

V.34 Multi-Port Security Modems



QUALITY COMMUNICATIONS PRODUCTS
Made in the U.S.A.

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TABLE OF CONTENTS

SUBJECT	PAGE
INTRODUCTION	2
FRONT PANEL LIGHTS	2
BACK PANEL CONNECTORS	2
QUICK START GUIDELINES	4
DIALING INTO A MULTI-PORT MODEM	4
Logging In	5
Selecting a Port and Entering Data Mode	5
Returning From Data Mode to Command Mode	6
Setting the State of a Relay	6
Reviewing the Status of Ports and Relays	6
Logging Out and Disconnecting	6
SECURITY METHODS	7
Timekeeping Commands	7
Security Methods Configuration Command	8
Password Maintenance Commands	8
Caller ID Maintenance Commands	9
Audit Trail Maintenance Commands	9
REMOTE CONFIGURATION	10
SETTING PORT PARAMETERS	10
AT COMMAND SET	11
AT Commands	12
AT& Commands	16
AT% Commands	19
AT\ Commands	19
AT+ Commands	21
MNP 10 Commands	22
AT COMMAND RESULT CODES	23
S REGISTERS	24
S REGISTER SUMMARY	24
S REGISTER DEFINITIONS	26
CERTIFICATIONS	36

INTRODUCTION

This manual covers configuration and operation of all V.34 multi-port security modems. While a variety of models are available with a range of port and relay configurations, all units offer the following unique feature set:

- Multiple RS-232 ports provide access to numerous devices through one telephone connection.
- Each RS-232 port maintains unique speed, character format and flow control characteristics.
- One RS-232 port may be configured for synchronous auto-dial backup of leased facilities.
- Multiple relays provide reset and power cycle capabilities.
- Patented, multi-level security features provide password and caller ID protection for your dialup connection.
- Access masks may be defined to limit user access to specific ports and relays.
- Precision timekeeping and audit trail capabilities provide a complete history of all successful and unsuccessful access attempts.
- Windows 95/NT management software provides centralized control of security features and automated data collection facilities for audit trail information.

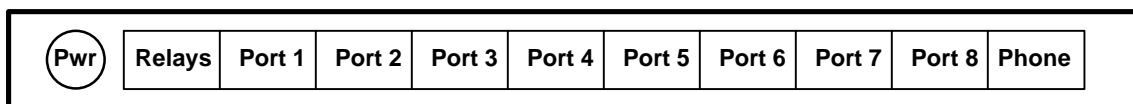
FRONT PANEL LIGHTS

MR Modem Ready
TR Terminal Ready
SD Send Data

RD Receive Data
OH Off Hook
CD Carrier Detect

BACK PANEL CONNECTORS

The following diagram presents the back panel connector layout for all multi-port modems:

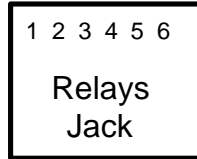


PWR

The standard power supply for all multi-port modems will accept either 9vac or 9 – 14vdc and is not polarity sensitive. Maximum current requirements for 8 port models, with both relays energized, is 314ma at 12vdc. Maximum current requirements for 4 port models, with its single relay energized, is 285ma at 12vdc. **CAUTION:** Several DC power options are available for special applications. Modems equipped with special DC power options will be polarity sensitive and will be shipped with power specifications that supersede the specifications of this paragraph. However, the center pin of the power connector will always be positive (+) on all polarity sensitive supplies.

RELAYS

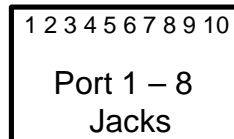
Eight port and two port models provide two single pole double throw relays for controlling external equipment. Four port and single models offer a single relay of the same type. Relays are rated for a maximum current of 1 ampere at 48vdc. The relay connector provides access to the relay contacts through a standard six pin modular plug. The following diagram defines the pins of the relay connector as you look into it from the back of the unit.



PIN#	SIGNAL DESCRIPTION
1	Relay 1 common
2	Relay 1 normally closed
3	Relay 1 normally open
4	Relay 2 common
5	Relay 2 normally closed
6	Relay 2 normally open

NOTE: Relay 2 is not available on 1 and 4 port models

PORT 1 – 8 Eight port models provide eight RS-232 connections, four port models provide four connections (ports 1 – 4), two port models provide two connections (ports 1-2) and single port models provide only port 1. Each port connector provides access to RS-232 signals through a standard ten pin modular plug. All ports may be used for communications with asynchronous equipment. In addition, port 1 provides clock signals and offers special configuration options so that synchronous dial backup operations may be initiated through it. The following diagram defines the pins of the port connectors as you look into them from the back of the unit.



PIN #	SIGNAL DESCRIPTION	SOURCE	NOTES
1	Carrier Detect	DCE	(CD light on front panel)
2	Data Terminal Ready	DTE	(TR light on front panel)
3	Data Set Ready	DCE	(MR light on front panel)
4	Clear To Send	DCE	
5	Request To Send	DTE	
6	Receive Data	DCE	(RD light on front panel)
7	Transmit Data	DTE	(SD light on front panel)
8	DCE Receive Clock	DCE	(Port 1 only)
9	DCE Transmit Clock	DCE	(Port 1 only)
10	Signal Ground	DTE/DCE	

PHONE This RJ-11 connector provides a standard connection between the modem and a normal dial telephone circuit.

QUICK START GUIDELINES

While StarComm multi-port security modems offer a wide variety of configuration options, only a few steps are actually necessary to establish a basic configuration. This section presents those steps and references sections of this manual that will provide detailed guidance on each topic. Once these steps have been completed, we suggest that you proceed to the next section of this manual (Dialing Into a Multi-Port Modem) and familiarize yourself with online operation of StarComm multi-port modems. You may enter initial configuration commands by dialing into the modem with the default password of **starcomm** or by connecting a PC or terminal to port 1, which is always enabled when a call is not in progress. If you choose to configure through port 1, please review the default port parameters, which are shown in paragraph 5 of this section. You may wish to override these settings with an AT&F command so that autobaud, echo and result codes are enabled during your configuration session.

1. **Set Time and Date** - See the AT\T Command in the section of this manual titled Security Methods.
2. **Enable or Disable Security Methods** – In order to meet specific requirements, you may disable or enable any or all of the security methods provided in the multi-port security modem. All units are shipped with password protection enabled, password prompt enabled and caller ID protection disabled. If this default is acceptable, you may enter initial passwords into the security database and proceed. For more detail see the section of this manual titled Security Methods.
3. **Enable or Disable Remote Configuration** – See the AT\R command in the section of this manual titled Remote Configuration. All devices are shipped with remote configuration enabled.
4. **Set Port Parameters** – You must set the characteristics of each port to match those of the devices that you will be communicating with. Configuration is accomplished through an extended format of standard AT commands. For more detail, see the section of this manual titled Setting Port Parameters. The default configuration for all ports is as follows:

Bit Rate	-	Fixed at 9600bps	DTR Significance	-	Ignore DTR
Character Length	-	8 bit	Command Echo	-	Off
Parity	-	None	Result Codes	-	Off
Flow Control	-	Disabled			

DIALING INTO A MULT-PORT MODEM

This section will describe the remote access interface of StarComm multi-port modems. It will also describe all commands necessary for controlling a remote access session and for gaining access to the ports and relays of the multi-port modem. The remote access interface is controlled by a unique class of AT commands that begin with a period. Each of these new commands is defined in this section.

The remote access interface of all StarComm multi-port modems operates on three unique levels that are defined within the security methods of the multi-port modem:

- Level 1 – Level 1 allows access to ports and relays of the modem. A caller may be restricted to specific ports and relays through an access mask that is associated with a password or caller ID.
- Level 2 – This level allows access to ports and relays of the modem and also allows the caller to issue any valid AT command. Therefore, a level 2 user may reconfigure the modem, modify the security database and review the modem's audit trail.

- Level 3 – This level of access is reserved for use by StarComm’s Windows 95/NT based management software. Level 3 will not be discussed in this section.

LOGGING IN - Calling a multi-port modem is no different than calling any other modem. However, once a connection is established, the caller must successfully pass the validity checks of any security methods that have been enabled. Failure to pass the validity checks will result in an immediate disconnect. If the caller is successfully validated as either a Level 1 or Level 2 user, the modem will enter command mode and present the caller with the appropriate prompt:

```
Level 1 Prompt:  .... ENTER ONE OF THE FOLLOWING COMMANDS ....
                  : AT.Pn    - Select port "n" and go online           :
                  : AT.Rn=x  - Select relay "n" off (x = 0) or on (x = 1) :
                  : AT.S     - Display port and relay status           :
                  : AT       - Display this help screen                 :
                  :.....:

```

This prompt indicates that the modem is operating at Level 1. In this mode, only commands shown in the prompt menu may be issued. If security is enabled, port and relay access will be limited by the access mask associated with the caller’s password or caller ID. The following situations will result in the modem operating at level 1:

- A caller logs in as a Level 1 user and the modem is configured for password protection.
- A call is accepted from a Level 1 caller ID and the modem is configured for caller ID protection.
- Under all conditions when remote configuration is disabled.

Level 2 prompt: **OK**

This prompt indicates that the modem is operating at Level 2. From this prompt, the caller may issue any of the commands that are valid at Level 1 plus any valid AT command. If security is enabled, port and relay access will be limited by the access mask associated with the caller’s password or caller ID. The following situations will result in the modem operating at level 2:

- A caller logs in as a Level 2 or 3 user and the modem is configured for both password protection and remote configuration.
- A call is accepted from a Level 2 or 3 caller ID and the modem is configured for both caller ID protection and remote configuration.
- Under all conditions when all security methods are disabled and remote configuration is enabled.

SELECTING A PORT AND ENTERING DATA MODE – Use the following command to select a port:

AT.Pn - Where n = Port number in the range of 1 – 8 for eight port models, 1 – 4 on four port models, 1 – 2 on two port models or 1 on single port models.

If the caller selects a valid port number and that port number is defined in the caller’s access mask, the modem will attempt to connect the caller to that port. Before establishing a connection, the modem will verify that all signals required by the current port configuration are present. If the modem detects that

required signals are not present, an error message will be generated and a connection to the port will not be established. Signals that the modem will monitor are Data Terminal Ready (DTR) and Request To Send (RTS). If all required signals are present, a connection will be established with the specified port and the modem will enter data mode.

RETURNING FROM DATA MODE TO COMMAND MODE (The escape sequence) – When a multi-port modem is in data mode with a specific port, a 3 character escape sequence must be entered in order to return to command mode. Please note that multi-port modems set S register 2 (the escape character) to a default value of 125, which is the ASCII character tilde (~). Therefore, three tilde characters (~~~) must be entered in order to escape from a port connection and return to the command mode prompt.

SETTING THE STATE OF A RELAY – Set the state of a relay using the following command:

AT.Rn=x - Where n = relay number in the range of 1 – 2 for two port and eight port models or 1 on single port and four port models. The value of x may be 0 (zero) for off and 1 for on.

If the caller selects a valid relay number and that relay number is defined in the caller's access mask, the modem will set the state of that relay as requested by the user. Once a relay state has been set, the relay will remain in that state until another command is issued that specifically changes the state of the relay. Even if power is cycled on the modem, the relay will always return to the state that was previously defined through the AT.R command.

REVIEWING STATUS OF PORTS AND RELAYS – Use the following command to review the status of ports and relays:

AT.S - This command will generate a report in the following format:

PORT 1 = \C0,\D5,&K0,&D0,E1,Q0	DTR = off	RTS = off
PORT 2 = \C0,\D5,&K0,&D0,E1,Q0	DTR = off	RTS = off
PORT 3 = \C0,\D5,&K0,&D0,E1,Q0	DTR = off	RTS = off
PORT 4 = \C0,\D5,&K0,&D0,E1,Q0	DTR = off	RTS = off
PORT 5 = \C0,\D5,&K0,&D0,E1,Q0	DTR = off	RTS = off
PORT 6 = \C0,\D5,&K0,&D0,E1,Q0	DTR = off	RTS = off
PORT 7 = \C0,\D5,&K0,&D0,E1,Q0	DTR = off	RTS = off
PORT 8 = \C0,\D5,&K0,&D0,E1,Q0	DTR = off	RTS = off

RELAY 1 = on
RELAY 2 = off

Please note that any port or relay not defined in the access mask of the caller's password or caller ID will not be displayed in this report.

LOGGING OUT AND DISCONNECTING – To disconnect from a multi-port modem use the following command:

AT.X

SECURITY METHODS

PROTECTION OPTIONS - Password protection and Caller ID protection are provided on all multi-port models. Both security methods are designed to control access to the modem, the modem's ports and relays, and the modem's remote configuration facility.

ACCESS CONTROL - When Password protection is enabled, the user is required to enter a password before the modem will allow communications to occur. If the user's password exists in the modem's database, the user will be granted access and the modem will enter online command mode where ports and relays may be selected. If Caller ID protection is enabled, the modem will only answer calls from telephone numbers that have been registered in the modem's database. If both protection methods are enabled, the user must call from a registered number and have a valid password.

Both valid Passwords and/or registered Caller IDs may be stored in the modem's database. Each Password may contain up to ten alphanumeric characters and each Caller ID may contain ten numeric characters. With each Password or Caller ID, there is an associated level and access mask:

1. Level One Passwords or Caller IDs may only access specified ports and relays of the modem. They are not allowed access to remote configuration and password maintenance. Access may be limited to specific ports and relays through the associated access mask.
2. Level Two Passwords or Caller IDs may access specified ports and relays of the modem and may also perform remote configuration and password maintenance. Access may be limited to specific ports and relays through the associated access mask.
3. Level Three Passwords or Caller IDs are reserved for use by the StarComm Device Management software. They place the modem in a protocol mode that is required by the device management software. All modems that will be managed by the StarComm Device Management Software must contain a Level Three Password.

You may configure password protection to operate either with or without a password prompt. Operating without a password prompt makes it more difficult for intruders to understand system operation and access requirements.

AUDIT TRAIL CAPABILITIES – All multi-port modems provide a nonvolatile audit trail with precision date and time recording. When Password protection is enabled, all successful and unsuccessful attempts to access the modem will be recorded. When Caller ID protection is enabled, all successful attempts to access the modem will be recorded. As an option, the telephone number of all unregistered callers may also be recorded. When the audit trail becomes full, it will automatically wrap around and begin overwriting the oldest entries.

TIMEKEEPING COMMANDS

AT+T=mm/dd/yy hh:mm - Set Time and Date

mm = month (1-12)

yy = year (0 -99)

mm = minute (0-59)

dd = day (1-29, 30 or 31 based on month)

hh = hour (0-23)

AT+T?

- Display Time and Date

SECURITY METHODS CONFIGURATION COMMAND

ATSn – Enable/Disable Password and Caller ID Protection Options

	Password Security	Password Prompt	Caller ID Security	Log Telephone Number of All Unregistered Callers
\S0	OFF	N/A	OFF	N/A
\S1	ON	NO PROMPT	OFF	N/A
\S2	ON	PROMPT	OFF	N/A (default)
\S3	OFF	N/A	ON	YES
\S4	ON	NO PROMPT	ON	YES
\S5	ON	PROMPT	ON	YES
\S6	OFF	N/A	ON	NO
\S7	ON	NO PROMPT	ON	NO
\S8	ON	PROMPT	ON	NO

PASSWORD MAINTENANCE COMMANDS

ATP+nnnnnnnnnn,l,87654321 - Add Password, Level and Access Rights

nnnnnnnnnn = Password 1 – 10 alphanumeric characters

l = Level
 1 = normal, port and relay selection only)
 2 = special, port and relay selection + remote configuration)
 3 = for use by Device Management Software)

87654321 = Access Mask which defines access rights for ports and relays. The length of this mask must equal the number of ports on your particular model. You must enter all 8 positions on an 8 port unit, 4 positions on a 4 port unit, 2 positions on a 2 port unit and 1 position on 1 port unit. Each position in the mask must contain either a 1 or a 0 (zero). For example, a one in position 1 will enable access to port 1 and relay 1, a 1 in position 2 will enable access to port 2 and relay 2 and a 1 in position 8 will enable access to port 8.

ATP-nnnnnnnnnn - Delete Password

ATP-* - Delete All Passwords

ATP? - Display All Passwords in the following format:

PASSWORD	LEVEL	ACCESS
nnnnnnnnnn	1	11111111
nnnnnnnnnn	2	00000001
nnnnnnnnnn	1	10101010

CALLER ID MAINTENANCE COMMANDS

ATI+nnnnnnnnnn,I,87654321 - Add Caller ID, Level and Access Rights

nnnnnnnnnn = Caller ID 1 – 10 numeric characters

I = Level
1 = normal, port and relay selection only)
2 = special, port and relay selection + remote configuration)
3 = for use by Device Management Software)

87654321 = Access Mask which defines access rights for ports and relays. The length of this mask must equal the number of ports on your particular model. You must enter all 8 positions on an 8 port unit, 4 positions on a 4 port unit, 2 positions on a 2 port unit and 1 position on 1 port unit. Each position in the mask must contain either a 1 or a 0 (zero). For example, a one in position 1 will enable access to port 1 and relay 1, a 1 in position 2 will enable access to port 2 and relay2 and a 1 in position 8 will enable access to port 8.

ATI-nnnnnnnnnn - Delete Caller ID

ATI-* - Delete All Caller IDs

ATI? - Display All Caller IDs in the following format:

<u>CALLER ID</u>	<u>LEVEL</u>	<u>ACCESS</u>
nnnnnnnnnn	1	00000001
nnnnnnnnnn	2	11111111
nnnnnnnnnn	1	01010101

AUDIT TRAIL MAINTENANCE COMMANDS

ATE - Erase Audit Trail

This command will erase the current contents of the audit trail and initialize it to an empty state.

ATO - Output Audit Trail Report to DTE

When this command is entered, the audit trail will be presented as formatted ASCII output. The format will contain standard carriage return/line feed control for display on any standard ASCII terminal or terminal emulator package. Since this command does not erase the contents of the audit trail, it may be executed repetitively. The report format is as follows:

<u>DATE</u>	<u>TIME</u>	<u>PASSWORD</u>	<u>STATUS</u>
mm/dd/yy	hh:mm:ss	nnnnnnnnnn	APPROVED
mm/dd/yy	hh:mm:ss	nnnnnnnnnn	DENIED
mm/dd/yy	hh:mm:ss	nnnnnnnnnn	APPROVED
mm/dd/yy	hh:mm:ss	nnnnnnnnnn	APPROVED
mm/dd/yy	hh:mm:ss	nnnnnnnnnn	DENIED

<MORE - press ENTER to continue - >

REMOTE CONFIGURATION

All multi-port modems are equipped with a remote configuration facility that may be enabled or disabled through the following command:

ATRn - Where n = 0 (zero) to disable remote configuration and 1 to enable remote configuration.

Access to the remote configuration facility may be protected by any, or all of the security methods provided in the multi-port modem. When a call is placed to a multi-port modem that has remote configuration enabled, the device will enter online command mode and present the caller with an OK prompt. Once the remote modem enters online command mode, any valid AT command may be used to review or change the configuration of the remote device.

When a multi-port modem is in data mode, the caller may escape back into the online command mode by entering a 3 character escape sequence. Please note that multi-port modems set S register 2 (the escape character) to a default value of 125, which is the ASCII character tilde (~).

SETTING PORT PARAMETERS

StarComm multi-port modems maintain a separate set of parameters for each RS-232 port. This allows the modem to automatically adjust to the unique characteristics of numerous devices. Port parameters may be set through the following command:

AT.Cn=cmd - Where n = Port number in the range of 1 – 8 for eight port models, 1 – 4 on four port models, 1 – 2 on two port models and 1 on single port models. The cmd field may contain one or more AT commands from the following subset:

Echo	-	E0, E1
Result codes	-	Q0, Q1
DTR control	-	&D0, &D1, &D2, &D3
Flow Control	-	&K0, &K3, &K4, &K5, &K6
DTE speed	-	\D0, \D1, \D2, \D3, \D4, \D5, \D6, \D7, \D8, \D9
Character format	-	\C0, \C1, \C2
Synch dial backup	-	&Q2 (see note 1)

Example: AT.C1=E0Q1&D0&K0\D5\C0 - This command string sets port 1 to the following configuration:

Bit Rate	- 9600bps	DTR Significance	- Ignore DTR
Character Length	- 8 bit	Command Echo	- Off
Parity	- None	Result Codes	- Off
Flow Control	- Disabled		

A detailed description of all commands may be found in the AT Command Set section of this manual.

NOTE 1: The &Q2 command is only valid for port 1. It is used to configure this port for unattended synchronous dial backup operations. The &Q2 command sets port

1 to a mode of operation where it will automatically dial a stored number when DTR is turned on. A synchronous connection will then be established and maintained until DTR is turned off. When using the &Q2 command, all port commands shown above, with the exception of echo control and result code control, are ignored. It is also necessary store a telephone number in the modem through the AT&Z0 command.

AT COMMAND SET

Command Guidelines

The basic AT commands used to control modem operation are defined in this section. Under AT operation, the modem performs autobaud, autoparity and autolenh functions on each header entered. The autoparity and autolenh facilities can detect 7 or 8-bit characters of even, odd, or no parity with one stop bit.

Command Format

A command line is a string of characters sent from a DTE to the modem (DCE) while the modem is in a command state. A command line has a prefix, a body, and a terminator. Each command line (with the exception of the A/command) must begin with the character sequence AT and must be terminated by a carriage return.

Characters within the command line are parsed as commands with associated parameter values. The basic commands consist of single ASCII characters, or single characters preceded by a prefix character (e.g., "&"), followed by a decimal parameter. Missing decimal parameters are evaluated as 0.

The AT sequence may be followed by any number of commands in sequence, except for commands such as Z, D, or A. Commands following commands Z, D, or A on the same command line will be ignored. The maximum number of characters on any command line is 39 (including "A" and "T"). If a syntax error is found anywhere in a command line command, the remainder of the line will be ignored and the ERROR result code will be returned.

Escape Code Sequence

When the modem has established a connection and has entered on-line data mode, it is possible to break into the data transmission in order to issue further commands to the modem in an on-line command mode. This is achieved by sending to the modem a sequence of three ASCII characters specified by register S2. The default character is '~'. The timing of the three characters must comply with specific time constraints. There is a guard time before the first character (the pre-sequence time), a guard time following the third character (the post-sequence time), and a guard time-out between the first and second characters and between the second and third characters (the inter-character time). These times are controlled by the value recorded in register S12.

Command Set Detail

The modem will respond to the commands detailed below. Parameters applicable to each command are listed with the command description. The defaults shown for each configuration command are those used in factory profile 0.

AT COMMANDS

A/ - Re-execute Command

The modem behaves as though the last command line had been re-sent by the DTE. "A/" will repeat all the commands in the command buffer.

AT=x - Write to Selected S-Register

This command writes the value x to the currently selected S-Register. An S-Register can be selected by using the ATSn command.

AT? - Read Selected S-Register

This command reads and displays the selected S-Register.

A - Answer

The modem will go off-hook and attempt to answer an incoming call if correct conditions are met.

Bn - CCITT or Bell

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 according to the parameter supplied. Any other line speed will use a CCITT modulation standard.

- B0 Selects CCITT operation at 300 or 1200 bps.
- B1 Selects BELL operation at 300 or 1200 bps. (Default)

Cn - Carrier Control

This command is included for compatibility only, and has no effect other than returning a result code. The only valid parameter is 1.

Dn - Dial

This command 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.

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

- 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.
- J Perform MNP10 link negotiation at 1200 bps.
- K Enable power level adjustment during MNP10 link negotiation.
- L Re-dial last number.
- P Select pulse dialing.
- T Select tone dialing.
- R Ignored.
- S=n Dial the number stored in the directory.

- ! Flash: the modem will go on-hook for a time defined by the value of S29.
- 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, the modem will abort the rest of the sequence.
- @ Wait for silence: the modem will wait for at least 5 seconds of silence in the call process 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 bong is not detected within the time specified by S7, the modem will abort the rest of the sequence.
- ' Dial pause: the modem will pause for a time specified by S8 before dialing the digits following the ",,".
- ; 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 ",,".
- ^ 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.
- <i> Invalid character: will be ignored.

En - Command Echo

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

- E0 Disables command echo.
- E1 Enables command echo.

Fn - Select Line Modulation (1442 ONLY)

This command selects the line modulation according to the parameter supplied. The line modulation is fixed unless Automode is selected.

- F0 Selects auto-detect mode. All connect speeds supported by the modem are possible according to the remote modem's preference.
- F1 Selects V.21 or Bell 103 according to the B setting as the only acceptable line speed resulting in a subsequent connection.
- F2 Not supported.
- F3 Selects V.23 as the only acceptable line modulation for a subsequent connection. Originator is at 75 bps and answerer is at 1200bps.
- F4 Selects V.22 1200 or Bell 212A according to the B command setting as the only acceptable line speed for a subsequent connection.
- F5 Selects V.22 bis as the only acceptable line modulation for a subsequent connection.
- F6 Select V.32bis 4800 or V.32 4800 as the only acceptable line modulation for a subsequent connection.
- F7 Selects V.32 bis 7200 as the only acceptable line modulation for a subsequent connection.
- F8 Selects V.32bis 9600 or V.32 9600 as the only acceptable line modulations for a subsequent connection.
- F9 Selects V.32bis 12000 as the only acceptable line modulation for a subsequent connection.
- F10 Selects V.32 bis 14400 as the only acceptable line modulation for a subsequent connection.

connection.

In - Identification

The modem reports to the DTE the requested result according to the command parameter.

- I0 Reports product code.
- I1 Reports a pre-computed checksum.
- I2 Reports "OK".
- I3 Reports firmware revision (VX.XXX) model code.
- I4 Reports OEM defined identifier string in Hayes compatible binary format.
- I5 Reports Country Code parameter.
- I6 Reports modem data pump model and internal code revision.
- I7 Reports StarComm device type

Ln - Speaker Volume

The modem sets the speaker volume control according to the parameter supplied.

- L0 Low volume.
- L1 Low volume. (Default)
- L2 Medium volume.
- L3 High volume.

Mn - Speaker Control

- 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.

Nn - Automode Enable

This command enables or disables Automode detection.

- N0 Automode detection is disabled.
- N1 Automode detection is enabled. (Default).

P - Set Pulse Dial Default

This command forces pulse dialing until the next T dial modifier or T command is received.

Qn - Quiet Results Codes Control

The command enables or disables the sending of result codes to the DTE according to the parameter supplied.

- Q0 Enables result codes to the DTE.
- Q1 Disables result codes to the DTE.

Sn - Read/Write S-Register

The modem selects an S-Register, performs an S-Register read or write function, or reports the value of an S-Register.

- n Establishes S-Register n as the last register accessed.
- n=v Sets S-Register n to the value v.
- n? Reports the value of S-Register n.

T - Set Tone Dial Default

This command forces DTMF dialing until the next P dial modifier or P command is received.

Vn - Result Code Form

This command selects the sending of short-form or long-form result codes to the DTE.

- V0 Enables short-form (terse) result codes.
- V1 Enables long-form (verbose) result codes. (Default)

Wn - Connect Message Control

This command controls the format of CONNECT messages.

- W0 Modem reports DTE speed. (Default)
- W1 Modem reports line speed error correction protocol and DTE speed.
- W2 Modem reports the DCE speed.

Xn - Extended Result Codes

This command selects which subset of the result messages will be used by the modem to inform the DTE of the results of commands.

- X0 Disables monitoring of busy tones, sends only OK, CONNECT, RING, NO CARRIER, ERROR, and NO ANSWER result codes. Blind dialing is enabled.
- X1 Disables monitoring of busy tones, sends only OK, CONNECT, RING, NO CARRIER, ERROR, NO ANSWER, and CONNECT XXXX(XXXX=rate). Blind dialing is enabled.
- X2 Disables monitoring of busy tones, sends only OK, CONNECT, RING, NO CARRIER, ERROR, NO DIAL TONE, NO ANSWER, and CONNECT XXXX.
- X3 Enables monitoring of busy tones; send only OK, CONNECT, RING, NO CARRIER, ERROR, NO ANSWER, and CONNECT XXXX. Blind dialing is enabled.
- X4 Enables monitoring of busy tones, sends all messages. (Default).

Yn - Long Space Disconnect

This command enables/disables the generation and response to long space disconnect.

- Y0 Disables long space disconnect. (Default)
- Y1 Enables long space disconnect.

Zn - Soft Reset and Restore Profile

The modem performs a soft reset and restores (recalls) the configuration profile according to the parameter supplied. If no parameter is specified, zero is assumed.

- Z0 Soft reset and restore stored in profile 0.
- Z1 Soft reset and restore stored profile 1.

AT& COMMANDS

&Cn - RLSD (DCD) Option

This command controls the RLSD output in accordance with the parameter supplied.

- &CO RLSD remains ON at all times.
- &C1 RLSD follows the state of the carrier. (Default)

&Dn - DTR Option

This command interprets the ON to OFF transition of the DTR signal from the DTE in accordance with the parameter supplied.

- &DO DTR is ignored and assumed on.
- &D1 DTR drop forces modem to command state without disconnecting.
- &D2 DTR drop forces hang up, auto-dial is inhibited.
- &D3 DTR drop forces modem to soft reset.

&Fn - Restore Factory Configuration (profile)

This command loads the factory default configuration (profile).

- &F0 Restore factory configuration 0.
- &F1 Restore factory configuration 1.

&Gn - Select Guard Tone

This command controls the generation of guard tone.

- &G0 Disables guard tone.
- &G1 Disables guard tone.
- &G2 Selects 1800 Hz guard tone.

&Kn - Flow Control

This command defines the DTE/DCE (terminal/modem) flow control mechanism.

- &K0 Disables flow control.
- &K3 Enables RTS/CTS flow control.
- &K4 Enables XON/XOFF flow control.
- &K5 Enables transparent XON/XOFF flow control.
- &K6 Enables both RTS/CTS and XON/XOFF flow control.

&Mn - Asynchronous/Synchronous Mode Selection

This command determines the DTR operating mode. The modem treats the &M command as a subset of the &Q command.

- &M0 Selects direct asynchronous operation.
- &M1 Selects synchronous connect mode with asynch off-line command mode.
- &M2 Selects synchronous connect mode with asynch off-line command mode. Same as &M1

except that &M2 enables DTR dialing of directory slot 0. The modem will disconnect if DTR is OFF for more than the period in S25.

- &M3 Selects synchronous connect mode. This mode allows DTR to act as a talk/data switch. The call is manually initiated while DTR is inactive. When DTR becomes active, the handshake proceeds in originate or answer mode according to S14 bit 7.

&Pn - Select Pulse Dial Make/Break Ratio

This command determines the make/break ratio used during pulse dialing.

- &P0 Selects 39%-61% make/break ratio at 10 pulses per second. (Default)
- &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.

&QN - Sync/Async Mode

This command is an extension of the &M command is used to control the connection modes permitted. It is used in conjunction with S36 and S48.

- &Q0 Selects direct asynchronous operation.
- &Q1 Selects synchronous connect mode with asynch off-line command mode.
- &Q2 Selects synchronous connect mode with asynch off-line command mode and enables DTR dialing of directory 0.
- &Q3 Selects synchronous connect mode with asynch off-line command mode and enables DTR to act as Talk/Data switch.
- &Q4 Selects AutoSync operation. Auto-synch operation when used in conjunction with the Hayes Synchronous Interface (HSI) capability in the DTE, provides synchronous communication capability from an asynchronous terminal.
- &Q5 The modem will try to negotiate an error-corrected link. (Default)
- &Q6 Selects asynchronous operation in normal mode (speed buffering).

&Rn - RTS/CTS Option

This selects how the modem controls CTS. CTS operation is modified if the hardware flow control is selected.

- &R0 In sync mode, CTS tracks the state of RTS; the RTS to CTS delay is defined by S26. In async mode, CTS acts according to V.25bis handshake.
- &R1 In sync mode, CTS is always ON. In async mode, CTS will only drop if required by flow control. (Default)

&Sn - DSR Override

This command selects how the modem will control DSR.

- &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. (Default)

&Tn - Test and Diagnostics

The modem will perform selected test and diagnostic functions according to the parameter supplied. A test can be run only when in asynchronous operation in non-error-correction mode (normal or direct mode). To terminate a test in progress, the escape sequence must be entered first, except for parameters 7 and 8. If S18 is non-zero, a test will terminate automatically after the time specified by S18 and display the OK message.

- &T0 Terminates test in progress.
- &T1 Initiates local analog loopback, V.54, Loop 3.
- &T2 Returns ERROR.
- &T3 Initiates local digital loopback, V.54 Loop 2.
- &T4 Enables digital loopback for remote request. (Default)
- &T5 Disables digital loopback for remote request.
- &T6 Requests a remote digital loopback, V.54 Loop 2 without self test.
- &T7 Requests remote digital loopback, V.54 Loop 2, with self test.
- &T8 Initiates local analog loopback, V.54 Loop 3, with self test.

&V - Display Current Configuration and Stored Profiles

Reports the current (active) configuration, the stored (user) profiles, and the first four stored telephone numbers.

&V1 - Display Status of Last Call

Presents an analysis of modem performance and telephone circuit quality during the last call.

&Wn - Store Current Configuration

Saves the current configuration and S-Registers in one of the two user profiles which are kept in non-volatile memory (NVRAM).

- &W0 Store as profile 0.
- &W1 Store as profile 1.

&Xn - Select Synchronous Clock Source

Selects the source of the transmit clock for synchronous operation.

- &X0 Internal clock from DCE.
- &X1 External clock from DTE. (DTE must supply clock on pin 24)
- &X2 Internal clock from DCE synchronized with carrier from remote modem.

&Yn - Designate a Default Profile

Selects the user profile that will be used after a reset.

- &Y0 Profile 0.
- &Y1 Profile 1.

&Zn - Store Telephone Number

The modem can store up to four telephone numbers.

- &Zn=x Where n = 0 to 3 and x = dial string.

AT% COMMANDS

%C - Enable/Disable Data Compression

Enables or disables data compression negotiation. The modem can only perform data compression on an error corrected link.

- %C0 Disables data compression.
- %C1 Enables MNP5 data compression negotiation.
- %C2 Enables V.42 bis data compression.
- %C3 Enables both V.42 bis and MNP5 data compression. (Default)

%En - Enable/Disable Line Quality Monitor and Auto-Retrain or Fallback/Fall Forward

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).

- %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)

%L - Line Signal Level

Returns a value which indicates the received signal level.

%Q - Line Signal Quality

Reports line signal quality.

AT\ COMMANDS

\An - Select Maximum MNP Block Size

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

- \A0 64 characters.
- \A1 128 characters. (Default)
- \A2 192 characters.
- \A3 256 characters.

\Bn - Transmit Break to Remote

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

\Cn - Select DTE Character Format

This command forces the modem to operate with a fixed character format. Caution: Always remove the modem from autobaud mode with the AT\D command before attempting to establish a fixed character format.

- \C0 8 Data bits, No parity, 1 Stop bit
- \C1 7 Data bits, Odd parity, 1 Stop bit
- \C2 7 Data bits, Even parity, 1 Stop bit

\Dn - Select DTE Data Rate

This command allows the user to enable autobaud or set a fixed DTE bit rate.

\D0	Autobaud to DTE	\D5	9600 bps
\D1	300 bps	\D6	19.2 kbps
\D2	1200 bps	\D7	38.4 kbps
\D3	2400 bps	\D8	57.6 kbps
\D4	4800 bps	\D9	115.2 kbps

\Gn - Modem to Modem Flow Control (XON/XOFF) (1442 ONLY)

In non-error-correction mode, the modem enables or disables the generation or recognition of modem to modem XON/XOFF flow control according to the parameter supplied. In error correction mode, the setting of modem to modem XON/XOFF flow control is ignored. However, the serial port flow control settings (AT&K) remain active during a reliable link.

\G0	Disables modem to modem flow control. (Default)
\G1	Enables modem to modem XON/XOFF flow control.

\Kn - Break Control

Controls the response of the modem to a break received from the DTE or the remote modem or the \B command according to the parameter supplied. The response is different in three separate cases. The first case: The modem receives a break from the DTE when operating in data transfer mode:

\K0	Enter on line command mode, no break sent to the remote modem.
\K1	Clear data buffers and send break to remote modem.
\K2	Same as 0.
\K3	Send break to remote modem immediately.
\K4	Same as 0.
\K5	Send break to remote modem in sequence with data. (Default)

The second case: The modem is in the on-line command state (waiting for AT commands) during a data connection and the \B is received in order to send a break to the remote modem:

\K0	Clear data buffers and send break to remote modem.
\K1	Same as 0.
\K2	Send break to remote modem immediately.
\K3	Same as 2.
\K4	Send break to remote modem in sequence with data.
\K5	Same as 4. (Default)

The third case: A break is received from a remote modem during a non-error corrected connection:

\K0	Clears data buffers and send break to the DTE.
\K1	Same as 0.
\K2	Send a break immediately to DTE.
\K3	Same as 2.
\K4	Send a break in sequence with received data to DTE.
\K5	Same as 4. (Default)

\Nn - Operating Mode

This command controls the preferred error correcting mode to be negotiated in a subsequent data connection.

- \N0 Normal speed buffered mode (disables error correction).
- \N1 Direct mode.
- \N2 MNP only.
- \N3 MNP with fallback to normal mode (auto reliable mode).
- \N4 V.42 only.
- \N5 V.42 with fallback to MNP only.
- \N6 V.42 with fallback to MNP with fallback to normal. (Default)

\V1 - Enhanced Connect Message

Presents a comprehensive, single line connect message, showing DTE speed, DCE speed, protocol and compression.

AT+ COMMANDS

+MS - Select Modulation

This extended format command selects the modulation, optionally enables or disables automode, and optionally specifies the lowest and highest connection rates using one to four subparameters. The command format is:

+MS=<mod>[,<automode>][,<min_rate>][,<max_rate>]]<CR>

Notes:

1. For 14400 bps and lower speeds, the Nn command and S37 register can alternatively be used in which case the +MS subparameters will be modified to reflect the Nn and S37=x settings. Use of the Nn and S37=x commands is not recommended but is provided for compatibility with existing communication software. (S37 is not updated by the +MS command).
2. Subparameters not entered (enter a comma only or <CR> to skip the last subparameter) remain at their current values.

Reporting Selected Options

The modem can send information to the DTE consisting of selected options using the following command: +MS?

The response is: +MS:<mod>,<automode>,<min_rate>,<max_rate>

For example: +MS: 11,1,300,33600 (shows default values)

Reporting Supported Options

The modem can send information to the DTE consisting of supported options using the following command: +MS=?

The response is: +MS:(list of supported <mod> values),(list of supported <automode> values)(list of supported <min_rate> values),(list of supported <max_rate> values)

For example: +MS:(0,1,2,3,8,9,10,13,64,69,74),(0,1),(300-33600),(300-33600)

Subparameter Definitions

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

<mod>	Modulation	Possible Rates(bps)	Notes
0	V.21	300	
1	V.22	1200	
2	V.22bis	2400 or 1200	
3	V.23	1200	See Note 2
9	V.32	9600 or 4800	
10	V.32bis	14400,12000,9600,7200,4800	
11	V.34	33600,31200,28800,26400,24000,21600,19200, 16800,14400,12000,9600,7200,4800,2400	
64	Bell 103	300	
69	Bell 212	1200	
74	V.FC	33600,31200,28800,26400,24000,21600,19200, 16800,14400	

2. <automode> is an optional numeric value which enables or disables automatic modulation negotiation using V.8 or V.32bis Annex A. The options are:

<automode>	Option Selected	Notes
0	Automode disabled	
1	Automode enabled using V.8 or V.32 Annex A	Default

3. <min_rate> is an optional number which specifies the lowest rate at which the modem may establish a connection. The value is decimal coded in units of bps, e.g. 2400 specifies the lowest rate to be 2400 bps. The default is 300 for 300 bps.
4. <max_rate> is an optional number which specifies the highest rate at which the modem may establish a connection. The value is decimal coded, in units of bps, e.g. 14400 specifies the highest rate to be 14400 bps. The default is 33600 for 33600 bps.

MNP 10 COMMANDS

)Mn - Enable Cellular Power Level Adjustment

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

-)M0 Disables transmit power level adjustment during MNP10 link negotiation. The)M0 command allows transmit power adjustment if cellular operation is requested by the remote modem. Uses wireline power level for initial cellular connection. (Default)
-)M1 Enables transmit power level adjustment during MNP10 link negotiation. Uses the @Mn value to establish initial cellular connection. After connection, the optimal power level is determined by the modem. NOTE:)M1 should not be used with *H2.
-)M2 Enables transmit power level adjustment during MNP10 link negotiation. Uses the @Mn value to establish initial cellular connection. After connection, the power level is fixed.

***Hn - Link Negotiation Speed**

This command controls the connection speed for link negotiations before upshift occurs between two MNP10 modems.

- *H0 Link negotiation occurs at the highest supported speed. (Default)
- *H1 Link negotiation occurs at 1200 bps; used primarily for establishing cellular connections.
- *H2 Link negotiation occurs at 4800 bps; used primarily to negotiate an MNP10 connection on less than average quality telephone lines.

-Kn - MNP Extended Services

Enables or disables conversion of a V.42 LAPM connection to an MNP10 connection.

- K0 Disables V.42 LAPM to MNP10 conversion.
- K1 Enables V.42 LAPM to MNP10 conversion. (Default)
- K2 Enables V.42 LAPM to MNP10 conversion; inhibits MNP Extended Services initiation during V.42 LAPM answer mode detection phase.

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

Enables or disables fallback from MNP10 to V.22bis/V.22.

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

@Mn - Initial Cellular Power Level Setting

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

@M0	-26 dBm. (Default)	@M11	-11 dBm.
@M1	-30 dBm.	@M12	-12 dBm.
@M2	-10 dBm.	@M30	-30 dBm.
@M3-@M10	-10 dBm.	@M31	-31 dBm.

:E - Compromise Equalizer Enable Command

Enables or disables the V.32 compromise equalizer. The parameter value, if valid, is written to S201 bit 5. This command can be used when the modem is attached to either a flat line or a cellular connection.

- :E0 Disables the equalizer.
- :E1 Enables the equalizer. (Default)

AT COMMAND RESULT CODES

The modem responds to commands from the DTE and to activity on the line by signaling to the DTE in the form of result codes. The result codes that the modem can send are described in the following table:

- 0- OK
- 1- CONNECT
- 2- RING
- 3- NO CARRIER
- 4- ERROR
- 5- CONNECT 1200
- 6- NO DIALTONE
- 7- BUSY
- 8- NO ANSWER
- 9- CONNECT 0600
- 10- CONNECT 2400
- 11- CONNECT 4800
- 12- CONNECT 9600
- 13- CONNECT 7200
- 14- CONNECT 12000
- 15- CONNECT 14400
- 16- CONNECT 19200
- 17- CONNECT 38400
- 18- CONNECT 57600
- 19- CONNECT 115200
- 22- CONNECT 75TX/1200RX
- 23- CONNECT 1200TX/75RX
- 24- DELAYED
- 32- BLACKLISTED
- 33- FAX
- 35- DATA
- 40- CARRIER 300
- 44- CARRIER 1200/75
- 45- CARRIER 75/1200
- 46- CARRIER 1200
- 47- CARRIER 2400
- 48- CARRIER 4800
- 49- CARRIER 7200
- 50- CARRIER 9600
- 51- CARRIER 12000
- 52- CARRIER 14400
- 53- CARRIER 16800
- 54- CARRIER 19200
- 55- CARRIER 21600
- 56- CARRIER 24000
- 57- CARRIER 26400
- 58- CARRIER 28800
- 59- CONNECT 16800
- 61- CONNECT 21600
- 62- CONNECT 24000
- 63- CONNECT 26400
- 64- CONNECT 28800
- 66- COMPRESSION: CLASS 5
- 67- COMPRESSION: V.42 bis
- 69- COMPRESSION: NONE
- 70- PROTOCOL: NONE
- 77- PROTOCOL: LAPM
- 78- CARRIER 31200
- 79- CARRIER 33600
- 80- PROTOCOL: ALT
- 81- PROTOCOL: ALT-CELLULAR
- 84- CONNECT 33600
- 91- CONNECT 31200

S-REGISTERS

The table in this section summarizes the S-Registers and their default values. Registers denoted with (*) may be stored in user profiles. All bit-mapped registers are read-only. The appropriate AT command, which controls the relevant bits in the S-Register, should be used to change the value.

Factory Defaults

The factory default values are stored in ROM and are loaded into the active configuration at power up or by the ATZn command. In addition, the designated default profile is subsequently loaded, and may change some of the factory default values. The designated default profile can be changed by entering the &Yn command where n is one of the two possible use profiles. The factory default values may be loaded at any time by entering the &Fn command.

S-REGISTER SUMMARY					
Register	Function	Range	Units	Saved	Default
S0	Rings to Auto-Answer	0-255	rings	*	1
S1	Ring Counter	0-255	rings		0
S2	Escape Character	0-255	ASCII	*	125

S3	Carriage Return Character	0-127	ASCII		13
S4	Line Feed Character	0-127	ASCII		10
S5	Backspace Character	0-255	ASCII		8
S6	Wait Time for Dial Tone	2-255	s	*	2
S7	Wait Time for Carrier	1-255	s	*	50
S8	Pause Time for Dial Delay	0-255	s	*	2
S9	Carrier Detect Response time	1-255	0.1s	*	6
S10	Carrier Loss Disconnect time	1-255	0.1s	*	14
S11	DTMF Tone Duration	50-255	0.001s	*	95
S12	Escape Prompt Delay	0-255	0.02s	*	50
S13	Reserved	-	-		-
S14	General Bit Mapped Options	-	-	*	138
S15	Reserved	-	-		-
S16	Test Mode Bit Mapped	-	-		0
S17	Reserved	-	-		-
S18	Test Timer	0-255	s	*	0
S19	AutoSync Options	-	-		0
S20	AutoSync HDLC or BSC Char.	0-255	-	*	0
S21	V.24/General Bit Mapped	-	-	*	4
S22	Speaker/Results Bit Mapped	-	-	*	117
S23	General Bit Mapped	-	-	*	54
S24	Sleep Inactivity Timer	0-255	s	*	0
S25	Delay to DTR Off	0-255	s or 0.01s		5
S26	RTS-to-CTS Delay	0-255	0.01s		1
S27	General Bit Mapped	-	-	*	9
S28	General Bit Mapped	-	-	*	0
S29	Flash Dial Modifier	0-255	10 ms		0
S30	Disconnect Timer	0-255	10 s		0
S31	General Bit-Mapped	-	-	*	2
S32	XON Character	0-255	ASCII		17
S33	XOFF Character	0-255	ASCII		19
S34-S35	Reserved	-	-		-
S36	LAPM Failure Control	-	-	*	7
S37	Line Connection Speed	-	-	*	0
S38	Delay Before Hang up	0-255	s		20
S39	Flow Control Bit Mapped	-	-	*	3
S40	General Bit-Mapped	-	-	*	105
S41	General Bit-Mapped	-	-	*	195
S42-S45	Reserved	-	-		-
S46	Data Compression Control	-	-	*	138
S48	V.42 Negotiation Control	-	-	*	7
S82	LAPM Break Control	-	-		128
S86	Call Failure Reason	0-255	-		-
S91	PSTN Transmit Attenuation	0-15	dBm		10
S92	FAX Transmit Attenuation	0-15	dBm		10
S95	Result Code Control	-	-	*	0
S201	Cellular Transmit Level	0-63		*	58

*Register value may be stored in either user profile with the &W command.

S-REGISTER DEFINITIONS

S0 - Number of Rings to Auto Answer

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

Range:	0-255 rings	Default:	1
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S1 - Ring Counter

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

Range:	0-255 rings	Default:	0
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S2 - Escape Character

S2 holds the decimal value of the ASCII character used as the escape character. The default value corresponds to an ASCII "~". A value over 127 disables the escape process.

Range:	0-255, decimal	Default:	125(~)
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S3 - Carriage Return Character

Sets the command line and result code terminator character.

Range:	0-127, decimal	Default:	13 (Carriage Return)
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S4 - Line Feed Character

Sets the character recognized as a line feed.

Range:	0-127, decimal	Default:	10(line feed)
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S5 - Backspace Character

Sets the character recognized as a backspace.

Range:	0-255, decimal	Default:	8 (Backspace)
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S6 - Wait Time for Dial Tone Before Blind Dialing

Sets the length of time in seconds that the modem will wait before starting to dial after going off-hook when blind dialing. The modem always pauses for a minimum of 2 seconds.

Range:	2-255 seconds	Default:	2
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S7 - Wait Time for Carrier After Dial, For Silence, or For Dial Tone After "W" Dial Modifier

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

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

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.

Range: 1-255 seconds Default: 50

S8 - Pause Time for Dial Delay

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

Range: 0-255 seconds Default: 2

S9 - Carrier Detect Response Time

Sets the time, in tenths of a second, that the carrier must be present before the modem considers it valid and turns on RLSD.

Range: 1-255 tenths of a second Default: 6 (0.6 second)

S10 - 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. 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 register S10 minus register S9. Therefore, S10 must be greater than S9 or the modem disconnects before it recognizes the carrier.

Range: 1-255 tenths of a second Default: 14 (1.4 seconds)

S11 - DTMF Tone Duration

Sets the duration of tones in DTMF dialing. This value has no effect on pulse dialing.

Range: 50-255 milliseconds Default: 95 (95 milliseconds)

S12 - 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 from the DTE and the sending of the OK result code to the DTE. If any characters are detected during this time, the OK will not be sent.

Range: 0-255 1/50 of a second Default: 50 (1 second)

S13 - Reserved

S14 - General Bit Mapped Options Status

Indicates the status of command options.

Default: 138

Bit0 : This bit is ignored
Bit1 : Command echo(En)
0 = Disabled (EO)
1 = Enabled (E1) (Default)

Bit2 : Quiet mode (Qn)
 0 = Send result codes (Q0) (Default)
 1 = Do not send result codes (Q1)
 Bit3 : Numeric (V0)
 0 = Numeric (V0)
 1 = Verbose (V1) (Default)
 Bit4 : Reserved
 Bit5 : Tone (T)/Pulse(P)
 0 = Tone(T) (Default)
 1 = Pulse (P)
 Bit6 : Reserved
 Bit7 : Originate/Answer
 0 = Answer
 1 = Originate (Default)

S15 - Reserved

S16 - General Bit Mapped Test Options Status

Indicates the test in progress status.

Default: 0
 Bit0 : Local analog loopback
 1 = In progress (&T1)
 Bit1 : Not used
 Bit2 : Local digital loopback
 1 = In progress (&T3)
 Bit3 : Remote digital loopback (RDL)
 1 = RDL in progress
 Bit4 : RDL requested
 1 = RDL requested (&T6)
 Bit5 : RDL with self test
 1 = RDL requested (&T7)
 Bit6 : Local analog loopback (LAL) with self test
 1 = In progress (&T8)
 Bit7 : Not used

S17 - Reserved

S18 - Test Timer

Sets the length of time, in seconds, that the modem conducts a test (commanded by &Tn) before returning to the command mode. If this register value is zero, the test will not automatically terminate; the test must be terminated from the command mode by issuing a &T0 or H command. When S18 is non-zero, the modem returns the OK message upon test termination.

Range: 0-255 seconds Default: 0

S19 - AutoSync Bit Mapped Options

Defines the options for AutoSync operation (see &Q4 command). S19 must be set to the desired value before &Q4 is issued.

Default: 0

Bit0 : Reserved

Bit1 : BSC/HDLC Format Select
0 = BSC selected (Default)
1 = HDLC selected

Bit2 : Address detection enable/disable
0 = Disabled (Default)
1 = Enabled

Bit3 : NRZI/NRZ coding select
0 = NRZI (Default)
1 = NRZ

Bit4 : Idle indicator select
0 = Mark idle (Default)
1 = Flag of sync idle

Bits5-7 : Reserved

S20 - AutoSync HDLC Address or BSC Sync Character

Defines the HDLC address (S19 bit 1 = 1) or BSC Sync Character (S19 bit 1 = 0) for Auto Sync operation (see &Q4 command).

Range: 0-255 Default: 0

S21 - V.24/General Bit Mapped Options Status

Indicates the status of command options.

Default: 4

Bit0 : Set by &Jn command but ignored otherwise.
0 = &J0 (Default)
1 = &J1

Bit1 : Reserved

Bit2 : CTS behavior (&Rn)
0 = CTS tracks RTS (&R0)
1 = CTS always on (&R1) (Default)

Bits3-4 : DTR behavior (&Dn)
0 = &D0 selected (Default)
1 = &D1 selected
2 = &D2 selected
3 = &D3 selected

BIT5 : RLSD(DCD) behavior (&Cn)
0 = &C0 selected (Default)
1 = &C1 selected

Bit6 : DSR behavior (&Sn)
0 = &S0 selected (Default)
1 = &S1 selected

Bit7 : Long space disconnect (Yn)
0 = Y0 (Default)
1 = Y1

S22 - Speaker/Results Bit Mapped Options Status

Indicates the status of command options.

Default: 117

Bits0-1 : Speaker volume (Ln)
0 = Off (L0)
1 = Low (L1) (Default)
2 = Medium (L2)
3 = High (L3)

Bits2-3 : Speaker control (Mn)
0 = Disabled (M0)
1 = Off on carrier (M1) (Default)
2 = Always on (M2)
3 = On during handshake (M3)

Bits4-6 : Limit result codes (Xn)
0 = X0
4 = X1
5 = X2
6 = X3
7 = X4 (Default)

Bit7 : Reserved

S23 - General Bit Mapped Options Status

Indicates the status of command options.

Default: 54

Bit0 : Grant RDL
0 = RDL not allowed (&T5) (Default)
1 = RDL allowed (&T4)

Bits1-3 : DTE Rate
0 = 0-300 bps 4 = 4800 bps
1 = 600 bps 5 = 9600 bps
2 = 1200 bps 6 = 19200 bps
3 = 2400 bps 7 = 38400 bps or higher

Bits4-5 : Assumed DTE parity
0 = even
1 = not used
2 = odd
3 = none (Default)

Bits6-7 : Guard Tone (&Gn)
0 = None (&G0) (Default)
1 = None (&G1)
2 = 1800 Hz (&G2)

S24 - 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.

Range: 0-255 seconds Default: 0

S25 - Delay to DTR

Set 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.

Range: 0-255 Default: 5

S26 - RTS to CTS Delay

Sets the time delay, in hundredths of a second, before the modem turns CTS ON after detecting an OFF-to-ON transition on RTS when &R0 is commanded.

Range: 0-255 hundredths of a second Default: 1

S27 - Bit Mapped Options Status

Indicates the status of command options.

Default: 9

Bits0,1,3 : 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 = &Q4
	1	0	1 = &Q5 (Default)
	1	1	0 = &Q6

Bit2 : Leased line control (&Ln)
0 = Dial up line (&L0) (Default)
1 = Leased line (&L1)

Bits4-5 : Internal Clock select (&Sn)
0 = Internal clock (&X0) (Default)
1 = External clock (&X1)
2 = Slave clock (&X2)

Bit6 : CCITT/Bell mode select (Bn)
0 = CCITT mode (B0) (Default)
1 = Bell mode (B1)

Bit7 : Reserved

S28 - Bit Mapped Options Status

Default: 0

Bits0-1 : Reserved

Bit2 : Reserved (always 0)

Bits3-4 : Pulse dialing make/break ratio (&Pn)
0 = 39%-61% ratio at 10 pulses per second (&P0) (Default)

1 = 33%-67% ratio at 10 pulses per second (&P1)
 2 = 39%-61% ratio at 20 pulses per second (&P2)
 3 = 33%-67% ratio at 20 pulses per second (&P3)
 Bit5 : Reserved
 Bits6-7 : MNP Link Negotiation Speed (*Hn)
 0 = Link negotiation at highest speed (*H0) (Default)
 1 = Link negotiation at 1200 bps (*H1)
 2 = Link negotiation at 4800 bps (*H2)

S29 - Flash Dial Modifier Time

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

Range: 0-255 10 ms intervals Default: 0(disabled)

S30 - Disconnect Inactivity Timer

Sets the length of time in tens of seconds, that the modem will stay on line before disconnecting when no data is sent or received.

Range: 0-255 tens of seconds (0-2550 seconds) Default: 0 (disabled)

S31 - Bit Mapped Options Status

Default: 2
 Bit0 : Reserved
 Bit1 : Controls auto line speed detection (Nn)
 0 = Disabled (N0)
 1 = Enabled (N1) (Default)
 Bits2-3 : Controls error correction progress messages (Wn)
 0 = DTE speed only (W0) (Default)
 1 = Full reporting (W1)
 2 = DCE speed only (W2)
 Bits4-7 : Reserved

S32 - XON Character

Set the value of the XON character.

Range: 0-255, decimal Default: 17 (XON)

S33 - XOFF Character

Sets the value of the XOFF character.

Range: 0-255, decimal Default: 19 (XOFF)

S34-S35 - Reserved

S36 - LAPM Failure Control

Default: 7

Bits0-2 : 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.

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 = MNP connection is attempted and if it fails, a Normal mode connection is established. (Default)

Bits3-7 : Reserved

S37 - Desired Line Connection Speed

This register specifies the desired line connection speed.

Default: 0

Bits0-4 : Desired line connection speed.

0 = Automode 8 = V.32/32bis 4800bps

1-3 = 300bps 9 = V.32/32bis 9600bps

4 = Reserved 10 = V.32bis 12000bps

5 = V.22 1200bps 11 = V.32bis 14400bps

6 = V.22bis 2400bps 12 = V.32bis 7200bps

7 = V.23

Bits5-7 : Reserved

S38 - Delay Before Forced Hang Up

This register 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 register can be used to ensure that data in the modem buffer is sent before the modem disconnects.

1. 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.
2. 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.

Range: 0-255 seconds

Default: 20

S39 - Flow Control Bit Mapped Options Status

Default: 3
Bits0-2 : 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)
Bits3-7 : Reserved

S40 - General Bit Mapped Options Status

Indicates the status of command options.

Default: 105
Bit0-1 : MNP Extended Services (-Kn)
0 = Disable extended services (-K0)
1 = Enable extended services (-K1)
2 = Enable extended services (-K2)
Bit2 : Power Level Adjustment for Cellular Use ()Mn
0 = Auto-adjustment ()M0) (Default)
1 = Force adjustment ()M1)
Bits3-5 : Break Handling(\Kn)
0 = \K0
1 = \K1
2 = \K2
3 = \K3
4 = \K4
5 = \K5 (Default)
Bits6-7 : MNP Block size (\An)
0 = 64 chars (\A0)
1 = 128 chars (\A1) (Default)
2 = 192 chars (\A2)
3 = 256 chars (\A3)

S41 - General Bit Mapped Options Status

Indicates the status of the command options.

Default: 195
Bits0-1 : Compression Selection (%Cn)
0 = Disabled (%C0)
1 = MNP5 (%C1)
2 = V.42 bis (%C2)
3 = MNP5 and V.42 bis (%C3) (Default)
Bits2,6 : Auto retrain and fallback/fall forward (%En0
(bit6)(bit2)
0 0 = Retrain, fallback/fall forward
disabled (%E0) (Default)

	0	1 = Retrain enabled (%E1)
	1	0 = Fallback/fall forward enabled (%E2)
Bit3 :	Reserved	
Bit4 :	Block mode control (\Ln)	
	0	= Stream mode (\L0) (Default)
	1	= Block mode (\L1)
Bit5 :	Reserved	
Bit7 :	Enable fallback to V.22bis/V.22(-Qn)	
	0	= Disabled (-Q0)
	1	= Enabled (-Q1) (Default)

S46 - Data Compression Control

Controls selection of compression. The following actions are executed for the given values.

Range:	136 or 138	Default:	138
S46=136	Error correction protocol with no compression		
S46=138	Error correction protocol with compression. (Default)		

S48 - V.42 Negotiation Action

The V.42 negotiation process determines the capabilities of the remote modem. However, when the capabilities of the remote modem are known and negotiation is unnecessary, this process can be bypassed if so desired.

Range:	0,7, or 128	Default:	7
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.		

S82 - Break Handling Options

S82 is for compatibility purposes only, changing this register will not have any affect.

S86 - Call Failure Reason Code

When the modem issues a NO CARRIER result code, a value is written to this S-Register to help determine the reason for the failed connection. S86 records the first event that contributes to a NO CARRIER message. The cause codes are:

Range:	0,4,5,9,12,13, or 14		
Default:			
S86=0	Normal disconnect, no error occurred		
S86=4	Loss of carrier		
S86=5	V.42 negotiation failed to detect an error correction modem at the other end		
S86=9	The modems could not find a common protocol		
S86=12	Normal disconnect initiated by the remote modem		
S86=13	Remote modem does not respond after 10 transmissions of the same message		
S86=14	Protocol violation		

S91 - PSTN Transmit Attenuation Level

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

Range: 0 to 15 dBm Default: 10(-10 dBm)

S92 - Fax Transmit Attenuation Level

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

Range: 0 to 15 dBm Default: 10(-10dBm)

S95 - Extended Result Codes

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

Default: 0

- Bit1 : CONNECT result code indicates DCE speed instead of DTE speed
- Bit2 : Append/ARQ to CONNECT XXXX result code in error correction mode.
- Bit2 : Enable CARRIER XXXX result code.
- Bit3 : Enable PROTOCOL XXXX result code.
- Bit4 : Reserved
- Bit5 : Enable COMPRESSION result code.
- Bit6 : Reserved
- Bit7 : Reserved

S201 - Cellular Transmit Level

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

Default: 32

- Bits0-4 : Initial Cellular Power Level Setting
- Bit5 : Compromise Equalizer Enable Command
- Bit6 : Reserved
- Bit7 : Reserved

CERTIFICATIONS

FCC Part 68

This equipment complies with U.S. Code of Federal Regulations, Title 47, FCC Rules and Regulations Part 68. Located on the equipment is the FCC Registration Number and Ringer Equivalence Number (REN). You must provide this information to the telephone company if requested.

The Registration Number and REN will be on a label attached to the unit. The FCC requires these numbers be prominently displayed on an outside surface of the equipment.

The REN is used to determine the number of devices you may legally connect to your telephone line. In most areas, the sum of the REN of all devices connected to one line must not exceed five (5.0). You

should contact your telephone company to determine the maximum REN for your calling area. The telephone company may change technical operations or procedures affecting your equipment. You will be notified of changes in advance to give you ample time to maintain uninterrupted telephone service.

If you experience trouble with this telephone equipment, please contact StarComm Products, Inc. at (714) 899 - 7855 for information on obtaining service or repairs. The telephone company may ask that you disconnect this equipment from the network until the problem has been resolved. If your equipment continues to disrupt the network, the telephone company may temporarily disconnect service. If this occurs you will be informed of your right to file a complaint with the FCC.

This equipment may not be used on coin service provided by the telephone company. Connection to party lines is subject to state tariffs.

FCC Part 15

This equipment has been tested and complies with the limits for a Class A computing device according to U.S. Code of Federal Regulations, Title 47, FCC Rules and Regulations Part 15. Operation is subject to the following two conditions:

- (1) This device may cause harmful interference, and
- (2) This device must accept any interference received, including interference that may cause undesired operation.