V.34 and V.32bis Data/Fax Modems

STAR Comm

11-1006-002

# TABLE OF CONTENTS

INTRODUCTION

This manual covers configuration and operation of all V.34 and V.32bis external and rack mount models. Since many features discussed in this manual are optional, it is important to verify the specific configuration of your device before proceeding with installation and configuration. It is suggested that you use the **AT&V** command to verify the capabilities of your device. If the commands associated with an optional feature are displayed on the last line of your active profile, that feature exists in your device.

FRONT PANEL LIGHTS

MR	Modem Ready	**OH**	Off Hook
TR	Terminal Ready	**CD**	Carrier Detect
SD	Send Data	**AA**	Auto Answer
RD	Receive Data	**HS**	High Speed

BACK PANEL CONNECTORS

LINE   This RJ-11 connector should be used to connect the modem to a normal dial circuit or a dedicated 2-wire leased circuit. For those models with the optional 4-wire leased circuit interface, please refer to the following diagram:
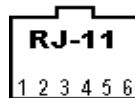
Transmit Pins (TX) = Pins #3 & 4
Receive Pins (RX) = Pins #2 & 5

PHONE   This RJ-11 connector is not present on all models. The phone jack directly parallels the line connector and allows another device to be connected to the same line as the modem. This connector is not installed on rack mount versions.

RS-232-C   This connector provides a standard RS-232-C(V.24) interface between the modem and a wide range of DTE. The following signals are provided.

PIN #	SIGNAL DESCRIPTION	SOURCE	NOTES
1	Frame ground	DTE/DCE	
2	Transmit Data	DTE	(SD light on front panel)
3	Receive Data	DCE	(RD light on front panel)
4	Request To Send	DTE	
5	Clear To Send	DCE	
6	Data Set Ready	DCE	(MR light on front panel)
7	Signal Ground	DTE/DCE	
8	Carrier Detect	DCE	(CD light on front panel)
12	Speed Indicator	DCE	
15	DCE Transmit Clock	DCE	
17	DCE Receive Clock	DCE	
20	Data Terminal Ready	DTE	(TR light on front panel)
22	Ring Indicator	DCE	
24	DTE Transmit Clock DTE		(See &Xn command)

DUMB MODE Next to the RS-232-C connector is a two pin header. When the pins of this connector are not connected (default), the modem operates in smart mode. When they are connected, the modem operates in dumb mode. For more detail, please refer to the dumb mode section of this manual.

POWER This connector is present on all stand alone models and accepts a 9VAC or 9–14VDC power source. On rack mount versions, a different power connector is used and it provides DC voltages to the modem from the rack back plane. **CAUTION:** Several DC power options are available for special applications. Modems equipped with special power options will contain specifications that supersede the power specifications of this paragraph.

POSITIVE Voltage
NEGATIVE Voltage

NEGATIVE Voltage
POSITIVE Voltage
FRAME GROUND
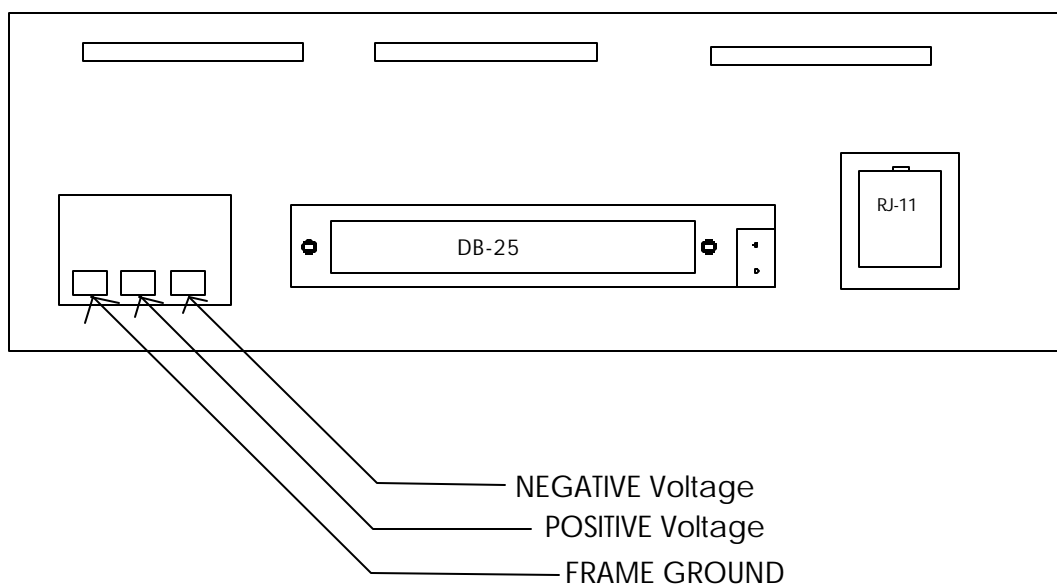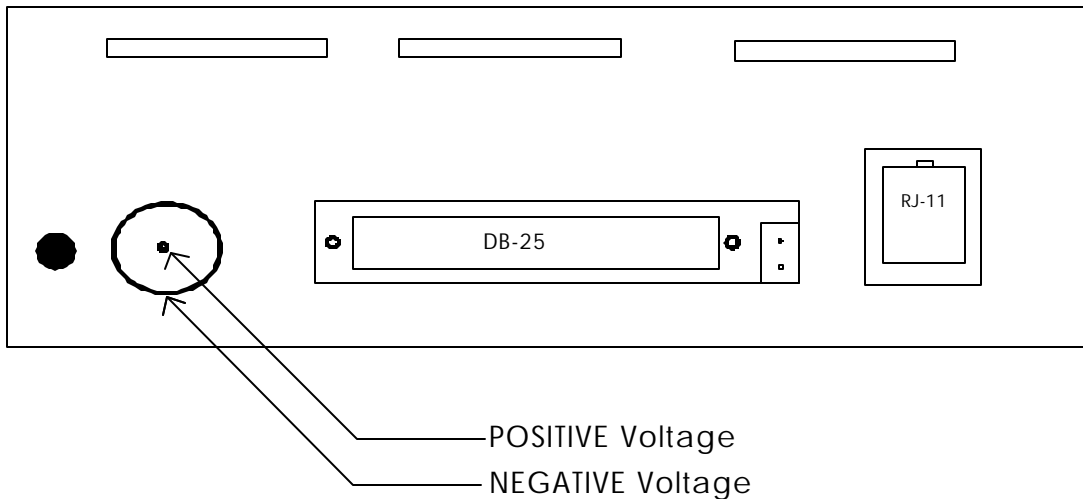
Command Guidelines
The basic AT commands used to control modem operation are defined in this section. Under AT operation, the modem performs autobaud, autoparity and autolength functions on each header entered. The autoparity and autolength facilities can detect 7 or 8-bit characters of even, odd, or 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. (Default)

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.

Hn - Disconnect (Hang-Up)

This command initiates a hang up sequence.

     HO   The modem will release the line if the modem is currently on-line, and will terminate any test that is in progress.

     H1   If on-hook, the modem will go off-hook and enter command mode.

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 the DAA code resulting from MCU interrogation of the DAA for auto DAA recognition.

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).

On - Return to On-Line Data Mode
This command determines how the modem will enter the on-line data mode.

O0	Enters on-line data mode, without a retrain.
O1	Enters on-line data mode with a retrain.

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. (Default)
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.

&C0   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.

&D0   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. (Default)
&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.

&Jn - Telephone Jack Control
This command is only included for compatibility and performs no function except to load the S-Register.

&J0   &J0 command. (Default)
&J1   &J1 command.

&Kn - Flow Control
This command defines the DTE/DCE (terminal/modem) flow control mechanism.

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

&Ln - Leased Line Operation
This command selects dial up or leased line operation.

&L0   Selects dial up operation.
&L1   Selects leased line operation.

&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.

\Fn - Set Answer or Originate Mode

In dial operation the answering modem typically assumes answer responsibility and the calling modem assumes originate responsibility. In leased line operation where there is no implied calling or answering modem, the relationship must be established with this command. Please note that setting the modem to answer mode is not the same as setting the modem to auto-answer mode. S register 0 must still be set for auto-answer dial operation.

\F0   Sets modem to answer mode.
\F1   Sets modem to originate mode.

\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.

\Hn - Auto-Connect

In many cases where the dumb mode of operation is required, it is necessary for the modem to be configured so that it constantly attempts to go off hook and connect as configured. This is necessary for leased line operation or for operation with an external manual dialer. This command allows that to occur.

\H0   Normal dial/answer operation under AT command control. (Default)
\H1   Modem constantly attempts to go off hook and connect as configured.

\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 states. The first state is where the modem receives a break from the DTE when the modem is 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 is where 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 is where 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 a string of 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 a string of 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 remains 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 @31 correspond to -11dBm to -31 dBm, respectively.

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

0- OK	14- CONNECT 12000
1- CONNECT	15- CONNECT 14400
2- RING	16- CONNECT 19200
3- NO CARRIER	17- CONNECT 38400
4- ERROR	18- CONNECT 57600
5- CONNECT 1200	19- CONNECT 115200
6- NO DIALTONE	22- CONNECT 75TX/1200RX
7- BUSY	23- CONNECT 1200TX/75RX
8- NO ANSWER	24- DELAYED
9- CONNECT 0600	32- BLACKLISTED
10- CONNECT 2400	33- FAX
11- CONNECT 4800	35- DATA
12- CONNECT 9600	40- CARRIER 300
13- CONNECT 7200	44- CARRIER 1200/75

45- CARRIER 75/1200	61- CONNECT 21600
46- CARRIER 1200	62- CONNECT 24000
47- CARRIER 2400	63- CONNECT 26400
48- CARRIER 4800	64- CONNECT 28800
49- CARRIER 7200	66- COMPRESSION: CLASS 5
50- CARRIER 9600	67- COMPRESSION: V.42 bis
51- CARRIER 12000	69- COMPRESSION: NONE
52- CARRIER 14400	70- PROTOCOL: NONE
53- CARRIER 16800	77- PROTOCOL: LAPM
54- CARRIER 19200	78- CARRIER 31200
55- CARRIER 21600	79- CARRIER 33600
56- CARRIER 24000	80- PROTOCOL: ALT
57- CARRIER 26400	81- PROTOCOL: ALT-CELLULAR
58- CARRIER 28800	84- CONNECT 33600
59- CONNECT 16800	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 one of the two user profiles by entering the &Wn command. One of these profiles may be loaded at any time by using the Zn command. Registers or register fields quoted as "reserved" are reserved for current or future use. 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	*	0
S1	Ring Counter	0-255	rings		0
S2	Escape Character	0-255	ASCII	*	43
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

Register	Function	Range	Units	*	Default
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: 0

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

S2 - Escape Character

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

Range: 0-255, decimal   Default: 43(+)

S3 - Carriage Return Character

Sets the command line and result code terminator character.

Range: 0-127, decimal   Default: 13 (Carriage Return)

S4 - Line Feed Character

Sets the character recognized as a line feed.

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

S5 - Backspace Character

Sets the character recognized as a backspace.

Range: 0-255, decimal   Default: 8 (Backspace)

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, even if the value of S6 is less than two seconds.

Range: 2-255 seconds   Default: 2

S7 - Wait Time for Carrier After Dial, For Silence, or For Dial Tone After "W" Dial Modifier

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

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

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

DUMB MODE OF OPERATION

On the back of the modem, there is a two pin jumper located next to the V.24(RS-232-C) DB-25 connector. When the two pins on that jumper are connected together, the modem will then operate in dumb mode.

In dumb mode, the modem will operate as though it has no command mode. When the modem is powered on or reset, it will go directly into the mode of operation that it has been configured for. The dumb mode of operation is necessary for leased line and a range of special dial applications where the DTE expects the modem to have no command mode.

To place the modem in dumb mode, it is necessary to first configure the modem to the specific requirements of a particular application. Next, the configuration must be saved. Once the configuration has been saved,

install the dumb mode jumper and then cycle power on the modem. It will then be in dumb mode. If it becomes necessary to reconfigure the modem, remove the dumb mode jumper and cycle power on the modem. It will then be in command mode.

LEASED LINE OPERATION

All modems are factory configured to operate on 2-wire dial and 2-wire leased circuits. If you are configuring a modem for 2-wire leased line operation, please disregard the following paragraph on setting jumpers for 4-wire operation and proceed to the standard setup paragraph.

SETTING JUMPERS FOR 4-WIRE OPERATION – If your modem is equipped with the optional 4-wire interface, you must change one internal jumper to enable 4-wire operation. Once this jumper has been changed, the modem will not operate on 2-wire dial or leased circuits. To change the jumper setting, remove the 2 screws in the modem case bottom and remove the upper half of the modem case. Hold the modem so that the LEDs are facing toward you and the connectors are facing away from you. Locate J7 on the left side of the modem board. You will find that the 2 right pins of this 3 pin jumper are connected together with a removable shunt. Remove the shunt and place it over the 2 left pins of this 3 pin header. The modem is now in 4-wire mode and you may proceed to the standard setup paragraph that follows.

STANDARD SETUP FOR 2 AND 4-WIRE LEASED LINE OPERATION – In leased line mode, you may configure the modem to operate with either asynchronous or synchronous DTE. In order to configure the modem for leased line operation, it is necessary to use the following commands in your configuration string:

      Originate End: &L1\H1\F1s7=200[*user specific parameters*]&W
      Answer End: &L1\H1\F0s7=25[*user specific parameters*]&W

In the user specific section of each command string, commands may be entered to match the modem to the specific requirements of the attached DTE. Parameters such as synchronous operation, asynchronous operation, error correction, compression and flow control may be defined here. Once the modems have been configured, they must be placed in dumb mode and power must then be cycled.

ADJUSTING TRANSMIT POWER FOR LEASED LINE OPERATION – It is possible to adjust transmit power on all leased line models; however, improper adjustment could result in extremely poor performance. Please contact our technical support group if you feel adjustments are necessary for your application.

REMOTE CONFIGURATION

Modems equipped with the remote configuration option offer several commands that enable a remote user to completely manage and configure them. You may dial into a modem that has remote configuration enabled and enter online command mode on that device by typing a standard 3 character escape sequence. 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. It is recommended that a unique escape character be set in S register 2 of devices with remote configuration enabled. Otherwise, the local modem and remote modem will both enter online command mode when the escape sequence is entered. For this reason, all modems with the remote configuration option, set S register 2 to a default value of 126, which is the ASCII character tilde (~).

The remote configuration option also provides several commands to set DTE speed and character format.

These commands are extremely useful when installing modems on remote equipment that cannot issue the AT commands necessary for autobaud to occur. In such cases, it is possible to dial into the modem and remotely configure all parameters, including character format and DTE bit rate.

\Rn   - Enable/Disable Remote Configuration

When remote configuration is enabled, the modem will respond to a standard 3 character escape sequence from the calling modem. When the escape sequence is recognized, the modem will go into online command mode and allow the caller to issue any valid AT command. Please note that modems equipped with remote configuration, set S register 2 (the escape character) to a default value of 125, which is the ASCII character tilde (~).

\R0	Disable remote configuration.
\R1	Enable remote configuration.

\Cn   - Select DTE Character Format

This command forces the modem to operate with 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 (default)		\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

PASSWORD AND CALLER ID SECURITY

PROTECTION OPTIONS - Password protection, Caller ID protection and a combination of both protection methods are available as options in certain models. Both security methods have been implemented for controlling access to the modem 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. 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:
1. Level One Passwords or Caller IDs may only access the DTE attached to the modem. They are not allowed access to remote configuration and password maintenance.
2. Level Two Passwords or Caller IDs may access the DTE attached to the modem and may also

perform remote configuration and password maintenance.

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 – Models equipped with Password protection or Caller ID protection, also include facilities for 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.

AT\E   - Erase Audit Trail
This command will erase the current contents of the audit trail and initialize it to an empty state.

AT\I+nnnnnnnnnn,l   - Add Caller ID and Level

nnnnnnnnnn = Caller ID (1 – 10 numeric characters)
l = Level (1 = normal, logon only)
(2 = special. Logon + remote configuration)
(3 = for use by Device Management Software)

AT\I-nnnnnnnnnn   - Delete Caller ID

AT\I-*   - Delete All Caller IDs

AT\I?   - Display All Caller IDs
Provides a report of all Caller IDs and levels in the following format:

CALLER ID	LEVEL
nnnnnnnnnn	1
nnnnnnnnnn	2
nnnnnnnnnn	1

AT\O   - 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:

DATE	TIME	PASSWORD	STATUS
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	nnnnnnnnn	APPROVED
mm/dd/yy	hh:mm:ss	nnnnnnnnn	DENIED

<MORE - press ENTER to continue - >

AT\P+nnnnnnnnn,l   - Add Password and Level

nnnnnnnnn = Password (1 – 10 alphanumeric characters)
          l = Level (1 = normal, logon only)
                     (2 = special. Logon + remote configuration)
                     (3 = for use by Device Management Software)

AT\P-nnnnnnnnn   - Delete Password

AT\P-*   - Delete All Passwords

AT\P?   - Display All Passwords
Provides a report of all Passwords and levels in the following format

PASSWORD	LEVEL
nnnnnnnnn	1
nnnnnnnnn	2
nnnnnnnnn	1

AT\Sn   – 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 (default)
\S2	ON	PROMPT	OFF	N/A
\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

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

AT\T?   - Display Time and Date

LOW POWER OPERATION

STANDARD POWER CONSERVATION - All models offer a reduced power standby mode which is controlled by the timer value in S Register 24. On all standard models, this timer allows major current

consuming circuitry of the modem to go into a low power sleep mode if there is no activity.

OPTIONAL LOW CURRENT STANDBY CAPABILITIES- In addition to the standard power conservation features described above, several special models are available for applications, such as solar installations, that have extremely limited power reserves. On these special models, the value of S Register 24 still controls when the modem will go into low power sleep mode. However, these special models include circuitry that will allow the modem to completely power down during sleep mode. In this power down sleep mode, the device will draw approximately 5ma of standby current. When a ring signal is detected on the telephone circuit, the device will return to an operational state.

OPTIONAL CONTACT CLOSURE FOR CONTROL OF OTHER DEVICES - Models equipped with the optional power down sleep mode also include an internal relay with one set of normally open and one set of normally closed contacts. This relay is rated for a maximum current of 1 ampere and a maximum voltage of 48 volts. When the modem is in an operational state, this relay is energized. When the modem goes into power down sleep mode, this relay is de-energized. The contacts of the internal relay are available on a 3 pin connector (J6) which is located inside the modem case. With the top of the modem case removed, hold the modem so that the LEDs are facing to your left and the connectors are facing to your right. The middle pin of J6 is common, the right pin is normally open during sleep mode and the left pin is normally closed during sleep mode.

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.