports the line signal quality (DAA dependent). Returns the higher order byte of the EQM value. Based on the EQM value, retrain or fallback/fall forward may be initiated if enabled by %E1 or %E2.

Example: AT%Q

                                      015

Result Codes: OK   If connected.

                                ERROR   If not connected, or connected in 300 bps or V.23 modes.

Modulation Control Commands

Modulation Selection

Command: +MS

Description: This extended-format compound parameter controls the manner of operation of the modulation capabilities in the modem. It accepts six subparameters.

Syntax: +MS=[<carrier>[,<automode>[,<min_tx_rate>[,<max_tx_rate> [,<min_rx_rate> [,<max_rx_rate>]]]]]]

Where possible <carrier>, <min_tx_rate>, <max_tx_rate>, <min_rx_rate>, and <max_rx_rate> values are listed in Table 1-3.

Table 1-3. +MS Command Supported Rates

Modulation	<carrier>	Possible (<min_rx_rate>, <min_rx_rate>, (<min_tx_rate>), and <max_tx_rate>) Rates (bps)
Bell 103	B103	300
Bell 212	B212	1200 Rx/75 Tx or 75 Rx/1200 Tx
V.21	V21	300
V.22	V22	1200
V.22 bis	V22B	2400 or 1200
V.23	V23C	1200
V.32	V32	9600 or 4800
V.32 bis	V32B	14400, 12000, 9600, 7200, or 4800
V.34	V34	33600, 31200, 28800, 26400, 24000, 21600, 19200, 16800, 14400, 12000, 9600, 7200, 4800, or 2400
56K	K56	56000, 54000, 52000, 50000, 48000, 46000, 44000, 42000, 40000, 38000, 36000, 34000, 32000
V.90	V90	56000, 54667, 53333, 52000, 50667, 49333, 48000, 46667, 45333, 44000, 42667, 41333, 40000, 38667, 37333, 36000, 34667, 33333, 32000, 30667, 29333, 28000
V.92 downstream	V92	56000, 54667, 53333, 52000, 50667, 49333, 48000, 46667, 45333, 44000, 42667, 41333, 40000, 38667, 37333, 36000, 34667, 33333, 32000, 30667, 29333, 28000
V.92 upstream	V92	48000, 46667, 45333, 44000, 42667, 41333, 40000, 38667, 37333, 36000, 34667, 33333, 32000, 30667, 29333, 28000, 26667, 25333, 24000

Note: Some <carrier> values may not be supported by certain model models. For example, modem models supporting V92 may not support K56.

Defined Values:

<carrier> A string that specifies the preferred modem carrier to use in originating or answering a connection. <carrier> values are strings of up to eight characters, consisting only of numeric digits and upper case letters. <carrier> values for ITU standard modulations take the form: <letter><1-4 digits><other letters as needed>. Defined values are listed in Table 1-3.

<automode> A numeric value which enables or disables automatic modulation negotiation (ITU-T V.32*bis* Annex A or V.8).
0 = Automode disabled.
1 = Automode enabled. (Default.)

<min_rx_rate> and <max_rx_rate>
Numeric values which specify the lowest (<min_rx_rate>) and highest (<max_rx_rate>) rate at which the modem may establish a receive connection. May be used to condition distinct limits for the receive direction as distinct from the transmit direction. Values for this subparameter are decimal encoded, in units of bit/s. The possible values for each modulation are listed in Table 1-3. Actual values will be limited to possible values corresponding to the entered <carrier> and fall-back <carrier> as determined during operation. (Default = lowest (<min_rx_rate>) and highest (<max_rx_rate>) rate supported by the selected carrier.)

		<min_tx_rate> and <max_tx_rate>
		Numeric values which specify the lowest (<min_tx_rate>) and highest (<max_tx_rate>) rate at which the modem may establish a transmit connection. Non-zero values for this subparameter are decimal encoded, in units of bit/s. The possible values for each modulation are listed in Table 1-3.
		Actual values will be limited to possible values corresponding to the entered <carrier> and fall-back <carrier> as determined during operation. (Default = lowest (<min_tx_rate>) and highest (<max_tx_rate>) rate supported by the selected carrier.).
Report Commands:	+MS?	Reports current rates
		Response: +MS:<carrier>,<automode>,<min_tx_rate>, <max_tx_rate>, <min_rx_rate>,<max_rx_rate>
		Note: The current active settings are reported under control of the +MR parameter.
		Example: +MS: K56, 1,300,33600,300,56000
		For default values. This example allows maximum system flexibility to determine optimal receive and transmit rates during operation.
	+MS=?	Reports supported range of parameter values:
		Response: +MS: (< carrier> range),(<automode> range), (<min_tx_rate> range), (<max_tx_rate> range), (<min_rx_rate> range), (<max_rx_rate> range)
		Example 1: +MS: (B103,B212,V21,V22,V22B,V23C,V32,V32B,V34, K56,V90), (0,1),(300-33600),(300-33600),(300-56000),(300-56000)
		Example 2: +MS: (B103,B212,V21,V22,V22B,V23C,V32,V32B,V34, V90,V92), (0,1),(300-33600),(300-33600),(300-56000),(300-56000)
Result Code:		OK - Valid sub-parameter string
		Otherwise ERROR

Enable/Disable Data Compression

Command:	%C	
Description:	Enables or disables data compression negotiation. The modem can only perform data compression on an error-corrected link. The parameter value, if valid, is written to S41 bits 0 and 1.	
Defined Values:	%C0	Disables data compression. Resets S46 bit 1.
	%C1	Enables MNP 5 data compression negotiation. Resets S46 bit 1.
	%C2	Enables V.42 bis data compression. Sets S46 bit 1.
	%C3	Enables both V.42 bis and MNP 5 data compression. Sets S46 bit 1. (Default.)
Result Codes:	OK	
	ERROR	

Line Quality Monitor and Auto-Retrain

Command:	%E	
Description:	Controls whether or not the modem will automatically monitor the line quality and request a retrain (%E1) or fall back when line quality is insufficient or fall forward when line quality is sufficient (%E2). The parameter value, if valid, is written to S41 bits 2 and 6.	
	If enabled, the modem attempts to retrain for a maximum of 30 seconds.	

Fallback/Fall Forward. When %E2 is active, the modem monitors the line quality (EQM). When line quality is insufficient, the modem will initiate a rate renegotiation to a lower speed within the V.34/V.32 bis/V.32 (RC336) modulation speeds. The modem will keep falling back within the current modulation if necessary until the speed reaches 2400 bps (V.34) or 4800 bps (V.32). Below this rate, the modem will only do retrains if EQM thresholds are exceeded. If the EQM is sufficient for at least one minute, the modem will initiate a rate renegotiation to a higher speed within the current modulation speeds. The rate renegotiations will be done without a retrain if a V.32bis connection is established.

Speeds attempted during fallback/fall forward are those shown to be available in the rate sequences exchanged during the initial connection. Fallback/fall forward is available in error correction and normal modes, but not in direct mode or synchronous mode with external clocks.

Default:	2
Defined Values:	%E0 Disable line quality monitor and auto-retrain.
	%E1 Enable line quality monitor and auto-retrain.
	%E2 Enable line quality monitor and fallback/fall forward. (Default.)
Result Codes:	OK
	Otherwise ERROR

Select µ-Law or A-Law Codec Type

Command:	%U
Description:	Selects µ-Law or A-Law codec type for V.90 and 56K modulation.
	This command also stores the selected setting directly to NVRAM.
Default:	Default value is country specific
Defined Values:	0 Selects µ-Law.
	1 Selects A-Law.
Result Codes:	OK
	Otherwise ERROR

Communication Standard Setting – CCITT or Bell

Command:	B
Description:	When the modem is configured to allow either option, the modem will select Bell or CCITT modulation for a line speed connection of 300 or 1200 bps. Any other line speed will use a CCITT modulation standard. The parameter value, if valid, is written to S27 bit 6.
Default:	0
Defined Values:	B0 Selects CCITT operation at 300 or 1200 bps during Call Establishment and a subsequent connection. (Default.)
	B1 Selects BELL operation at 300 or 1200 bps during Call Establishment and a subsequent connection.
Result Codes:	OK
	Otherwise ERROR

Automode Enable

Command:	N
Description:	This command is implemented for compatibility and has no effect. Use the +MS command to control automode.
Default:	0
Defined Values:	N0
	N1
Result Codes:	OK
	Otherwise ERROR g

Connection Mode

Command:	&Q
Command:	&M
Description:	The &Q command is used to control the connection mode. It is used in conjunction with S36 and S48. The &M0 command is provided for compatibility and is equivalent to &Q0
Default:	5
Defined Values:	&Q0 Selects direct asynchronous operation. The value 000b is written to S27 bits 3, 1, and 0, respectively. Equivalent to &M0 command.
	&Q5 The modem will try to negotiate an error-corrected link. The modem can be configured using S36 to determine whether a failure will result in the modem returning on-hook or will result in fallback to another mode. The value 101b is written to S27 bits 3, 1, and 0, respectively. (Default.)
	&Q6 Selects asynchronous operation in normal mode (speed buffering). The value 110b is written to S27 bits 3, 1, and 0, respectively.
Result Codes:	OK
	Otherwise ERROR

Security Commands

Enable/Disable User Authentication

Command:	+A
Description:	Enables/disables user authentication for dial-in connections. When enabled, one or more users must be defined using the *+USER* command. Upon connection, the caller will be prompted for a user-name and password. The user is allowed three attempt to enter a valid user-name and password.
Default:	0
Defined Values:	+A0 Disables user authentication by writing the value 16 to S99 (Default.)
	+A1 Enables user authentication by writing the value 1 to S99.
Result Codes:	OK
	Otherwise ERROR

Enable/Disable Alert Action

Report Command:	+ALERT?
Set Command:	+ALERT=*n*
Description:	Enables/disables alert action. This command is intended for dial-in connections. When +ALERT is set to a nonzero value, the modem will count the number of consecutive failed authentication attempts. If this count exceeds the value of +ALERT, an alert action will take place. See +ALERTA command. an alert message will be displayed to the next valid user that successfully authenticates with the modem. This is intended to notify a valid user that an unauthorized user may be attempting a password attack on the modem.
Default:	0
Defined Values:	n=0 disables the alert message. Valid range is 0 to 255. The alert value is stored in S-Register 102
Result Codes:	OK
	Otherwise ERROR

Set Alert Action

Report Command:	+ALERTA?
Set Command:	+ALERTA=DIAL *number*
Description:	This command configures the action to take place if an alert condition occurs. See +ALERT command. If +ALERTA is set to a null string an alert message will be displayed to the next valid user that successfully authenticates with the modem. If +ALERTA is set to the action DIAL phone_number, the modem will dial the given phone number. This is intended to notify a valid user that an unauthorized user may be attempting a password attack on the modem.
Default:	null string
Defined Values:	null string – display alert message to next authenticated user.
	DIAL *number* – Dial the indicated phone number, such as a pager number.
Result Codes:	OK
	Otherwise ERROR

Set Dial-Back Message

Report Command:	+DBMSG?
Set Command:	+DBMSG=*string,*
Description:	Set the dial-back message. When a user is configured for dial-back, the message set by the +DBMSG command is displayed before the modem disconnects the call to perform the dial-back operation. The dial-back message string may be terminated by a comma character if another command is to follow on the command-line. The dial-back message is automatically stored in NVRAM and is not part of the profile.

Default:	null string
Defined Values:	The string may be 0 to 19 characters in length.
Result Codes:	OK
	Otherwise ERROR

Enable/Disable Encryption

Command:	+E
Description:	Enables/disables AES based authentication and encryption. When enabled, both modems will perform a cipher based authentication handshake to determine that each have the same key. After authentication, a session key is exchanged which will be used to encrypt all further communications. The session key is retained for the life of the connection. If multiple authentication schemes are enabled, the cipher based authentication will occur first. See the +K command for setting the encryption key.
Default:	0
Defined Values:	+E0 Disables user authentication by writing the value 16 to S98 (Default.)
	+E1 Enables user authentication by writing the value 1 to S98.
Result Codes:	OK
	Otherwise ERROR

Hide Encryption Key

Command:	+H
Description:	Enables/disables hiding of the encryption key. When enabled, the encryption key can not be displayed using the +K? Command, nor can it be read via the S-Registers. When hiding is disabled, the encryption key is set to all zeros. The state of the +H command is automatically stored in NVRAM and is not considered part of the profile.
Default:	0
Defined Values:	+H0 Disables key hiding and zeros the encryption key (Default.)
	+H1 Enables key hiding.
Result Codes:	OK
	Otherwise ERROR

Set Encryption Key

Report Command:	+K?
Set Command:	+K=key,
	+K!
Description:	Sets the AES-256 bit encryption key. The key is stored in S-Registers 112 through 143. The key may be optionally terminated with a comma character in the case the key is less that 64 characters and another AT command follows the key. See the +E and +H commands for enabling encryption and hiding the key. The +K! Command may be used to set a random key, then the key may be copied and pasted to the other modem.
Default:	0
Defined Values:	The key is entered as 0 to 64 hexadecimal (0-9, A-F) characters. If less than 64 characters are entered, the key is padded to the right with zeros.
Result Codes:	OK
	Otherwise ERROR

Display Activity Log

Command:	+LOG
Description:	Display the activity Log. The activity log contains the last 400 events pertaining to dial-in, dial-out, authentication, and connect time. The event log is cached in volatile RAM and flushed to non volatile flash memory no more than every 30 minutes in order to preserve flash memory life.
Result Codes:	OK

Clear Activity Log

Command:	+ZLOG
Description:	Clear the activity log.
Result Codes:	OK

Display Usage Statistics

Command:	+AUDIT
Description:	Display usage statistics. Usage statistics are cached in volatile RAM and flushed to non volatile flash memory no more than every 30 minutes in order to preserve flash memory life.
Result Codes:	OK

Clear Usage Statistics

Command:	+ZAUDIT
Description:	Zero all usage statistics.
Result Codes:	OK

Set Modem Name

Report Command:	+NAME?
Set Command:	+NAME=*name_str,*
Description:	Set a name or descriptive string that will be displayed when a remote user connects to the modem. The name is automatically saved in NVRAM and is not part of the profile.
Default:	Null string
Defined Values:	The name may be 0 to 19 characters in length. The comma character may be optionally used as a termination character.
Result Codes:	OK
	Otherwise ERROR

Protect S-Registers 96 – 255 from &F command

Command:	+P
Description:	Enable/disable protecting S-Registers 96 – 255 from the *&F* command. Many software packages automatically issue an &F command to set a modem to defaults. However, this may have the undesired effect of clearing security and Ethernet related settings. The state of the +P command is automatically stored to NVRAM and is not considered part of the profile.
Default:	0
Defined Values:	+P0 Do not protect S-Registers 96 – 255 (Default.)
	+P1 Protect S-Registers 96 – 255.
Result Codes:	OK
	Otherwise ERROR

Enable/Disable One-time Pass-code Authentication

Command: +PA

Description: Enables/disables one-time pass-code authentication for dial-in connections. When enabled, the modem will prompt for a one-time pass-code. The user must enter the correct pass-code before access is allowed. The user is allowed 3 chances to enter the correct pass-code otherwise the call is disconnected. Once a pass-code has been used, it is destroyed. See the +PCODE command for generating the pass-code list. When the pass-code list is empty, dial-in access will not be allowed until a new list is generated. Please note that the generated pass-codes are case sensitive.

Default: 0

Defined Values: +PA0 Disables pass-code authentication by writing the value 16 to S101 (Default.)

+PA1 Enables pass-code authentication by writing the value 1 to S101.

Result Codes: OK
Otherwise ERROR

Generate One-time Pass-code List

Command: +PCODE

Description: This command will generate and display 80 random pass-codes. The pass-code list is automatically stored to NVRAM and is not saved as part of a profile.

Default: N/A

Result Codes: OK

Set Remote ESC Password

Report Command: +RPASS?

Set Command: +RPASS=*password,*

Description: Set a remote escape password. If RPASS is set to a non-null string, a remote user will be required to enter the password before the modem will enter remote command mode. The remote escape password is automatically stored to NVRAM and is not saved as part of a profile.

Default: Null string

Defined Values: The password may be 0 to 29 characters in length. The comma character may be optionally used as a termination character.

Result Codes: OK
Otherwise ERROR

Enable/Disable Telnet Authentication

Command: +TA

Description: Enables/disables user authentication for telnet connections. When enabled, one or more users must be defined using the *+USER* command. Upon connection, the caller will be prompted for a user-name and password. The user is allowed three attempt to enter a valid user-name and password.

Default: 0

Defined Values: +TA0 Disables telnet authentication by writing the value 16 to S100 (Default.)

+TA1 Enables telnet authentication by writing the value 1 to S100.

Result Codes: OK
Otherwise ERROR

Set User

Report Command:	+USER?
Set Command:	+USER*n=name,password,action*
Description:	This command is used to configure remote users. It applies to both dial-in and Telnet users. The modem can store 10 distinct users, indexed from 0 to 9. The action field only applies to dial-in users. It specifies what operation to perform after the user has authenticated. USER0 is a special case. When no users are defined, the action defined for USER0 will be the default action for all dial-in connections. The user table is automatically stored to NVRAM and is not saved as part of a profile.
Defined Values:	+USER0 +USER1 … +USER9
Name:	The name may be 0 to 19 characters, terminated by the comma character. The name is case sensitive.
Password:	The password may be 0 to 19 characters, terminated by the comma character. The password is case sensitive.
Actions:	null string - modem to serial pass-through (default) telnet [*host* [*port*]] - initiate a telnet session dial *number* - *initiate dial-back*
Result Codes:	OK Otherwise ERROR

Ethernet Commands

Enable Ethernet Port

Command:	+N
Description:	Enable/Disable the 10/100 Ethernet Port. The state of the Ethernet port is stored in S-Register 96.
Default:	1
Defined Values:	+N0 Disable the Ethernet port.
	+N1 Enable the Ethernet port (default.)
Result Codes:	OK
	Otherwise ERROR

Set IP Address

Report Command:	+IP?
Set Command:	+IP=*ip_addr*
Description:	Set the Ethernet port IP address. The IP address is stored in S-Registers 176 through 179. If the IP address is set to 0.0.0.0, the modem will attempt to obtain an IP address, subnet mask, and default gateway using DHCP.
Default:	192.168.0.11
Result Codes:	OK
	Otherwise ERROR

Set Subnet Mask

Report Command:	+SM?
Set Command:	+SM=*mask*
Description:	Set the IP address subnet mask. The subnet mask is stored in S-Registers 180 through 184. If the IP address is set to 0.0.0.0, the modem will used DHCP to obtain the subnet mask.
Default:	255.255.255.0
Result Codes:	OK
	Otherwise ERROR

Set Gateway Address

Report Command:	+GW?
Set Command:	+GW=*gw_addr*
Description:	Set the default gateway address. The GW address is stored in S-Registers 184 through 187. If the IP address is set to 0.0.0.0, the modem will use DHCP to obtain the GW address.
Default:	0.0.0.0
Result Codes:	OK
	Otherwise ERROR

Set DNS Address

Report Command:	+DNS?
Set Command:	+DNS=*dns_addr*
Description:	Set the IP address of the DNS server. The DNS address is stored in S-Registers 188 through 191. If a DNS server is specified, host names may be used within telnet.
Default:	0.0.0.0
Result Codes:	OK
	Otherwise ERROR

Ping host

Command:	+PING=*host*
Description:	Sends a ping request to the given host. The host is specified as an IP address or, if a DNS server is configured, as a host name.
Default:	N/A
Result Codes:	OK
	Otherwise ERROR

Set Telnet Port

Report Command:	+TP?
Set Command:	+TP=*port_num*
Description:	Set the Telnet server port. The telnet port is stored in S-Registers 192 and 193. Setting the Telnet server port to 0 will disable the Telnet server.
Default:	23
Result Codes:	OK
	Otherwise ERROR

Maintenance Commands

Firmware Upload

Command: +RX

Description: This command is used to upgrade the modem's firmware. Issuing the +RX command initiates a Xmodem file receive. A firmware image may then be uploaded to the modem by using the Xmodem file transfer feature found in most terminal emulation applications. Only use a firmware image obtained from DCB. Also, if key hiding is enabled with the +H1 command, the encryption key will be erased before the new firmware is loaded. This is to protected against using modified firmware to steal key values.

Default: N/A

Result Codes: N/A

S-Registers

Certain modem values, or parameters, are stored in memory locations called S-registers. Use the **S** command to read or to alter the contents of S-registers (see previous section). Register value may be stored on one of two user profiles with the command **&W**.

Register	Unit	Range	Default	Description
S0	1 *ring*	0–255	0	**Number of Rings to Auto-Answer:** Sets the number of rings until the modem answers. ATS0=0 disables autoanswer completely.
S1	1 ring	0–255	0	**Ring Counter:** Counts the rings that have occurred. S1 is cleared if no rings occur over eight-second intervals.
S2	decimal	0–255	43 (+)	**Escape Character:** Holds the decimal value of the ASCII character used as the escape character. The default value corresponds to an ASCII '+'. A value over 127 disables the escape process; e.g., no escape character will be recognized.
S3	decimal	0–127	13 (^M)	**Carriage Return Character:** Sets the command line and result code terminator character. Pertains to asynchronous operation only.
S4	decimal	0–127	10 (^J)	**Line Feed Character:** Sets the character recognized as a line feed. Pertains to asynchronous operation only. The Line Feed control character is output after the Carriage Return Control character if verbose result codes are used.
S5	decimal	0–255	8 (^H)	**Backspace Character :** Sets the character recognized as a backspace. Pertains to asynchronous operation only. The modem will not recognize the Backspace character if it is set to a value that is greater than 32 ASCII. This character can be used to edit a command line. When the echo command is enabled, the modem echoes back to the local DTE the Backspace character, an ASCII space character and a second Backspace character; this means a total of three characters are transmitted each time the modem processes the Backspace character.
S6	seconds	2–255	2	**Wait Time Before Blind Dialing or for Dial Tone:** 1. Sets the length of time, in seconds, that the modem will wait before starting to dial after going off-hook when blind dialing. This operation, however, may be affected by some ATX options according to country restrictions. The "Wait for Dial Tone" call progress feature (W dial modifier in the dial string) will override the value in register S6. (When configured for US). 2. Sets the length of time, in seconds, that the modem will wait for dial tone when encountering a "W" dial modifier before returning NO DIAL TONE result code. (W class). Default is country-dependent. The modem always pauses for a minimum of 2 seconds, even if the value of S6 is less than 2 seconds.
S7	seconds	1–255*	50	**Wait Time for Carrier, Silence, or Dial Tone:** 1. Sets the length of time, in seconds, that the modem will wait for carrier before hanging up. The timer is started when the modem finishes dialing (originate), or 2 seconds after going off-hook (answer). In originate mode, the timer is reset upon detection of answer tone if allowed by country restrictions. 2. Sets the length of time, in seconds, that modem will wait for silence when encountering the @ dial modifier before continuing with the next dial string parameter. 3. Sets the length of time, in seconds, that the modem will wait for dial tone when encountering a "W" dial modifier before continuing with the next dial string parameter. (US model.) The default is country dependent.

Register	Unit	Range	Default	Description
S8	seconds	2–255	2	**Pause Time for Dial Delay**: Sets the time, in seconds, that the modem must pause when the "," dial modifier is encountered in the dial string.

S9	0.1 s	1–255	6	**Carrier Detect Response Time:** Supported for backward compatibility only. No value can be written. Responds with default value.
S10	0.1 s	1–255	14	**Lost Carrier to Hang Up Delay:** Sets the length of time, in tenths of a second that the modem waits before hanging up after a loss of carrier. This allows for a temporary carrier loss without causing the local modem to disconnect. When register S10 is set to 255, the modem functions as if a carrier is always present.
				The actual interval the modem waits before disconnecting is the value in register S10 minus the value in register S9. Therefore, the S10 value must be greater than the S9 value or else the modem disconnects before it recognizes the carrier.
				Note: For Call Waiting detection, if the modem is set to US country code and S10 >=16, then the modem will detect the Call Waiting tone and hang-up the line. If S10 <16, the modem will not detect Call Waiting tone.
S11	0.001 s	50–255	95	**DTMF Tone Duration:** 1. For US models, S11 sets the duration of tones in DTMF dialing (has no effect on pulse dialing). 2. For W-class models, S11 is a country parameter. The default is country dependent.
S12	0.02 s	0–255	50	**Escape Prompt Delay (EPD):** Defines the maximum period, in fiftieths of a second, allowed between receipt of the last character of the three escape character sequence from the DTE and sending of the OK result code to the DTE. If any characters are detected during this time, the OK will not be sent. Sending of the OK result code does not affect entry into command mode.
S14			138 (8Ah)	**General Bit-Mapped Options Status:** Indicates the status of command options.

S14 bit definitions:

Bit 0   This bit is ignored.
Bit 1   Command echo (En)
    0 =   Disabled (E0)
    1 =   Enabled (E1) (Default.)
Bit 2   Quiet mode (Qn)
    0 =   Send result codes (Q0) (Default.)
    1 =   Do not send result codes (Q1)
Bit 3   Result codes (Vn)
    0 =   Numeric (V0)
    1 =   Verbose (V1) (Default.)
Bit 4   Reserved
Bit 5   Tone (T)/Pulse (P)
    0 =   Tone (T) (Default.)
    1 =   Pulse (P)
Bit 6   Reserved
Bit 7   Originate/Answer
    0 =   Answer
    1 =   Originate (Default.)

| S16 | | | 0 | **Test Mode Bit-Mapped Options Status:** Indicates the test in progress status. |

S16 bit definitions:

Bit 0   Local analog loopback
    0 =   Disabled (Default.)
    1 =   Enabled (&T1)
Bits 1-7   Not used

S19 and S20   **Reserved**

Register	Unit	Range	Default	Description
S21			52 (34h)	**V.24/General Bit-Mapped Options Status:** Indicates the status of command options.

				Bits 0 - 1 Reserved (0)
				Bit 2 CTS behavior (&Rn)
				0 = CTS tracks RTS (&R0)
				1 = CTS always on (&R1) (Default.)
				Bits 3-4 DTR behavior (&Dn)
				0 = &D0 selected
				1 = &D1 selected
				2 = &D2 selected (Default.)
				3 = &D3 selected
				Bit 5 RLSD (DCD) behavior (&Cn)
				0 = &C0 selected
				1 = &C1 selected (Default.)
				Bit 6 DSR behavior (&Sn)
				0 = &S0 selected (Default.)
				1 = &S1 selected
				Bit 7 Long space disconnect (Yn)
				0 = Y0 (Default.)
				1 = Y1

S22			117 (75h)	**Speaker/Results Bit-Mapped Options Status:** Indicates the status of command options.
				Default: 117 (75h) (01110101b)
				Bits 0-1 Speaker volume (Ln)
				0 = Off (L0)
				1 = Low (L1) (Default.)
				2 = Medium (L2)
				3 = High (L3)
				Bits 2-3 Speaker control (Mn)
				0 = Disabled (M0)
				1 = Off on carrier (M1) (Default.)
				2 = Always on (M2)
				3 = On during handshake (M3)
				Bits 4-6 Limit result codes (Xn)
				0 = X0
				4 = X1
				5 = X2
				6 = X3
				7 = X4 (Default.)
				Bit 7 Reserved

S23			0	**General Bit-Mapped Options Status:** Indicates the status of command options.
				Bits 0-6 Not used
				Bits 6-7 Guard tone (&Gn)
				0 = None (&G0) (Default.)
				1 = None (&G1)
				2 = 1800 Hz (&G2)

S24	seconds	0–255	0	**Sleep Inactivity Timer:** Sets the length of time, in seconds, that the modem will operate in normal mode with no detected telephone line or DTE line activity before entering low-power sleep mode. The timer is reset upon any DTE line or telephone line activity. If the S24 value is zero, neither DTE line nor telephone inactivity will cause the modem to enter the sleep mode.
S25	0.01 s	0–255	5	**Delay to DTR OFF:** Sets the length of time that the modem will ignore DTR for taking the action specified by &Dn. Its units are seconds for synchronous modes and one hundredths of a second for other modes.
S26				*Reserved*

Register	Unit	Range	Default	Description

S27 — 73 (49Ah) — **General Bit-Mapped Options Status:** Indicates the status of command options.

Default: 73 (49h) (01001001b)

Bits 0, 1, 3 — Synchronous/asynchronous selection (&Mn/&Qn)

3 1 0	
0 0 0	&M0 or &Q0
0 0 1	&M1 or &Q1
0 1 0	&M2 or &Q2
0 1 1	&M3 or &Q3
1 0 0	Reserved
1 0 1	&Q5 (Default.)
1 1 0	&Q6

Bit 2 — Leased line control (&Ln)
 0 = Dial up line (&L0) (Default.)

Bits 4 - 5 — Internal clock select (&Xn)
 0 = Internal clock (&X0) (Default.)
 1 = External clock (&X1)
 2 = Slave clock (&X2)

Bit 6 — CCITT/Bell mode select (Bn)
 0 = CCITT mode (B0)
 1 = Bell mode (B1) (Default.)

Bit 7 - Reserved

S28 — 0 — **General Bit-Mapped Options Status:** Indicates bit mapped options status.

Default: 0

Bits 0 - 1 — Reserved

Bit 2 — Reserved (always 0).

Bits 3 - 4 — Pulse dialing (&Pn)
 0 = 39%-61% make/break ratio at 10 pulses per second (&P0)
 1 = 33%-67% make/break ratio at 10 pulses per second (&P1)
 2 = 39%-61% make/break ratio at 20 pulses per second (&P2)
 3 = 33%-67% make/break ratio at 20 pulses per second (&P3)

Bit 5-7 — Reserved

S29 — 10 ms — 0–255 — 70 — **Flash Dial Modifier Timer:** Sets the length of time, in units of 10 ms, that the modem will go on-hook when it encounters the flash (!) dial modifier in the dial string. S29 is a country dependent parameter. The S29 value cannot be changed using S29=XX. Default: 70 (700 ms) for U.S.

S30 — 10 s — 0–255 — 0 — **Disconnect Inactivity Timer:** Sets the length of time, in tens of seconds, that the modem will stay online before disconnecting when no data is sent or received. In error-correction mode, any data transmitted or received will reset the timer. In other modes, any data transmitted will reset the timer. The timer is inoperative in synchronous mode.

S31 — 192 (C0h) — **General Bit-Mapped Options Status:** Indicates bit mapped options status.

Default: 192 (C0h) (11000000b)

Bit 0 — Single line connect message enable/disable (\Vn)
 0 = Messages controlled by S95, Wn and Vn (\V0) (Default.)
 1 = Single line connect message (\V1)

Bit 1 — Reserved (0)

Bits 2-3 — Error correction progress messages (Wn)
 0 = DTE speed only (W0) (Default.)
 1 = Full reporting (W1)
 2 = DCE (line) speed only (W2)

Bits 4-7 — Reserved

Register	Unit	Range	Default	Description

S36			7	**LAPM Failure Control:** This value indicates what should happen upon a LAPM failure. These fallback options are initiated immediately upon connection if S48=128. If an invalid number is entered, the number is accepted into the register, but S36 will act as if the default value has been entered.

Default: 7 (00000111b)
Bits 0-2
0 = Modem disconnects.
1 = Modem stays on-line and a Direct mode connection is established.
2 = Reserved.
3 = Modem stays on-line and a Normal mode connection is established.
4 = An MNP connection is attempted and if it fails, the modem disconnects.
5 = An MNP connection is attempted and if it fails, a Direct mode connection is established.
6 = Reserved.
7 = An MNP connection is attempted and if it fails, a Normal mode connection is established. (Default.)
Bits 3-7   Reserved

S38	seconds	0–255	20	**Delay Before Forced Hang Up:** Specifies the delay between the modem's receipt of the H command to disconnect (or ON-to-OFF transition of DTR if the modem is programmed to follow the signal), and the disconnect operation. Applicable to error-correction connection only. This parameter can be used to ensure that data in the modem buffer is sent before the modem disconnects.

If S38 is set to a value between 0 and 254, the modem will wait that number of seconds for the remote modem to acknowledge all data in the modem buffer before disconnecting. If time expires before all data is sent, the NO CARRIER result code will be issued to indicate that data has been lost. If all data is transmitted prior to time-out, the response to the H0 command will be OK.
If S38 is set to 255, the modem does not time-out and continues to attempt to deliver data in the buffer until the connection is lost or the data is delivered.

S39			3	**Flow Control Bit-Mapped Options Status.**

Default: 3 (00000011b)
Bits 0-2   Status of command options
            0 =   No flow control
            3 =   RTS/CTS (&K3) (Default.)
            4 =   XON/XOFF (&K4)
            5 =   Transparent XON (&K5)
            6 =   Both methods (&K6)
Bits 3-7   Reserved

S40			104 (68h)	**General Bit-Mapped Options Status.** Indicates the status of command options.

Default: 104 (68h) (01101000b)
Bits 0-1   MNP Extended Services (-Kn)
            0 =   Disable extended services (-K0) (Default.)
            1 =   Enable extended services (-K1)
            2 =   Enable extended services (-K2)
Bit 2   Reserved
Bits 3-7   Reserved*

Register	Unit	Range	Default	Description
S41			195 (C3h)	**General Bit-Mapped Options Status.** Indicates the status of command options.

S41 (continued):

Default: 13 (C3h) (00001101b)

Bits 0 -1   Compression selection (%Cn)

0 =   Disabled (%C0)
1 =   MNP 5 (%C1)
2 =   V.42 bis (%C2)
3 =   MNP 5 and V.42 bis (%C3) (Default.)

Bits 2, 6   Auto retrain and fallback/fall forward (%En)

Bit 6	Bit 2	Meaning
0	0	Retrain and fallback/fall forward disabled (%E0)
0	1	Retrain enabled (%E1)
1	0	Fallback/fall forward enabled (%E2) (Default.)

Bit 3   Reserved

Bits 4-5 Reserved

Bit 7   Reserved

Register	Unit	Range	Default	Description
S46			138	**Data Compression Control.** Controls selection of compression.

The following actions are executed for the given values:

S46=136 Execute error correction protocol with no compression.

S46=138 Execute error correction protocol with compression. (Default.)

Register	Unit	Range	Default	Description
S48			7	**V.42 Negotiation Control.** Negotiation process determines the capabilities of the remote modem. However, when the capabilities of the remote modem are known and negotiation is unnecessary, this process can be bypassed if so desired.

Range: 0, 7, or 128 If an invalid number is entered, it is accepted into the S-Parameter, but S48 will act as if 128 has been entered.

S48=0 Disable negotiation; bypass the detection and negotiation phases; and proceed with LAPM.

S48=7 Enable negotiation. (Default.)

S48=128 Disable negotiation; bypass the detection and negotiation phases; and proceed at once with the fallback action specified in S36. Can be used to force MNP.

Register	*Unit*	*Range*	*Default*	*Description*
S86		0–26	21	**Call Failure Indication.** When the modem issues a NO CARRIER result code, a value is written to S86 Register to help determine the reason for the failed connection. S86 records the first event that contributes to a NO CARRIER message. The code definitions are:

S86=0   Normal hangup, no error occurred.
S86=1   Reserved.
S86=2   Reserved.
S86=3   Call Waiting caused disconnect.
S86=4   Physical carrier loss.
S86=5   No error correction at the other end.
S86=6   No response to feature negotiation.
S86=7   This modem is async only; the other modem is sync only.
S86=8   No framing technique in common.
S86=9   No protocol in common.
S86=10   Bad response to feature negotiation.
S86=11   No sync information from the remote modem.
S86=12   Normal hangup initiated by the remote modem.
S86=13   Retransmission limit reached.
S86=14   Protocol violation occurred.
S86=15   Lost DTR.
S86=16   Received GSTN cleardown.
S86=17   Inactivity timeout.
S86=18   Speed not supported.
S86=19   Long space disconnect.
S86=20   Key abort disconnect.
S86=21   Clears previous disconnect reason.
S86=22   No connection established.
S86=23   Disconnect after three retrains.
S86=24   Call Waiting tone detected.
S86=25   Extension pickup detected.
S86=26   Remote hangup detected.

Register	*Unit*	*Range*	*Default*	*Description*
S91	dBm	0–15	10	**PSTN Transmit Attenuation Level.** In non-PCM modes (V.90 or K56flex are PCM modes), S91 sets the transmit attenuation level from 0 to 15 dBm for the PSTN mode, resulting in a transmit level from 0 to -15 dBm. In some countries, the transmit level may not be changed and there are checks to prevent transmit attenuation level change. The default is country dependent.
S95			0	**Extended Result Codes Control.** A bit set to a 1 in this parameter, in conjunction with the W command, will enable the corresponding extended result code. *

The +MR, +ER, and +DR settings also control S95 bits 2, 3, and 5, respectively. The more recent settings of +MR, +ER, and +DR, or host writing of S95 bits 2, 3, and 5, along with the W command setting, determine the corresponding actual result code reporting (see +MR, +ER, DR, and W commands).

Bit 0   CONNECT result code indicates DCE speed instead of DTE speed.
Bit 1   Append/ARQ to CONNECT XXXX result code in error-correction mode (XXXX = rate).
Bit 2   Enable +MCR: XXXX result code (XXXX = modulation) and +MRR: XXXX result code (XXXX = rate). (Also, see +MR.)
Bit 3   Enable +ER: XXXX result code (XXXX = protocol identifier).
Bit 4   Reserved.
Bit 5   Enable +DR: XXXX result code (XXXX = compression type).
Bits 6-7 Reserved.

Register	*Unit*	*Range*	*Default*	*Description*
S98	decimal	0-255	16	**Encryption Enable.** A value of 16 indicates encryption is disabled. Any other value indicates encryption is enabled. The +E command sets this register.

Register	Unit	Range	Default	Description
S99	decimal	0-255	16	**Dial-in User Authentication Enable.** A value of 16 indicates user authentication for dial-in connections is disabled. All other values indicate user authentication is enabled. The +A command sets this register. See the +USER command for configuring user names and passwords.
S100	decimal	0-255	16	**Telnet User Authentication Enable.** A value of 16 indicates user authentication for Telnet connections is disabled. All other values indicate it is enabled. The +TA command sets this register. See the +USER command for configuring user names and passwords.
S101	decimal	0-255	16	**One-time Pass-code Authentication Enable.** A value of 16 indicates one-time pass-code authentication for dial-in connections is disabled. All other values indicate it is enabled. The +PA command sets this register. See the +PCODES command for generating the pass-codes.
S102	decimal	0-255	0	**Alert Enable.** A value of 0 in this register disables the Alert feature. Otherwise, the non-zero value sets the alert threshold (x). If the modem receives (x) back-to-back failed authentication attempts, The modem will take the defined action to notify of a possible access attack. See the +ALERT command.
S104	decimal	0–255	45(1)	**Remote Escape Character:** Holds the decimal value of the ASCII character used as the remote escape character. The default value corresponds to an ASCII '-'. A value over 127 disables the remote escape process; e.g., no escape character will be recognized.
S105	0.02 s	0–255	50	**Remote Escape Prompt Delay:** Defines the maximum period, in fiftieths of a second, allowed between receipt of the last character of the three escape character sequence and sending of the Remote: OK result code. If any characters are detected during this time, the OK will not be sent and the modem will not enter remote command mode.
S112 - S143	hexadecimal		0	**AES 256-Bit Master Encryption Key.** These 32 registers contain the 256-bit AES Master Encryption Key. This key is used when encryption is enabled, and must match exactly the key configured in the remote modem. The +K command is used to set the key. See the +E command for enabling encryption. Display of the these s-registers can be disabled using the +H1 command.

Result Codes

In command mode your modem can send responses called *result codes* to your computer. Result codes are used by communications programs and can also appear on your monitor.

Short Form	Long Form
0	OK
1	CONNECT
2	RING
3	NO CARRIER
4	ERROR
5	CONNECT1200
6	NO DIAL TONE
7	BUSY
8	NO ANSWER
9	CONNECT600
10	CONNECT 2400
11	CONNECT 4800
12	CONNECT 9600
13	CONNECT 7200
14	CONNECT 12000
15	CONNECT 14400
16	CONNECT 19200
17	CONNECT 38400
18	CONNECT 57600
19	CONNECT 115200
20	CONNECT 230400
22	CONNECT 75TX/1200RX
23	CONNECT 1200TX/75RX
24	DELAYED
32	BLACKLISTED
33	FAX
35	DATA
40	+MRR: 300
44	+MRR: 1200/75
45	+MRR: 75/1200
46	+MRR: 1200
47	+MRR: 2400
48	+MRR: 4800
49	+MRR: 7200
50	+MRR: 9600
51	+MRR: 12000
52	+MRR: 14400
53	+MRR: 16800
54	+MRR: 19200
55	+MRR: 21600

Short Form	Long Form
56	+MRR: 24000
57	+MRR: 26400
58	+MRR: 28800
59	CONNECT 16800
60	CONNECT 21600
62	CONNECT 24000
63	CONNECT 26400
64	CONNECT 28800
66	+DR: A LT
67	+DR: V 42B
69	+DR: N ONE
70	+ER: N ONE
77	+ER: L APM
78	+MRR: 31200
79	+MRR: 33600
80	+ER: A LT
81	+ER: A LT-CELLULAR
83	LINE-IN-USE
84	CONNECT 33600
91	CONNECT 31200
134	+MCR: B 103
135	+MCR: B 212
136	+MCR: V 21
137	+MCR: V 22
138	+MCR: V 22B
139	+MCR: V 23
140	+MCR: V 32
141	+MCR: V 32B
142	+MCR: V 34
144	+MCR: K 56
145	+MCR: V 90
150	+MRR: 32000
151	+MRR: 34000
152	+MRR: 36000
153	MRR: 38000
154	+MRR: 40000
155	+MRR: 42000
156	+MRR: 44000
157	+MRR: 46000
158	+MRR: 48000
159	+MRR: 50000
160	+MRR: 52000
161	+MRR: 54000
162	+MRR: 56000
165	CONNECT 32000
166	CONNECT 34000
167	CONNECT 36000

Short Form	Long Form
168	CONNECT 38000
169	CONNECT 40000
170	CONNECT 42000
171	CONNECT 44000
172	CONNECT 46000
173	CONNECT 48000
174	CONNECT 50000
175	CONNECT 52000
176	CONNECT 54000
177	CONNECT 56000
178	CONNECT 230400
180	CONNECT 28000
181	CONNECT 29333
182	CONNECT 30667
183	CONNECT 33333
184	CONNECT 34667
185	CONNECT 37333
186	CONNECT 38667
187	CONNECT 41333
188	CONNECT 42667
189	CONNECT 45333
190	CONNECT 46667
191	CONNECT 49333
192	CONNECT 50667
193	CONNECT 53333
194	CONNECT 54667
195	+MRR: 28000
196	+MRR: 29333
197	+MRR: 30667
198	+MRR: 33333
199	+MRR: 34667
200	+MRR: 37333
201	+MRR: 38667
202	+MRR: 41333
203	+MRR: 42667
204	+MRR: 45333
205	+MRR: 46667
206	+MRR: 49333
207	+MRR: 50667
208	+MRR: 53333
209	+MRR: 54667

Warranty and Repair

This DCB product is warranted to be free of defects in materials and workmanship for two years. Data Comm for Business, Inc. will repair or replace any equipment proven to be defective within the warranty period. All warranty work is F.O.B. Champaign, IL. This warranty is exclusive of abuse, misuse, accidental damage, acts of God or consequential damages, etc. DCB liability shall not exceed the original purchase price.

All equipment returned for repair must be accompanied by a Returned Material Authorization (RMA) number. To receive an RMA number, call (217) 897-6600 between the hours of 8 AM and 5 PM central time. Equipment must be shipped prepaid to DCB and will be returned at DCB's expense.

Ship returned items to:

Data Comm for Business
2949 County Road 1000E
Dewey, IL 61840
Attn: RMA number

Data Comm for Business, Inc.
PO Box 6329
Champaign, IL 61826-6329

Tel   (217) 897-6600
Fax   (217) 897-1331