AT Command Reference Manual for the RC144ACi/ATi, RC144ACL/ATL, RC144ACF/ATF, RC144ACFL/ATFL, and RC144ACG Modem Families (Preliminary)

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PREFACE

Revision 3 to this document incorporates the following:

1.   Revision of the Voice Commands Section to Voice/Audio Commands Section (Section 8) to support modem models with speakerphone capability.

2.   Addition of Enable/Disable RPI and DTE Speed (+Hn) command to support ATi, ATF, and ATFL models.

3.   Addition of Enable/Disable Distinctive Ring (-SDR=n) command.

4.   Addition of Enable/Disable MNP10-EC (-SEC=n) command.

5.   Deletion of functions not supported in current release of MCU firmware.

6.   General corrections.

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1. INTRODUCTION

1.1. OVERVIEW

This manual describes the AT commands for the following Rockwell modem families:

RC144ACi and RC144ATi
RC144ACL and RC144ATL
RC144ACG
RC144ACF and RC144ATF
RC144ACFL and RC144ATFL
RCV144ACi/SP

The descriptions apply to all these modems with any differences between modem product families noted. Refer to MCU FIrmware Release notes for the exact applicable commands to modem firmware.

Voice/Audio Mode operation in business audio products require use of the Proprietary Rockwell High Speed Interface (RHSI) included in the modem MCU firmware and use of an RHSI compatible communication software driver (RHSICOMM.DRV) in the host computer when operating in the Microsoft Windows environment.

ATi, ATL, ATF, and ATFL models support error correction and data compression (ECC) performed by the host CPU and communications software for Windows using the enhanced Rockwell Windows Protocol Interface (RPI or RPI+™) and WinRPI host software module.

1.1.1. Command Syntax

The fundamental DTE interface command syntax is described in Section 2.

1.1.2. Command Descriptions

These commands are grouped into the following categories:

AT commands   Section 3
S-Registers   Section 4
Fax Class 1 commands   Section 5
Fax Class 2 commands   Section 6
Voice/Audio commands   Section 7

The AT commands are implemented in microcontroller (MCU) firmware for specific modem models. The support for a command category is identified by modem model in the modem designer's guide. Additional configuration and implementation information is available in release notes and/or readme files that accompany MCU firmware release.

1.1.3. Call Progress and Blacklisting Parameters

The modem MCU firmware may be provided either in reconfigurable form or preconfigured form. Consult the specific firmware release notes for exact configuration information.

Reconfigurable Form. The modem MCU firmware can be configured for operation in specific countries by the PC-compatible ConfigurACE II program. The call progress and blacklisting parameters described in the ConfigurACE II User's Manual can be altered and loaded for a number of countries by this program.

Preconfigured Form. Specific MCU firmware configurations may be released that can be directly installed without requiring the use of ConfigurACE II.

1.1.4. ConfigurACE II

The ConfigurACE II User's Manual describes the use of ConfigurACE II and the country modifiable parameters. Consult any readme files accompanying the ConfigurACE II program for additional or later information.

1.2. REFERENCE DOCUMENTATION

Order No.	Description
MD86	RC144ACi and RC144ACL Modem Data Sheet
MD108	RC144ACG Modem Data Sheet
MD95	RC144ATi and RC144ATL Modem Data Sheet
MD129	RC144ACF and RC144ATF Modem Data Sheet
MD130	RC144ACFL and RC144ATFL Modem Data Sheet
MD137	RCV144ACi/SP Modem Data Sheet
876	RC144ACi and RC144ACL Modem Designer's Guide
897	RC144ATi and RC144ATL Modem Designer's Guide
1008	RC144ACG Modem Designer's Guide
1027	RC144ACFL and RC144ATFL Modem Designer's Guide
1055	RC144ACF and RC144ATF Modem Designer's Guide
893	ConfigurACE II User's Manual

2.   COMMAND SYNTAX

2.1.   DTE/DCE INTERCHANGE CIRCUITS

Communication between the DTE and modem is half duplex (i.e., only one entity 'talks' at a time).

2.2.   COMMAND SYNTAX AND GUIDELINES

2.2.1.   DTE Commands

The ISO 646 character set (CCITT T.50 International Alphabet 5, American Standard Code for Information Interchange) is used for the issuance of commands and responses. Only the low-order 7 bits of each character are used for commands or parameters; the high-order bit is ignored. Upper case characters are equivalent to lower case characters.

2.2.2.   DTE Command Lines

A command line is a string of characters sent from a DTE to the DCE while the DCE is in a command state. Command lines have a prefix, a body, and a terminator. The prefix consists of the ASCII characters "AT" (065, 084) or "at" (097, 116). The body is a string of commands restricted to printable ASCII characters (032 - 126). Space characters (ASCII 032) and control characters other than carriage return <CR> (default value = ASCII 013 = 0Dh, see register S3), backspace <BS> (default value = ASCII 008 = 08h, see register S5), and cancel <cntrl-x> (ASCII 024 = 18h) in the command string are ignored. The default terminator is the <CR> character. Characters that precede the AT prefix are ignored.

2.3.   AT COMMAND GUIDELINES

Modem operation is controlled by generic AT commands. These AT commands may be basic AT (i.e., commands preceded by AT, AT&, AT%, AT*, AT\, AT), AT-, or AT#), S-Register (e.g., S6=n), Fax class 1 (e.g., +FTM), Fax class 2 (e.g., +FDCS:), or voice (e.g., #VBS) commands. The command syntax and operation guidelines governing each of these command categories are described in subsequent sections.

2.3.1.   Basic Command Syntax

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, followed by a decimal parameter (e.g., "&D1"). Missing decimal parameters are evaluated as 0.

2.3.2.   Extended Command Syntax

The facsimile commands use extended syntax. They are preceded by the "+F" characters, and they are terminated by the semicolon ":" character (ASCII 059) or by the <CR> that terminates the command line.

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3.   AT COMMAND SET

3.1.   AT COMMAND GUIDELINES

The basic AT commands used to control modem operation are defined in this section. These commands are summarized in Appendix A. All these commands may not be available in a specific product depending upon supported data rates and modes. The default values are typical of a fully configured modem supporting all data rates and options. The actual default value is dependent upon modem firmware as defined by the firmware release notes.

3.1.1.   AT Commands, DTE Adaption

Under AT operation, the serial interfaced modem performs an autobaud/autoparity/autolength function on each AT header entered. The autolength/autoparity facility can detect 7- or 8-bit characters of even, odd, or no parity with one stop bit. This is not necessary for the parallel interfaced modem since it has direct access to the UART registers.

3.1.2.   AT 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. Commands entered in upper case or lower case are accepted, but both the A and T must be of the same case, i.e., "AT" = ASCII 065, 084 or "at" = ASCII 097, 116. The body is a string of commands restricted to printable ASCII characters (032 - 126). Space characters (ASCII 032) and control characters other than CR (ASCII 013) and BS (ASCII 010) in the command string are ignored. The default terminator is the ASCII <CR> character. Characters that precede the AT prefix are ignored. The command line interpretation begins upon receipt of the carriage return character.

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 modem supports the editing of command lines by recognizing a backspace character. When modem echo is enabled, the modem responds to receipt of a backspace or delete by echoing a backspace character, a space character, and another backspace. The hex value to be used for the backspace character is programmable through register S5. Values equal to 0 or greater than 127, or the value which corresponds to the carriage return character, cannot be used for the backspace character. This editing is not applicable to the AT header of a command. A command line may be aborted at any time by entering < cntrl-x > (18h).

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.

Most commands entered with parameters out of range will not be accepted and the ERROR response will be returned to the DTE.

Commands will only be accepted by the modem once the previous command has been fully executed, which is normally indicated by the return of an appropriate result code. Execution of commands D and A, either as a result of a direct command or a re-execute command, will be aborted if another character is entered before completion of the handshake.

3.1.3.   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 the DTE sending to the modem a sequence of three ASCII characters specified by register S2. The default character is '+'. The maximum time allowed between receipt of the last character of the three escape character sequence from the DTE and sending of the OK result code to the DTE is controlled by the S12 register.

3.2. AT COMMAND SET

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 the Rockwell factory profile 0.

3.2.1. 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.

The principal application of this command is to place another call (using the Dial command) that failed to connect due to a busy line, no answer, or a wrong number. This command must appear alone on a command line. This command should not be terminated by a carriage return.

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. All of the S-Registers will return the OK response if x is a number. Some registers may not be written due to country specific PTT limitations.

Result Codes

      OK   For all arguments.

AT? - Read Selected S-Register

This command reads and displays the selected S-Register. An S-Register can be selected by using the ATSn command.

Result Codes:

      OK   For all arguments.

A - Answer

The modem will go off-hook and attempt to answer an incoming call if correct conditions are met. Upon successful completion of answer handshake, the modem will go on-line in answer mode. This command may be affected by the state of Line Current Sense, if enabled. (Most countries do not require Line Current Sense.) Operation is also dependent upon +FCLASS command and country-specific requirements.

If +FCLASS=0 is selected, the modem will enter the connect state after exchanging carrier with the remote modem. If no carrier is detected within a period specified in register S7, the modem hangs up. Any character entered during the connect sequence will abort the connection attempt.

If +FCLASS=1 or 2 is selected, the modem will go off-hook in V.21 answer mode. It will generate the V.21 2100 Hz answer tone for 3 ± 0.5 seconds and, following a delay of 70 ms, will proceed as if the +FTH=3 command were issued. At any stage up to (but excluding) the +FTH=3 command state, any character will abort the communication. (See the description of the +FTH command for details.)

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. The parameter value, if valid, is written to S27 bit 6. (Also, see ATFn command.)

      B0   Selects CCITT operation at 300 or 1200 bps during Call Establishment and a subsequent connection. (Default for W-class models.)

      B1   Selects BELL operation at 300 or 1200 bps during Call Establishment and a subsequent connection. (Default for US models.)

Result Codes:

      OK   n = 0 or 1.
      ERROR   Otherwise.

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.

Result Codes:

OK	n = 1.
ERROR	Otherwise.

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. In W-class models, the action of going off-hook is affected by the status of the Line Current Sense input, if line current sensing is enabled, and by the blacklist and delayed list. **NOTE:** If the ATD command is issued before the S1 register has cleared, the modem will respond with the NO CARRIER result code.

If +FCLASS=0 is selected, the modem will behave as a data modem and will attempt to connect to another data modem. The modem will have up to the period of time specified by register S6 or S7 to wait for carrier and complete the handshake. If this time expires before the modem can complete the handshake, the modem will go on-hook with the NO CARRIER response. This command will be aborted in progress upon receipt of any DTE character before completion of the handshake.

If +FCLASS=1 or 2 is selected, the modem will behave as a facsimile modem and attempt to connect to a facsimile machine (or modem) by entering the HDLC V.21 channel 2 receive state (as if +FRH=3 had been issued). This command will be aborted upon receipt of any DTE character if the modem has not finished dialing. In this case, the modem will go on-hook and return to command mode after displaying the NO CARRIER message. If the modem has finished dialing, it proceeds as if the +FRH=3 command has been issued. (Refer to the +FRH command to determine how the modem behaves following this stage.)

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. Some countries may prohibit sending of these digits during dialing.
J	Perform MNP 10 link negotiation at 1200 bps (for this call only). (See *H.)
K	Enable power level adjustment during MNP 10 link negotiation (for this call only). (See)Mn.)
L	Re-dial last number: the modem will re-dial the last valid telephone number. The L must be immediately after the D with all the following characters ignored).
P	Select pulse dialing: pulse dial the numbers that follow until a "T" is encountered. Affects current and subsequent dialing. Some countries prevent changing dialing modes after the first digit is dialed.
T	Select tone dialing: tone dial the numbers that follow until a "P" is encountered. Affects current and subsequent dialing. Some countries prevent changing dialing modes after the first digit is dialed.
R	This command will be accepted, but not acted on.
S=n	Dial the number stored in the directory (n = 0 to 3). (See &Z.)
!	Flash: the modem will go on-hook for a time defined by the value of S29. Country requirements may limit the time imposed.
W	Wait for dial tone: the modem will wait for dial tone before dialing the digits following "W". If dial tone is not detected within the time specified by S7 (US) or S6 (W-class), the modem will abort the rest of the sequence, return on-hook, and generate an error message.

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

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

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

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

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

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

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

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

<i> Invalid character: will be ignored.

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

En - Command Echo

The modem enables or disables the echo of characters to the DTE according to the parameter supplied. The parameter value, if valid, is written to S14 bit 1.

E0 Disables command echo.

E1 Enables command echo. (Default.)

Result Codes:

OK n = 0 or 1.

ERROR Otherwise.

Fn - Select Line Modulation

This command selects the line modulation according to the parameter supplied. The line modulation is fixed unless Automode is selected. This command interacts with the S37 and the N command. The parameter value, if valid, is written to S37 bits 0-4. To select line modulation, it is recommended that either the F command, or a combination of the S37 and the N command, be used, but not both.

F0	Selects auto-detect mode. Sets N1 and sets S31 bit 1. In this mode, the modem configures for automode operation. All connect speeds supported by the modem are possible according to the remote modem's preference. The contents of S37 are ignored as is the sensed DTE speed.
F1	Selects V.21 or Bell 103 according to the B setting as the only acceptable line speed resulting in a subsequent connection. Sets N0, sets S37 to 1, and clears S31 bit 1. This command is equivalent to the command string: ATN0S37=1.
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 1200 bps. Sets N0, sets S37 to 7, and clears S31 bit 1. This command is equivalent to the command string: ATN0S37=7.
F4	Selects V.22 1200 or Bell 212A according to the B command setting as the only acceptable line speed for a subsequent connection. Sets N0, sets S37 to 5, and clears S31 bit 1. This command is equivalent to the command string: ATN0S37=5.
F5	Selects V.22 bis as the only acceptable line modulation for a subsequent connection. Sets N0, sets S37 to 6, and clears S31 bit 1. This command is equivalent to the command string: ATN0S37=6.
F6	Select V.32 bis 4800 or V.32 4800 as the only acceptable line modulation for a subsequent connection. Sets N0, sets S37 to 8, and clears S31 bit 1. This command is equivalent to the command string: ATN0S37=8.
F7	Selects V.32 bis 7200 as the only acceptable line modulation for a subsequent connection. Sets N0, sets S37 to 12, and clears S31 bit 1. This command is equivalent to the command string: ATN0S37=12.

This setting also allows connection at the Rockwell proprietary 7200 V.32 speed, e.g., with a RC9696/12 based modem. |
| F8 | Selects V.32 bis 9600 or V.32 9600 as the only acceptable line modulations for a subsequent connection. Sets N0, sets S37 to 9, and clears S31 bit 1. This command is equivalent to the command string: ATN0S37=9. |
| F9 | Selects V.32 bis 12000 as the only acceptable line modulation for a subsequent connection. Sets N0, sets S37 to 10, and clears S31 bit 1. This command is equivalent to the command string: ATN0S37=10.

This setting also allows connection at the Rockwell proprietary 12000 V.32 speed, e.g., with a RC9696/12 based modem. |
| F10 | Selects V.32 bis 14400 as the only acceptable line modulation for a subsequent connection. Sets N0, sets S37 to 11, and clears S31 bit 1. This command is equivalent to the command string: ATN0S37=11. |

Hn - Disconnect (Hang-Up)

This command initiates a hang up sequence.

This command may not be available for some countries due to PTT restrictions.

H0	The modem will release the line if the modem is currently on-line, and will terminate any test (AT&T) that is in progress. Country specific, modulation specific, and error correction protocol specific (S38) processing is handled outside of the H0 command.
H1	If on-hook, the modem will go off-hook and enter command mode. For US models, the modem will remain off-hook. For W-class models, the modem will return on-hook after a period of time determined by S7.

Result Codes:

OK	n = 0 or 1.
ERROR	Otherwise.

In - Identification

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

I0	Reports product code. Example: 14400
I1	Calculates the ROM checksum and reports the least significant byte of the checksum in decimal (see firmware release notes). Reports 255 if the prestored checksum value is FFh.
I2	Calculates the ROM checksum and compares it with the prestored checksum. Reports "OK" if the calculated checksum equals the prestored checksum or if the prestored checksum value is FFh; otherwise reports "ERROR".
I3	Reports the firmware version (F), basic model (ACX), application code (A), and interface type code (I) in the form VF.FFF-ACX_AI. The application codes are: D = Desktop, L = Low Power (PCMCIA). The interface type codes are: S = Serial, P = Parallel. Example: V1.200-ACL_DS
I4	Reports OEM defined identifier string in either Hayes-compatible binary format (default) or ASCII format (selectable by ConfigurACE). Example: RC144ACi (ASCII)
I5	Reports Country Code parameter. Example: 022
I6	Reports modem data pump model and internal code revision. Example: RC144DPL Rev 05BA

Result Codes:

OK	n = 0 to 7.
ERROR	Otherwise.

Ln - Speaker Volume

The modem sets the speaker volume control according to the parameter supplied. The parameter value, if valid, is written to S22 bits 0 and 1.

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

Result Codes:

OK	n = 0 to 3.
ERROR	Otherwise.

Mn - Speaker Control

This command selects when the speaker will be on or off. The parameter value, if valid, is written to S22 bits 2 and 3.

M0	Speaker is always off.
M1	Speaker is on during call establishment, but off when receiving carrier. (Default.)
M2	Speaker is always on.
M3	Speaker is off when receiving carrier and during dialing, but on during answering.

Result Codes:

OK	n = 0 to 3.
ERROR	Otherwise.

Nn - Automode Enable

This command enables or disables automode detection. The parameter value, if valid, is written to S31 bit 1.

N0	Automode detection is disabled. A subsequent handshake will be conducted according to the contents of S37 or, if S37 is zero, according to the most recently sensed DTE speed.
N1	Automode detection is enabled. A subsequent handshake will be conducted according to the automode algorithm supported by the modem. This command is equivalent to F0. (Default.)

Result Codes:

OK	n = 0 or 1.
ERROR	Otherwise.

On - Return to On-Line Data Mode

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

O0	Enters on-line data mode without a retrain. Handling is determined by the Call Establishment task. Generally, if a connection exists, this command connects the DTE back to the remote modem after an escape (+++).
O1	Enters on-line data mode with a retrain before returning to on-line data mode.

Result Codes:

OK	n = 0 or 1 and a connection exists.
ERROR	Otherwise or if not connected.

P - Set Pulse Dial Default

This command forces pulse dialing until the next T dial modifier or T command is received. Sets S14 bit 5.

As soon as a dial command is executed which explicitly specifies the dialing mode for that particular call (e.g., ATDT...), this command is overridden so that all future dialing will be tone dialed. (See T command.)

This command may not be permitted in some countries.

Result Code:

OK

Qn - Quiet Results Codes Control

The command enables or disables the sending of result codes to the DTE according to the parameter supplied. The parameter value, if valid, is written to S14 bit 2.

Q0   Enables result codes to the DTE. (Default.)

Q1   Disables result codes to the DTE.

Result Codes:

OK   n = 0 or 1.
ERROR   Otherwise.

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.

The parameter n can be omitted, in which case the last S-Register accessed will be assumed. The S can be omitted for AT= and AT?, in which case the last S-Register accessed will be assumed.

For example:

ATS7 establishes S7 as the last accessed register.

AT=40 sets the contents of the last register accessed to 40.

ATS=20 sets the contents of the last register accessed to 20.

If the number "n" is beyond the range of the S-Registers available, the modem will return the ERROR message. The value "v" is "MOD"ed with 256. If the result is outside the range permitted for a given S-Register the values will still be stored, but functionally the lower and higher limits will be observed. Input and output are always in decimal format. Note that some S-Registers are read-only.

In some cases, writing to the S-Register will appear to be accepted but the value will not actually be written.

Due to country restrictions, some commands will be accepted, but the value may be limited and replaced by a maximum or minimum value.

Minimum, maximum, and default values for S-Registers may be altered with ConfigurACE.

T - Set Tone Dial Default

This command forces DTMF dialing until the next P dial modifier or P command is received. The modem will set an S-Register bit to indicate that all subsequent dialing should be conducted in tone mode. Note that the DP command will override this command. Clears S14 bit 5.

This command may not be permitted in some countries. (See P.)

Result Code:

      OK

Vn - Result Code Form

This command selects the sending of short-form or long-form result codes to the DTE. The parameter, if valid, is written to S14 bit 3.

V0	Enables short-form (terse) result codes. Line feed is not issued before a short-form result code.
V1	Enables long-form (verbose) result codes. (Default.)

Result Codes:

OK	n = 0 or 1.
ERROR	Otherwise.

Wn - Connect Message Control

This command controls the format of CONNECT messages. The parameter value, if valid, is written to S31 bits 2 and 3. Note that the Wn command can be overridden by register S95 bits (see S95 description).

W0	Upon connection, the modem reports only the DTE speed (e.g., CONNECT 19200). Subsequent responses are disabled. (Default.)
W1	Upon connection, the modem reports the line speed, the error correction protocol, and the DTE speed, respectively. Subsequent responses are disabled.
W2	Upon connection, the modem reports the DCE speed (e.g., CONNECT 14400). Subsequent responses are disabled.

Result Codes:

OK	n = 0, 1, or 2.
ERROR	Otherwise.

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.

Blind dialing is enabled or disabled by country parameters. If the user wishes to enforce dial tone detection, a "W" can be placed in the dial string (see D command). Note that the information below is based upon the default implementation of the X results table. Table 3-1 indicates the messages which are enabled for each X value.

If the modem is in facsimile mode (+FCLASS=1 or 2), the only message sent to indicate a connection is CONNECT without a speed indication.

X0	Disables monitoring of busy tones unless forced otherwise by country requirements; send only OK, CONNECT, RING, NO CARRIER, ERROR, and NO ANSWER result codes. Blind dialing is enabled/disabled by country parameters. If busy tone detection is enforced and busy tone is detected, NO CARRIER will be reported. If dial tone detection is enforced or selected and dial tone is not detected, NO CARRIER will be reported instead of NO DIAL TONE. The value 000b is written to S22 bits 6, 5, and 4, respectively.
X1	Disables monitoring of busy tones unless forced otherwise by country requirements; send only OK, CONNECT, RING, NO CARRIER, ERROR, NO ANSWER, and CONNECT XXXX (XXXX = rate). Blind dialing enabled/disabled by country parameters. If busy tone detection is enforced and busy tone is detected, NO CARRIER will be reported instead of BUSY. If dial tone detection is enforced or selected and dial tone is not detected, NO CARRIER will be reported instead of NO DIAL TONE. The value 100b is written to S22 bits 6, 5, and 4, respectively.
X2	Disables monitoring of busy tones unless forced otherwise by country requirements; send only OK, CONNECT, RING, NO CARRIER, ERROR, NO DIALTONE, NO ANSWER, and CONNECT XXXX. If busy tone detection is enforced and busy tone is detected, NO CARRIER will be reported instead of BUSY. If dial tone detection is enforced or selected and dial tone is not detected, NO DIAL TONE will be reported instead of NO CARRIER. The value 101b is written to S22 bits 6, 5, and 4, respectively.
X3	Enables monitoring of busy tones; send only OK, CONNECT, RING, NO CARRIER, ERROR, NO ANSWER, and CONNECT XXXX. Blind dialing is enabled/disabled by country parameters. If dial tone detection is enforced and dial tone is not detected, NO CARRIER will be reported. The value 110b is written to S22 bits 6, 5, and 4, respectively.
X4	Enables monitoring of busy tones; send all messages. The value 111b is written to S22 bits 6, 5, and 4, respectively. (Default.)

Result Codes:

OK	n = 0 to 4.
ERROR	Otherwise.

Table 3-1.   **Result Codes**

Short Form	Long Form	n Value in ATXn Command				
		0	**1**	**2**	**3**	**4**
0	OK	x	x	x	x	x
1	CONNECT	x	x	x	x	x
2	RING	x	x	x	x	x
3	NO CARRIER	x	x	x	x	x
4	ERROR	x	x	x	x	x
5	CONNECT 1200	1	x	x	x	x
6	NO DIALTONE	3	3	x	x	x
7	BUSY	3	3	3	x	x
8	NO ANSWER	x	x	x	x	x
9	CONNECT 0600	1	x	x	x	x
10	CONNECT 2400	1	x	x	x	x
11	CONNECT 4800	1	x	x	x	x
12	CONNECT 9600	1	x	x	x	x
13	CONNECT 7200	1	x	x	x	x
14	CONNECT 12000	1	x	x	x	x
15	CONNECT 14400	1	x	x	x	x
16	CONNECT 19200	1	x	x	x	x
17	CONNECT 38400	1	x	x	x	x
18	CONNECT 57600	1	x	x	x	x
19	CONNECT 115200	1	x	x	x	x
22	CONNECT 75TX/1200RX	1	x	x	x	x
23	CONNECT 1200TX/75RX	1	x	x	x	x
24	DELAYED	4	4	4	4	x
32	BLACKLISTED	4	4	4	4	x
33	FAX	x	x	x	x	x
35	DATA	x	x	x	x	x
40	CARRIER 300	x	x	x	x	x
44	CARRIER 1200/75	x	x	x	x	x
45	CARRIER 75/1200	x	x	x	x	x
46	CARRIER 1200	x	x	x	x	x
47	CARRIER 2400	x	x	x	x	x
48	CARRIER 4800	x	x	x	x	x
49	CARRIER 7200	x	x	x	x	x
50	CARRIER 9600	x	x	x	x	x
51	CARRIER 12000	x	x	x	x	x
52	CARRIER 14400	x	x	x	x	x
66	COMPRESSION: CLASS 5	x	x	x	x	x
67	COMPRESSION: V.42 bis	x	x	x	x	x
69	COMPRESSION: NONE	x	x	x	x	x
76	PROTOCOL: NONE	x	x	x	x	x
77	PROTOCOL: LAPM	x	x	x	x	x

Table 3-1.   Result Codes (Cont'd)

Short Form	Long Form	n Value in ATXn Command				
		0	1	2	3	4
80	PROTOCOL: ALT	x	x	x	x	x
81	PROTOCOL: ALT-CELLULAR	x	x	x	x	x
+F4	+FCERROR	x	x	x	x	x
Note: An 'x' in a column indicates that the message (either the long form if verbose, or the value only for short form) will be generated when that particular value of 'n' (shown at the top of the column) has been selected by the use of ATXn. If the column is blank, then no message will be generated for that x option. A numeral indicates which less explicit message (verbose or short form) will be output for that X option. (Also, see Section 3.3).						

Yn - Long Space Disconnect

This command enables/disables the generation and response to long space disconnect. The parameter value, if valid, is written to S21 bit 7.

Y0   Disables long space disconnect. (default.)

Y1   Enables long space disconnect. In non-error correction mode, the modem will send a long space of four seconds prior to going on-hook. In error correction mode, the modem will respond to the receipt of a long space (i.e., a break signal greater than 1.6 seconds) by going on-hook.

Result Codes:

OK   n = 0 or 1.
ERROR   Otherwise.

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 profile 0.

Z1   Soft reset and restore stored profile 1.

Result Codes:

OK   n = 0 or 1.
ERROR   Otherwise.

3.2.2. AT& Commands

&Cn - RLSD (DCD) Option

The modem controls the RLSD output in accordance with the parameter supplied. The parameter value, if valid, is written to S21 bit 5.

&C0	RLSD remains ON at all times.
&C1	RLSD follows the state of the carrier. (Default.)

Result Codes:

OK	n = 0 or 1.
ERROR	Otherwise.

&Dn - DTR Option

This command interprets the ON to OFF transition of the DTR signal from the DTE in accordance with the parameter supplied. The parameter value, if valid, is written to S21 bits 3 and 4. Also, see S25.

&D0 -	DTR drop is interpreted according to the current &Qn setting as follows:	
	&Q0, &Q5, &Q6	DTR is ignored (assumed ON). Allows operation with DTEs which do not provide DTR.
	&Q1, &Q4	DTR drop causes the modem to hang up. Auto-answer is not affected.
	&Q2, &Q3	DTR drop causes the modem to hang up. Auto-answer is inhibited.
&D1	DTR drop is interpreted according to the current &Qn setting as follows:	
	&Q0, &Q1, &Q4, &Q5, &Q6	DTR drop is interpreted by the modem as if the asynchronous escape sequence had been entered. The modem returns to asynchronous command state without disconnecting.
	&Q2, &Q3	DTR drop causes the modem to hang up. Auto-answer is inhibited.
&D2	DTR drop is interpreted according to the current &Qn setting as follows:	
	&Q0 through &Q6	DTR drop causes the modem to hang up. Auto-answer is inhibited. (Default.)
&D3	DTR drop is interpreted according to the current &Qn setting as follows:	
	&Q0, &Q1, &Q4, &Q5, &Q6	DTR drop causes the modem to perform a soft reset as if the Z command were received. The &Y setting determines which profile is loaded.
	&Q2, &Q3	DTR drop causes the modem to hang up. Auto-answer is inhibited.

If &Q5, &Q6, +FCLASS=1 or +FCLASS=2 is in effect, the action taken is the same as for &Q0.

&Fn - Restore Factory Configuration (Profile)

The modem loads the factory default configuration (profile). The factory defaults are identified for each command and in the S-Register descriptions. A configuration (profile) consists of a subset of S-Registers.

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

Result Codes:

OK	
ERROR	If the modem is connected.

&Gn - Select Guard Tone

The modem generates the guard tone selected by this command according to the parameter supplied (DPSK modulation modes only). The parameter value, if valid, is written to S23 bits 6 and 7.

&G0   Disables guard tone. (Default for US models.)

&G1   Disables guard tone.

&G2   Selects 1800 Hz guard tone. (Default for W-class models.)

This command may not be permitted in some countries.

Result Codes:

OK   n = 0 to 2.
ERROR   Otherwise.

&Jn - Telephone Jack Control

This command is only included for compatibility and performs no function except to load the S-Register. The parameter value, if valid, is written S21 bit 1.

&J0   &J0 command. (Default.)

&J1   &J1 command.

Result Codes:

OK   n = 0 or 1.
ERROR   Otherwise.

&Kn - Flow Control

This command defines the DTE/DCE (terminal/modem) flow control mechanism. The parameter value, if valid, is written to S39 bits 0, 1, and 2.

&K0   Disables flow control.

&K3   Enables RTS/CTS flow control. (Default for data modem modes.)

&K4   Enables XON/XOFF flow control.

&K5   Enables transparent XON/XOFF flow control.

&K6   Enables both RTS/CTS and XON/XOFF flow control. (Default for fax modem and voice modes.)

Result Codes:

OK   n = 0, 3, 4, 5, or 6.
ERROR   Otherwise.

&Ln - Leased Line Operation

This command requests leased line or dial-up operation. This command is provided for compatibility only; no mode change is performed, dial-up operation continues. The OK response is returned for a valid parameter, but no other action is performed. The parameter value, if valid, is written to S27 bit 2.

&L0   Requests dial-up operation. Dial-up operation continues.

Result Codes:

OK   n = 0.
ERROR   Otherwise.

&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. Note that the command sequence &M0\N0 selects normal buffered mode, but the command sequence \N0&M0 selects direct mode. This is because the \N0 command is analogous to the &Q6 command. The value 000b is written to S27 bits 3, 1, and 0, respectively. (See &Q).

&M1 Selects synchronous connect mode with async off-line command mode. The value 001b is written to S27 bits 3, 1, and 0, respectively. (Serial interface operation only.)

&M2 Selects synchronous connect mode with async 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 (in units of hundredths of a second): the data connection will be synchronous. The value 010b is written to S27 bits 3, 1, and 0, respectively. (Serial interface operation only.)

&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. The value 011b is written to S27 bits 3, 1, and 0, respectively. (Serial interface operation only.)

Result Codes:

OK n = 0 to 3.
ERROR Otherwise.

&Pn - Select Pulse Dial Make/Break Ratio

This command determines the make/break ratio used during pulse dialing. It is only effective if the appropriate bit to enable this command is set through the ConfigurACE program. If enabled, it will override the make/break ratios in the OEM parameters in ConfigurACE. The default is country-dependent. The parameter value, if valid, is written to S28 bits 3 and 4.

&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.

Result Codes:

OK n = 0 to 3.
ERROR Otherwise.

&Qn - Sync/Async Mode

This command is an extension of the &M command and is used to control the connection modes permitted. It is used in conjunction with S36 and S48. (Also, see \N.)

NOTE: When the &Q0 to &Q4 command is issued to select the mode, the subsequent connect message will report the DCE speed regardless of the W command and S95 settings.

&Q0	Selects direct asynchronous operation. The value 000b is written to S27 bits 3, 1, and 0, respectively. See &M0.
&Q1	Selects synchronous connect mode with async off-line command mode. The value 001b is written to S27 bits 3, 1, and 0, respectively. See &M1. (Serial interface operation only.)
&Q2	Selects synchronous connect mode with async off-line command mode and enables DTR dialing of directory 0. The value 010b is written to S27 bits 3, 1, and 0, respectively. See &M2. (Serial interface operation only.)
&Q3	Selects synchronous connect mode with async off-line command mode and enables DTR to act as Talk/Data switch. The value 011b is written to S27 bits 3, 1, and 0, respectively. See &M3. (Serial interface operation only.)
&Q4	Selects AutoSync operation. The value 100b is written to S27 bits 3, 1, and 0, respectively.

AutoSync operation, when used in conjunction with the Hayes Synchronous Interface (HSI) capability in the DTE, provides synchronous communication capability from an asynchronous terminal.

Starting AutoSync. Set registers S19, S20, and S25 to the desired values before selecting AutoSync operation with &Q4. After the CONNECT message is issued, the modem waits the period of time specified by S25 before examining DTR. If DTR is on, the modem enters the synchronous operating state; if DTR is off, the modem terminates the line connection and returns to the asynchronous command state.

Stopping AutoSync. AutoSync operation is stopped upon loss of carrier or the on-to-off transition of DTR. Loss of carrier will cause the modem to return to the asynchronous command state. An on-to-off transition of DTR will cause the modem to return to the asynchronous command state and either not terminate the line connection (&D1 active) or terminate the line connection (any other &Dn command active).

&Q5	The modem will try to negotiate an error-corrected link. The modem can be configured using S36 to determine whether a failure will result in the modem returning on-hook or will result in fallback to an asynchronous connection. The value 101b is written to S27 bits 3, 1, and 0, respectively. (Default.)
&Q6	Selects asynchronous operation in normal mode (speed buffering). The value 110b is written to S27 bits 3, 1, and 0, respectively.

Result Codes:

OK	n = 0 to 6.
ERROR	Otherwise.

&Rn - RTS/CTS Option

This selects how the modem controls CTS. CTS operation is modified if hardware flow control is selected (see &K command). The parameter value, if valid, is written to S21 bit 2.

&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.25 bis handshake.
&R1	In sync mode, CTS is always ON (RTS transitions are ignored). In async mode, CTS will only drop if required by flow control. (Default.)

Result Codes:

OK	n = 0 or 1.
ERROR	Otherwise.

&Sn - DSR Override

This command selects how the modem will control DSR. The parameter value, if valid, is written to S21 bit 6.

&S0	DSR will remain ON at all times. (Default.)
&S1	DSR will become active after answer tone has been detected and inactive after the carrier has been lost.

Result Codes:

OK	n = 0 or 1.
ERROR	Otherwise.

&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 an 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 (see Section 3.1.3). 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. Clears S16.
&T1	Initiates local analog loopback, V.54 Loop 3. Sets S16 bit 0. If a connection exists when this command is issued, the modem hangs up. The CONNECT XXXX message is displayed upon the start of the test.
&T2	Returns ERROR.
&T3	Initiates local digital loopback, V.54 Loop 2. Sets S16 bit 2. If no connection exists, ERROR is returned. Sets S16 bit 4 when the test is in progress.
&T4	Enables digital loopback acknowledgment for remote request, i.e., an RDL request from a remote modem is allowed. Sets S23 bit 0. (Default.)
&T5	Disables digital loopback acknowledgment for remote request, i.e., an RDL request from a remote modem is denied. Clears S23 bit 0.
&T6	Requests a remote digital loopback (RDL), V.54 Loop 2, without self test. If no connection exists, ERROR is returned. Sets S16 bit 4 when the test is in progress. The CONNECT XXXX message is displayed upon the start of the test.
&T7	Requests a remote digital loopback (RDL),V.54 Loop 2, with self test. (In self test, a test pattern is looped back and checked by the modem.) If no connection exists, ERROR is returned. When the test is terminated either via expiration of S18, or via the &T0 or H command, the number of detected errors is reported to the DTE. Sets S16 bit 5 when the test is in progress.
&T8	Initiates local analog loopback, V.54 Loop 3, with self test. (In self test, a test pattern is looped back and checked by the modem.) If a connection exists, the modem hangs up before the test is initiated. When the test is terminated either via expiration of S18, or via the &T0 or H command, the number of detected errors is reported to the DTE. Sets S16 bit 6 when the test is in progress. This command may not be available in some countries due to PTT restrictions.

&V - Display Current Configuration and Stored Profiles

Reports the current (active) configuration, the stored (user) profiles, and the first four stored telephone numbers. The stored profiles and telephone numbers are not displayed if the NVRAM is not installed or is not operational as detected by the NVRAM test during reset processing.

Result Code:

OK

Example:

```
AT&V
ACTIVE PROFILE:
B0 E1 L1 M1 N1 QO T V1 W0 X4 Y0 &C0 &D0 &G2 &J0 &K3 &Q5 &R1 &S0 &T4 &X0 &Y0
S00:002 S01:000 S02:043 S03:013 S04:010 S05:008 S06:002 S07:030 S08:002 S09:006
S10:014 S11:255 S12:050 S18:000 S25:005 S26:001 S36:007 S37:000 S38:020 S46:138
S48:007 S95:000

STORED PROFILE 0:
B0 E1 L1 M1 N1 QO T V1 W0 X4 Y0 &C0 &D0 &G2 &J0 &K3 &Q5 &R1 &S0 &T4 &X0
S00:002 S02:043 S06:002 S07:030 S08:002 S09:006 S10:014 S11:095 S12:050 S18:000
S36:007 S37:000 S40:105 S41:003 S46:138 S95:000

STORED PROFILE 1:
B0 E1 L1 M1 N1 QO T V1 W0 X4 Y0 &C0 &D0 &G2 &J0 &K3 &Q5 &R1 &S0 &T4 &X0
S00:002 S02:043 S06:002 S07:030 S08:002 S09:006 S10:014 S11:095 S12:050 S18:000
S36:007 S37:000 S40:105 S41:003 S46:138 S95:000

TELEPHONE NUMBERS:
0 =                                              1 =
2 =                                              3 =

OK
```

&Wn - Store Current Configuration

Saves the current (active) configuration (profile), including S-Registers, in one of the two user profiles in NVRAM as denoted by the parameter value. This command will yield an ERROR message if the NVRAM is not installed or is not operational as detected by the NVRAM test.

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

&W0	Store the current configuration as profile 0.
&W1	Store the current configuration as profile 1.

Result Codes:

OK	n = 0 or 1.
ERROR	Otherwise.

&Xn - Select Synchronous Clock Source

Selects the source of the transmit clock for the synchronous mode of operation. The parameter value, if valid, is written to S27 bits 4 and 5.

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

&X0   Selects internal timing. The modem generates the transmit clock signal and applies it to the TXCLK output at the serial interface.

&X1   Selects external timing. The local DTE sources the transmit clock signal on the XTCLK input of the serial interface. The modem applies this clock to the TXCLK output at the serial interface.

&X2   Selects slave receive timing. The modem derives the transmit clock signal from the incoming carrier and applies it to the TXCLK output at the serial interface.

Result Codes:

OK   n = 0 to 2.

ERROR   Otherwise.

&Yn - Designate a Default Reset Profile

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

&Y0   The modem will use profile 0.

&Y1   The modem will use profile 1.

Result Codes:

OK   n = 0 to 1.

ERROR   If n > 1, or if NVRAM is not installed or is not operational.

&Zn=x - Store Telephone Number

The modem can store up to four telephone numbers and each telephone number dial string can contain up to 35 digits.

&Zn=x   n = 0 to 3 and x = dial string. (Requires 256-byte NVRAM.)

Result Codes:

OK   For n = 3, and x = 35 digits.

ERROR   If n > 3, x > 35 digits, or if NVRAM is not installed or is not operational.

3.2.3.   AT% Commands

%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). The parameter value, if valid, is written to S41 bits 2 and 6.

If enabled, the modem attempts to retrain for a maximum of 30 seconds.

%E0	Disable line quality monitor and auto-retrain.
%E1	Enable line quality monitor and auto-retrain.
%E2	Enable line quality monitor and fallback/fall forward. (Default.)

Result Codes:

OK	n = 0, 1, or 2.
ERROR	Otherwise.

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

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

%L - Line Signal Level

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

Result Codes:

OK

%Q - Line Signal Quality

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

Example:

```
AT%Q

015
```

Result Codes:

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

%T - PTT Testing Utilities

Facilitates PTT testing of signal levels by providing continuous signals regardless of whether the modem is connected or not. The signal transmitted is in accordance with the parameter provided.

This is a range of commands that allow the user to initiate a series of signals that are necessary for PTT approval. The signals emitted include answer tone, modulation, carriers, and other pertinent signals. A test is initiated upon receipt of an %TTn (the second T is a password and n is a test number), and the test is aborted when any keyboard character is entered. The modem will continuously transmit the tone or carrier according to the parameter supplied.

%TT00-%TT09	DTMF tone dial digits 0 to 9.
%TT0A	DTMF digit *.
%TT0B	DTMF digit #.
%TT0C	DTMF digit A.
%TT0D	DTMF digit B.
%TT0E	DTMF digit C.
%TT0F	DTMF digit D.
%TT10	V.21 channel 1 mark (originate) symbol.
%TT11	V.21 channel 2 mark symbol.
%TT12	V.23 backward channel mark symbol.
%TT13	V.23 forward channel mark symbol.
%TT15	V.22 originate (call mark) signalling at 1200 bps.
%TT16	V.22 bis originate (call mark) signalling at 2400 bps.
%TT17	V.22 answer signalling (guard tone if PTT required).
%TT18	V.22 bis answer signalling (guard tone if required).
%TT19	V.21 channel 1 space symbol.
%TT1A	V.21 channel 2 space symbol.
%TT1B	V.23 backward channel space symbol.
%TT1C	V.23 forward channel space symbol.
%TT20	V.32 9600 bps.
%TT21	V.32 bis 14400 bps.
%TT30	Silence (on-line), i.e., go off-hook.
%TT31	V.25 answer tone.
%TT32	1800 Hz guard tone.
%TT33	V.25 calling tone (1300 Hz).
%TT34	Fax calling tone (1100 Hz).
%TT40	V.21 channel 2
%TT41	V.27 ter 2400 bps
%TT42	V.27 ter 4800 bps
%TT43	V.29 7200 bps
%TT44	V.29 9600 bps
%TT45	V.17 7200 bps long train
%TT46	V.17 7200 bps short train
%TT47	V.17 9600 bps long train
%TT48	V.17 9600 bps short train
%TT49	V.17 12000 bps long train
%TT4A	V.17 12000 bps short train
%TT4B	V.17 14400 bps long train
%TT4C	V.17 14400 bps short train

3.2.4. AT\ Commands

\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 parameter value, if valid, is written to S40 bits 3, 4, and 5.

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

Result Codes:

OK	n = 0 to 5.
ERROR	Otherwise.

\Nn - Operating Mode

This command controls the preferred error correcting mode to be negotiated in a subsequent data connection. This command is affected by the OEM firmware configuration.

\N0	Selects normal speed buffered mode (disables error-correction mode). (Forces &Q6.)
\N1	Serial interface selected - Selects direct mode and is equivalent to &M0, &Q0 mode of operation. (Forces &Q0.)
	Parallel interface selected - Same as \N0.
\N2	Selects reliable (error-correction) mode. The modem will first attempt a LAPM connection and then an MNP connection. Failure to make a reliable connection results in the modem hanging up. (Forces &Q5, S36=4, and S48=7.)
\N3	Selects auto reliable mode. This operates the same as \N2 except failure to make a reliable connection results in the modem falling back to the speed buffered normal mode. (Forces &Q5, S36=7, and S48=7.)
\N4	Selects LAPM error-correction mode. Failure to make an LAPM error-correction connection results in the modem hanging up. (Forces &Q5 and S48=0.) Note: The -K1 command can override the \N4 command.
\N5	Selects MNP error-correction mode. Failure to make an MNP error-correction connection results in the modem hanging up. (Forces &Q5, S36=4, and S48=128.)

Result Codes:

OK	n = 0 to 5.
ERROR	Otherwise.

3.2.5. AT+ Commands

+Hn - Enable/Disable RPI and DTE Speed

This command enables or disables Rockwell Protocol Interface (RPI) processing and sets the DTE speed.

+H0	Disable RPI.
+H1	Enable RPI and set DTE speed to 19200 bps.
+H2	Enable RPI and set DTE speed to 38400 bps.
+H3	Enable RPI and set DTE speed to 57600 bps.

Result Codes:

OK	n = 0 to 3.
ERROR	Otherwise.

……………..

+MS - Select Modulation

This extended-format command selects the modulation and, optionally, enables or disables automode, specifies the lowest
and highest connection rates, selects m-Law or A-Law codec type, and enables or disables robbed bit signaling generation (server modem) or detection (client modem) using one to five subparameters. The command format is:

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

For example,

+MS: 56,1,300,56000,0,0 [RC56 default values]
+MS: 11,1,300,33600,0,0 [RC336 default values]
+MS: 10,1,300,14400,0,0 [RC144 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), (list of supported <x_law> values), (list of supported <rb_signaling> values)

For example,

+MS: (0,1,2,3,9,10,11,56, 64,69),(0,1),(300-33600),(300-56000),(0,1),(0,1) [RC56]
+MS: (0,1,2,3,9,10,11,64,69),(0,1),(300-33600),(300-33600),(0,1),(0,1) [RC336]
+MS: (0,1,2,3,9,10,64,69),(0,1),(300-14400),(300-14400),(0,1),(0,1) [RC144]

Subparameter Definitions

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

<mod>	Modulation	Possible Rates (bps) 1	Notes
0	V.21	300	
1	V.22	1200	
2	V.22 bis	2400 or 1200	
3	V.23	1200	See Note 2
9	V.32	9600 or 4800	
10	V.32 bis	14400, 12000, 9600, 7200, or 4800	Default for RC144
11	V.34	33600, 31200, 28800, 26400, 24000, 21600, 19200, 16800, 14400, 12000, 9600, 7200, 4800, or 2400	Default for RC56/RC336/RC288 [RC56/RC336/RC288 only]
56	K56flex	56000, 54000, 52000, 50000, 48000, 46000, 44000, 42000, 40000, 38000, 36000, 34000, 32000	[RC56 only]
64	Bell 103	300	
69	Bell 212	1200	

Notes:

1. See optional <automode>, <min_rate>, and <max_rate> subparameters.
2. For V.23, originating modes transmit at 75 bps and receive at 1200 bps; answering modes transmit at 1200 bps and receive at 75 bps. The rate is always specified as 1200 bps.

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

   a. The modem may not be able to automatically switch from the current modulation (specified by <mod>) to some other modulation. For example, there is no standard way to automode from Bell 103 to V.23.
   b. The DTE may disable automode operation (see <automode> below).
   c. The DTE may constrain the range of modulations available by specifying the lowest and highest rates (see <min_rate> and <max_rate> below).

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

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

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

For <automode> = 0 (automode disabled, i.e., fixed modulation):
   a. If <max_rate> is within the rates supported by the selected modulation, the selected rate is that specified by <max_rate>. For example:
   +MS=10,0,1200,4800 selects V.32 bis 4800 bps fixed rate.
   b. If <max_rate> is greater than the highest speed supported by the modulation specified by <mod>, the starting rate is the highest rate supported by the selected modulation. For example:
   +MS=10,0,2400,14400 selects V.32 bis 14400, 12000, 9600, 7200, or 4800 bps.
   c. To emulate issuance of the N0S37=x command sequence to select fixed mode operation, specify the <max_rate> and <min_rate> both to be the (same) requested speed, and <mod> to be the modulation for that speed. For example:
   +MS=11,0,16800,16800 selects V.34 16800 bps fixed mode (no comparable S37 command).
   +MS=10,0,12000,12000 selects V.32 bis 12000 bps fixed mode (same as N0S37=10).

For <automode> = 1 (automode enabled, i.e., automatically selected speed and modulation):
The modem connects at the highest possible rate in accordance with V.8 bis/V.8, or V.32 bis Annex A if V.8 bis/V.8 is not supported by the remote modem.

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

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

    b. To emulate issuance of the N1S37=x sequence command, specify the modulation and the rate to start automoding down from using <mod> and <max_rate>, respectively. Set <min_rate> to 300 to allow automoding all the way down to V.21 300 bps. For example:

    +MS=11,1,300,16800 selects automode starting at V.34 16800 bps (no comparable S37 command).

    +MS=9,1,300,12000 selects automode starting at V.32 bis 12000 bps (same as N1S37=10).

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

5. <x_law> is an optional number which specifies the codec type. The options are:
    0 = m-Law
    1 = A-Law
    Note that ATZ will reset the <x_law> selection to 0 (m-Law).

6. <rb_signaling> is an optional number which enables or disables robbed bit signaling generation in a server modem or enables or disables robbed bit signaling detection in a client modem. The options are:
    0 = Robbed bit signaling generation (server modem) or detection (client modem) disabled (default)
    1 = Robbed bit signaling generation (server modem) or detection (client modem) enabled
    Note that ATZ will reset the <rb_signaling> selection to 0 (disabled).

Result Codes:
OK Valid subparameter string

ERROR Otherwise.

……………..

3.2.6.   AT** Command

** - Download to Flash Memory

The linear flash memory downloader in the modem firmware allows flash memory connected to the modem external memory bus to be upgraded with revised modem firmware. This process transfers (uploads) the upgraded modem firmware (data) from the host computer to the modem which transfers (downloads) the data to the flash memory device. Note that this downloader function must be provided in modem MCU firmware initially installed in external flash memory, i.e., the downloader does not support the programming of blank flash memory.

Programming the flash memory device is a two-step process.

1.   When the AT** command is issued, the modem firmware boot loader is invoked and the user will first load a flash load module (FLM) into the modem's RAM. The FLM contains the programming algorithm for the flash memory device being programmed and any messages that may be sent during the load process.

2.   The user will then load the new modem firmware which the FLM will then program into the flash memory device.

Procedure:

1.   Install in the modem a flash memory programmed with the RC288ACn firmware; ensure that the flash memory device is programmed with the sector secure mode set to UNSECURE, otherwise the device cannot be re-programmed in the modem.

2.   Put the XXXFLM.S37 file and the new RC288AXX.S37 file in an appropriate directory on the computer's hard disk.

3.   Configure the communications application program for a DTE rate of between 9600 bps and 57600 bps (57600 bps is faster) and RTS/CTS flow control. A load at 57600 bps will take approximately 2 minutes; a load at 19200 bps will take approximately 6 minutes.

4.   Check the modem for response by typing AT.

5.   Initiate the download process using the AT**n command, where:

          AT** or AT**0   Download speed is the last sensed speed (recommended command).

          AT**1   Download speed is 38.4k bps.

          AT**2   Download speed is 57.6k bps.

     The "Download Initiated" message appears upon issuing the AT**n command.

6.   Perform an ASCII upload of the XXXFLM.S37 file (e.g., AMDFLM.S37) from the host computer to the modem RAM using an industry standard communications software or an equivalent process (ensure that all ASCII translation or pacing is turned off).

     To abort the load at this point, wait for the FLM download process to time-out, send a bad S37 record, or reset (POR) the modem. If the load process times-out, the modem must be reset (ATZ) before the FLM can be loaded again.

7.   After the FLM has been loaded, perform an ASCII upload of the new modem firmware hex file (e.g., RC288ACi.S37) (within 20 seconds, or the load will time-out) from the host computer to the modem RAM using an industry standard communications software or an equivalent process. There will be a 3-second pause after the first record of the RC288AXX.S37 file is sent, which is the FLASH erase cycle. **There is no turning back at this point.**

     If the flash download fails (because of a bad .S37 record for example) or the upload is aborted, as long as the modem is not turned off or reset, it will remain in the flash load cycle and the upload can be re-attempted at step 7.

     A "Wrong Device" message is displayed if an incorrect FLM is used. In this case, restart at step 5 and upload the correct FLM file.

     A "Wrong Hex file or flow control" message is displayed if an incompatible hex file format is used (non-Motorola S3 format) or if the DTE ignores flow control (the flash download uses both Xon/Xoff and RTS/CTS flow control). If the wrong format was used, reinitiate the upoad at step 7 using a correct firmware hex file.

8.   A "Device successfully programmed" message is displayed by the FLM at the completion of a successful download and the modem will do a cold start.

3.2.7. AT- Commands

-SDR=n - Enable/Disable Distinctive Ring

This command enables or disables detection and reporting of distinctive ring. The syntax is AT-SDR=n, where n is a number from 0 to 7. One, two, or three distinctive ring types can be simultaneously enabled depending upon the value of n (bit mapped). The detected ring type is reported in the long form (verbose) of the result code by appending the ring type number to the end of the RING message.

-SDR=0	Disables Distinctive Ring. Any valid ring detected is reported as RING (default).
-SDR=1	Enables Distinctive Ring Type 1.
-SDR=2	Enables Distinctive Ring Type 2.
-SDR=3	Enables Distinctive Ring Type 1 and 2.
-SDR=4	Enables Distinctive Ring Type 3.
-SDR=5	Enables Distinctive Ring Type 1 and 3.
-SDR=6	Enables Distinctive Ring Type 2 and 3.
-SDR=7	Enables Distinctive Ring Type 1, 2, and 3.

Result Codes:

OK	n = 0 to 7.
ERROR	Otherwise.

The n value bit map is:

Bit 0=1	Enable RING type 1. RING type 1 is detected and reported as RING1.
Bit 1=1	Enable RING type 2. RING type 2 is detected and reported as RING2.
Bit 2=1	Enable RING type 3. RING type 3 is detected and reported as RING3.

The ring types supported and the corresponding ring cadence detect criteria are:

Distinctive Ring Type	Ring Cadence Detect Criteria
1	2.0 sec ON, 4.0 sec OFF.
2	0.8 sec ON, 0.4 sec OFF, 0.8 sec ON, 4.0 sec OFF.
3	0.4 sec ON, 0.2 sec OFF, 0.4 sec ON, 0.2 sec OFF, 0.8 sec ON, 4.0 sec OFF.

Notes:

1. The Ring Indicate (RI) output does not toggle on the first ring if AT-SDR?0.

2. The RI output waveform is the same for all ring types detected, i.e., RI is on for the total duration of the ring period.

3.3. ERROR DETECTION AND DATA COMPRESSION COMMANDS

3.3.1. 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. The parameter value, if valid, is written to S41 bits 0 and 1.

%C0	Disables data compression. Resets S46 bit 1.
%C1	Enables MNP 5 data compression negotiation. Resets S46 bit 1.
%C2	Enables V.42 bis data compression. Sets S46 bit 1.
%C3	Enables both V.42 bis and MNP 5 data compression. Sets S46 bit 1. (Default.)

Result Codes:

OK	n = 0, 1, 2, or 3.
ERROR	Otherwise.

3.3.2. 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. The parameter value, if valid, is written to S40 bits 6 and 7.

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

Result Codes:

OK	n = 0 to 3.
ERROR	Otherwise.

\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. The command works in conjunction with the \K command.

In error correction mode, the modem will signal a break through the active error correction protocol, giving no indication of the length.

\B1-\B9	Break length in 100 ms units. (Default = 3.) (Non-error corrected mode only.)

Result Codes:

OK	If connected in data modem mode.
NO CARRIER	If not connected or connected in fax modem mode.

Note: When the modem receives a break from the remote modem, break is passed to the DTE as follows: In non-error correction mode direct, the break length is passed; in non-error correction mode normal and in error correction mode, a 300 ms break is passed.

3.4. MNP 10 COMMANDS

3.4.1. AT) Commands

)Mn - Enable Cellular Power Level Adjustment

Enables or disables automatic adjustment of the transmit power level to accommodate the signalling requirements of cellular telephone equipment. S40 bit 2 and S201 bit 6 are reset when)M0 is active; S40 bit 2 is set and S201 bit 6 is reset when)M1 is active; S40 bit 2 and S201 bit 6 are set when)M2 is active.

)M0	Disables transmit power level adjustment during MNP 10 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 MNP 10 link negotiation. Uses the @Mn value, or the value from the cellular driver (see 3.7) when operating in direct connect mode, 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 MNP 10 link negotiation. Uses the @Mn value, or the value from the cellular driver (see 3.7) when operating in direct connect mode, to establish initial cellular connection. After connection, the power level remains fixed.

Result Codes:

OK	n = 0 to 2.
ERROR	Otherwise.

Notes:

1. For both cellular and land based modems in both originate or answer modes, if either)M1 or)M2 is set, the transmit power level used for non-MNP 10 or fax connections is either the @Mn value or the value from the cellular driver (see 3.7).

2. **Power Level Considerations.** The following tables define the power levels chosen for each mode of operation. The transmit power levels are given in the form initial/final, where initial is the power level of the handshake at V.22 in *H1 modes or the power level of the initial V.32 bis handshake in *H0 or *H2 modes, and final is the power level of the subsequent V.32 bis handshake in *H1 modes or the power level after a retrain in *H0 or *H2 modes. A power level indicated by "<" means that the final power level is adjusted from the preferred level by the dynamic transmit level adjustment (DTLA) algorithm.

Cellular Modem (Remote Modem also MNP 10 Compatible)

Local Configuration -->	*H1)M1	*H2)M1	*H1)M2	*H2)M2
@M0	-10/<-26	-26/<-26	-10/-26	-26/-26
@M1	-10/<-30	-30/<-30	-10/-30	-30/-30
@M10	-10/<-10	-10/<-10	-10/-10	-10/-10
@Mn (n = 11 to 30)	-10/<-n	-n/<-n	-10/-n	-n/-n

Land Modem

Local Configuration -->	*H0)M0			*H0)M1	*H0)M2
Remote Configuration -->	*H0)M0	*H1)M1 or *H1)M2	*H2)M1 or *H2)M2	*H0, *H1, or *H2	*H0, *H1, or *H2
@M0	-10/-10	-10/<-26	NR	-26/<-26	-26/-26
@M1	-10/-10	-10/<-30	NR	-30/<-30	-30/-30
@M10	-10/-10	-10/<-10	NR	-10/<-10	-10/-10
@Mn (n = 11 to 30)	-10/-10	-10/<-n	NR	-n/<-n	-n/-n

Notes:

1. NR = Not Recommended.

2. In direct connect mode, the cellular driver value is used in place of the @Mn value; DTLA still functions in direct connect mode when)M1 is set, but it would be better to use)M2.

*Hn - Link Negotiation Speed

This command controls the connection speed for link negotiations before upshift occurs between two MNP 10 modems. The parameter value, if valid, is written to S28 bits 6 and 7.

*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 MNP 10 connection on less than average quality telephone lines.

Result Codes:

OK	n = 0 to 2.
ERROR	Otherwise.

-Kn - MNP Extended Services

Enables or disables conversion of a V.42 LAPM connection to an MNP 10 connection. The parameter value, if valid, is written to S40 bits 0 and 1.

-K0	Disables V.42 LAPM to MNP 10 conversion.
-K1	Enables V.42 LAPM to MNP 10 conversion. (Default.)
-K2	Enables V.42 LAPM to MNP 10 conversion; inhibits MNP Extended Services initiation during V.42 LAPM answer mode detection phase.

Result Codes:

OK	n = 0 or 2.
ERROR	Otherwise.

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

Enables or disables fallback from MNP 10 to V.22 bis/V.22. The parameter value, if valid, is written to S41 bit 1.

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

Result Codes:

OK	n = 0 or 1.
ERROR	Otherwise.

-SEC=n - Enable/Disable MNP10-EC

Enables or disables MNP10-EC operation. The command format is:

-SEC=n,[<tx level>]	where <tx level> is the optional transmit level sub parameter.
-SEC=0	Disable MNP10-EC; the transmit level is that defined in S91.
-SEC=1,[<tx level>]	Enable MNP10-EC; the transmit level will be defined by the sub parameter <tx level> range 0 to 30 (0 dBm to -30 dBm), the default <tx level> (<tx level> not specified) is the S91 value.

Result Codes:

OK	n=0, 1, or 1 and <tx level>=0 to 30
ERROR	Otherwise

Example: AT-SEC=1,18 enables MNP10-EC and sets the transmit level to -18 dBm.

Note: If AT-SEC=0 the modem will automatically set AT-SEC=1 if the remote modem indicates Cellular in the V.8 phase.

Inquiries

AT-SEC?	Retrieves the current -SEC command settings, e.g., 1,18.

@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 @M30 correspond to -11 dBm to -30 dBm, respectively. The parameter value, if valid, is written to S201 bits 0-4.

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

Result Codes:

OK	n = 0 to 30.
ERROR	Otherwise.

: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.)

Result Codes:

OK	n = 0 or 1.
ERROR	Otherwise.

3.5. W-CLASS COMMANDS

3.5.1. AT* Commands

*B - Display Blacklisted Numbers

This command requests the modem to return a list of blacklisted numbers to the DTE. The format of the response is shown by the example below. Permanently forbidden numbers as defined by country requirements will not appear on this list. If no numbers are blacklisted, only the OK result code is issued.

Example:

```
NO. - PHONE NUMBER -

------ ----------------------------

1;    4175537660
2;    8288924961
3;    3887278862
4;    3124839442
5;    6284664


OK
```

*D - Display Delayed Numbers

This command causes the modem to send a list of the delayed numbers together with the delay associated with each. The modem will return a list of delayed telephone numbers as defined in the *B command. The format of the response is shown by the example below (delay times are shown as hours:minutes:seconds). If no numbers are delayed, only the OK result code is issued.

Example:

```
NO. - PHONE NUMBER -DELAY

------ ------------------------------------------

1;    8264734660    2:00:00
2;    7532634661    2:00:00
3;    2587334662    0:02:00
4;    7532651663    0:03:25
5;    7459931664    0:01:45


OK
```

*NCn - Country Select

Up to four sets of country parameters may be stored in the EPROM. This command checks to see if the entered number matches the country code of one of the countries stored in the EPROM. If found, the modem stores the location of that country in NVRAM. Upon power up or a soft reset (Z command), the modem uses this location to load the parameters for the corresponding country. The default value of zero is used if no NVRAM is installed or the NVRAM failed self test during reset.

Note: Automatic DAA country code recognition is enabled by the *NC0 command (the 0 country code is reserved for this function). Automatic DAA country code recognition is disabled by the *NCn command selecting any other valid country code.

*NCn   Select country parameters corresponding to entered country code (n). The country codes are:

Country	Code (n)
Australia	40
Austria	1
Belgium	2
Bulgaria	27
Canada	20
Czech Republic	19
Denmark	3
Finland	4
France	5
Germany	6
Greece	17
Hungary	23
Ireland	7
Israel	18
Italy	8
Japan	43
Luxembourg	9
Mexico	21
Netherlands	10
New Zealand	48
Norway	11
Poland	24
Portugal	12
Russia	25
Singapore	47
Slovac Republic	26
Spain	13
Sweden	14
Switzerland	15
United Kingdom	16
United States	22

Result Codes:

OK   If parameters corresponding to entered country code are present in EPROM.
ERROR   Otherwise.

3.6. CALLER ID COMMANDS

3.6.1. AT#CID Command

#CIDn - Caller ID

Enables or disables Caller ID.

#CID=0	Disables Caller ID. (Default.)
#CID=1	Enables Caller ID with formatted presentation to the DTE. The modem will present the data items in a <Tag><Value> pair format. The expected pairs are data, time, caller code (telephone number), and name.
#CID=2	Enables Caller ID with unformatted presentation to the DTE. The modem will present the entire packet of information, excluding the leading U's, in ASCII printable hex numbers.

Result Codes:

OK	n = 0 or 2.
ERROR	Otherwise.

Inquiries

#CID?	Retrieves the current Caller ID mode from the modem.
#CID=?	Returns the mode capabilities of the modem in a list with each element separated by commas.

Formatted Form Reporting

The modem presents the data in the <tag> = <value> pair format as described in the table below. Spaces are present on both sides of the equal sign.

Tag	Description
DATE	DATE = MMDD where MM is the month number (01 to 12) and DD is the day number (01..31).
TIME	TIME = HHMM where HH is the hour number (00 to 23) and MM is the minute number (00 to 59).
NMBR	NMBR = <number> or P or O where <number> is the telephone number of the caller, where P indicates that the calling number information is not available since the originating caller has requested private service, and where O indicates that the calling number information is not available or out of service at the calling location.
NAME	NAME = <listing name> where <listing name> is the subscription name.
MESG	MESG = <data tag> <length of message> <data> <checksum> in printable ASCII hex numbers. This tag indicates a data item not listed above. The message is only possible for Multiple Message Format.

Notes:

1. The modem does not present any Caller ID information if the DCE detects a checksum error in the Caller ID packet.

2. In the event of an unrecognized data tag, the modem will present the data in ASCII hex numbers following the MESG tag.

Example of Formatted Form Reporting

1. The following example illustrates the standard Caller ID message packet.

    ```
    RING

    DATE  = 0321
    TIME  = 1405
    NMBR  = 5045551234
    NAME  = A N OTHER

    RING

    RING
    ```

2. The following example illustrates the case where the tag of the packet is not recognized by the modem.

    ```
    RING

    MESG  = 060342424231

    RING

    RING
    ```

Unformatted Form Reporting

The modem presents all information and packet control information found in the message. The modem, however, excludes the leading U's (channel seizure information) from the presentation. The packet is presented in ASCII printable hex numbers, the modem does not insert spaces, or line feeds, for formatting between bytes or words of the packet.

The modem does not detect the checksum of the packet.

Example of Unformatted Form Reporting

```
RING

0412303332323234303539313435353132333435

RING

RING
```

3.7. CELLULAR COMMANDS

The Direct Connect Modem allows a direct interface to most cellular telephones eliminating the need for other intelligent interfaces.

Landline modems operate with the telephone system by either going off hook detecting dialtone and the dialing the telephone number using pulses or DTMF digits, or detecting the RING signal and answering the call. Intelligent cellular phone interfaces connect between the modems RJ-11 socket and the cellular phone's data interface. The interface provides landline features to the modem (line current, dial tone, ringing, etc.), and translates the modem's signals (off hook, DTMF digits, etc.) into signals that the cellular phone understands. Once connected the interface acts as a transparent link between the modem and the cellular telephone.

The Direct Connect Modem interfaces directly to the cellular phone's data interface and provides direct control over the cellular phones operation. For example if the user were to instruct the modem to dial using the ATDTnnnn command the modem would relay the telephone number and the SEND command to the cellular phone over the data interface.

The modem connects to the cellular phone using a special cable which must be purchased separately. A different cable is required for each cellular phone or make of cellular phones. Below is a block diagram of a typical Direct Connect Cellular Modem (based on AK14-X270 Rev 4 reference schematic).

3.7.1. Cellular Phone Drivers

The data interface to cellular phones differs between manufacturers and models and requires a unique cellular phone driver for each phone or group of phones. Therefore the particular phone driver needs to be downloaded from the PC into the modem's RAM before the modem can be used directly with the cellular phone. If a driver is not loaded the modem will operate as a normal landline modem.

3.7.2. Cellular Commands

^C2 - Download Cellular Phone Driver

The ^C2 command initiates the cellular phone driver download function. Upon receipt of the command, the modem issues the "OK" message. The user then performs an ASCII download of the driver (in .S37 format) from the host to the modem, typically using a communications software package (with transmit pacing turned off).

    ^C2   Download Cellular Phone command

Result Codes:

    OK
    [Download Process]
    OK   Cellular phone driver download completed successfully
    ERROR   Cellular phone driver download not completed successfully, e.g., checksum of record (in S37 file)
                    is not correct, driver size is larger than 2k bytes, or an invalid driver is downloaded, or modem is
                    connected.

^I - Identify Cellular Phone Driver

The modem reports the identification of the loaded cellular phone driver in response to the ^I command. The response is dependent upon the driver.

Result Codes (Typical):

    CELLULAR DRIVER: OKI 900/910
    (c) Copyright 1994, Spectrum Cellular, Inc.
    Version 0.07 Thu Jan 10:29:52 1994
    OK
    or
    ERROR   Cellular phone driver is not loaded

^T6 - Indicate Status of Cellular Phone

The status of the cellular phone connected to the modem is reported in response to the ^T6 command. The status is reported in a single byte formatted as a decimal number. The individual status signals assigned to the status byte bits are:

bit 0	1 =	Cellular phone is receiving an incoming call
bit 1	1 =	Cellular phone is in use
bit 2	1 =	Cellular phone is locked (cannot be used)
bit 3	1 =	There is no service for cellular phone (does not indicate signal strength)
bit 4	1 =	Cellular phone is powered on
bit 5	1 =	Cellular driver is initialized
bit 6	0 =	Reserved (0)
bit 7	1 =	Cellular cable detected

Result Codes (typical):

    128   (Cellular cable detected)
    OK

Application of ^T6 Status Byte

The information obtained by issuing a AT^T6 can be used to determine if the loading of the cellular phone driver is necessary by the host software. A download is not necessary if landline (or no cable) is connected to the modem, in which ^T6 will return a value of 0 (bit 7=0). A download is necessary when a cellular cable is detected (implied cellular phone is also connected), in which ^T6 will return a value of 128 (bit 7=1). Once a driver is downloaded to the modem, it will be able to operate in landline or cellular mode based on detection of a cellular cable.

3.7.3. Operation

Once the driver is loaded and the modem is connected to the cellular phone, and the phone is powered on dial/answer functions will be routed through the phone instead of the landline DAA, i.e., no special commands are needed to place or answer calls, the same AT commands and software packages that are used for landline communication sessions can be used. If the cellular phone is not connected or is powered off dial/answer functions will be routed through the landline DAA, and if V.42 bis connection is established the cellular phone driver will be purged so that the V.42 bis dictionaries can be increased to their normal size.

While the modem is being used with a cellular phone it will respond with normal result messages with the following differences in meaning:

    NO DIALTONE   Indicates that cellular service is not currently available.
    RING   Indicates that the cellular phone is receiving an incoming call.

Modem Configuration

Modem performance will be improved by modification of your standard configuration, it is recommended that the landline modem also be MNP10 EC compatible for reliable communications.

MNP10 EC to MNP10 EC Connection

    Cell Site   AT -SEC=1,12 &C1 &D2   (optional for the connect message: AT S95=46)
    Base Site   AT -SEC=1,18 &C1 &D2   (optional for the connect message: AT S95=46)

MNP10 EC to MNP10 Link Negotiation at 4800 bps (Quick Connect)

    Cell Site   AT -SEC=1,12 &C1 &D2   (optional for the connect message: AT S95=46)
    Base Site   AT&F)M2 @M18 &C1 &D2   (optional for the connect message: AT S95=46)

AT -SEC=1,12 will put the modem into EC mode, the transmit level will be -12 dBm. The optimum trnsmit level will depend on the phone being used.

MNP10 EC to Non-MNP10 Modems

If calls are made from a cellular modem to a landline modem that does not support MNP10 EC or MNP10 EC the following configuration is recommended:

>   AT -SEC=1,12 %E2

If calls cannot reliably be made using the above configuration, it may be necessary to force the connection to 9600 bps or slower using the following configuration string:

>   AT -SEC=1,12 %E2 N1 S37=9   (V.32 bis modems) or
>   AT -SEC=1,12 %E2 +MS=11,1,300,9600   (V.34 modems)

Disabling MNP10 EC

AT -SEC=0 will disable MNP10 EC, however if the remote modem indicates cellular during the V.8 negotiation AT-SEC=1 will automatically be set (V.34 only).

Fax Configuration

It is recommended that fax transmissions be configured to operate at 9600 bps in V.17 mode or 7200 bps in V.29 mode.

Cellular Phone Configuration

To achieve the best operational performance, a cellular data connection should be attempted in a location where adequate signal strength is observed for the cellular phone. This condition can be easily monitored on some phones with signal strength indicator. In locations where even voice calls are unreliable, data connections should not be attempted. Under some circumstances a special high gain antenna may improve performance.

Additional information regarding the use of the cellular phone and cellular network should be obtained from the service provider and or cellular phone manufacturer.

3.8.   AT COMMAND RESULT CODES

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

Two forms of each result code are available: long-form, an English-like "verbose" response, and short-form, a data-like numeric response (included in parentheses following the long-form). The long-form code is preceded and terminated by the sequence < CR> < LF>. The short-form is terminated by < CR>, only with no preceding sequence.

If result messages are suppressed, nothing is returned to the DTE. The long-form results codes can be modified by the OEM through the ConfigurACE Configuration Utility Program. (See ConfigurACE description.)

0- OK

The OK code is returned by the modem to acknowledge execution of a command line.

1- CONNECT

The modem will send this result code upon connecting when:

1.   The line speed is 300 bps and the modem has been instructed to report the line speed to the DTE upon connecting, or

2.   The DTE speed is 300 bps and the modem has been instructed to report the DTE speed to the DTE upon connecting, or

3.   The range of result code responses is restricted by the X command such that no speed reporting is allowed.

2- RING

The modem sends this result code when incoming ringing is detected on the line. What qualifies as a ring signal is determined by country-dependent parameters, modifiable through ConfigurACE.

When cellular interface is selected, RING indicates that the cellular phone is receiving an incoming call.

3- NO CARRIER

The modem sends this result code when attempting to establish a call if:

1.   Ringback is detected and later ceases but no carrier is detected within the period of time determined by register S7, or

2.   No ringback is detected within the period of time determined by register S7.

This result code is also used when the modem auto-disconnects due to loss of carrier.

Under X0, if busy tone detection is enforced, this result code is used as a response to the detection of busy or circuit busy. Under X0, if dial tone detection is enforced or selected, this result code is used to indicate that dial tone has not been detected.

4- ERROR

The modem returns this result code if the command line contains a syntax error or it is unable to execute a command contained in the command line. It is issued if a command does not exist or if the parameter supplied is outside the permitted range.

Under X0, X1, X2, and X3, this result is used instead of DELAYED and BLACKLISTED.

5- CONNECT 1200

For X1, X2, X3, and X4, the modem sends this result code when:

1.   The line speed is 1200 bps and the modem has been instructed to report the line speed to the DTE upon connecting, or

2.   The DTE speed is 1200 bps and the modem has been instructed to report the DTE speed to the DTE upon connecting.

(Also, see the W command.)

6- NO DIALTONE

For X2 and X4, the modem sends this result code if it has been instructed to wait for dial tone during dialing but none is received.

When cellular phone interface is selected, NO DIALTONE indicates that cellular service is not currently available.

7- BUSY

For X3 and X4, if busy tone detection is enforced, the modem sends this result code when attempting to originate a call if the busy (engaged) signal is detected on the line.

8- NO ANSWER

The modem sends this result code when attempting to originate a call if a continuous ringback signal is detected on the line until the expiration of the timer S7.

9- CONNECT 0600

For X1, X2, X3, and X4, the modem sends this result code when:

1. The line speed is 600 bps and the modem has been instructed to report the line speed to the DTE upon connecting, or

2. The DTE speed is 600 bps and the modem has been instructed to report the DTE speed to the DTE upon connecting.

10- CONNECT 2400

For X1, X2, X3, and X4, the modem sends this result code when:

1. The line speed is 2400 bps and the modem has been instructed to report the line speed to the DTE upon connecting, or

2. The DTE speed is 2400 bps and the modem has been instructed to report the DTE speed to the DTE upon connecting.

11- CONNECT 4800

For X1, X2, X3, and X4, the modem sends this result code when:

1. The line speed is 4800 bps and the modem has been instructed to report the line speed to the DTE upon connecting, or

2. The DTE speed is 4800 bps and the modem has been instructed to report the DTE speed to the DTE upon connecting.

12- CONNECT 9600

For X1, X2, X3, and X4, the modem sends this result code when:

1. The line speed is 9600 bps and the modem has been instructed to report the line speed to the DTE upon connecting, or

2. The DTE speed is 9600 bps and the modem has been instructed to report the DTE speed to the DTE upon connecting.

13- CONNECT 7200

For X1, X2, X3, and X4, the modem sends this result code when:

1. The line speed is 7200 bps and the modem has been instructed to report the line speed to the DTE upon connecting, or

2. The DTE speed is 7200 bps and the modem has been instructed to report the DTE speed to the DTE upon connecting.

14- CONNECT 12000

For X1, X2, X3, and X4, the modem sends this result code when:

1. The line speed is 12000 bps and the modem has been instructed to report the line speed to the DTE upon connecting, or

2.   The DTE speed is 12000 bps and the modem has been instructed to report the DTE speed to the DTE upon connecting.

15- CONNECT 14400

For X1, X2, X3, and X4, the modem sends this result code when:

1.   The line speed is 14400 bps and the modem has been instructed to report the line speed to the DTE upon connecting, or

2.   The DTE speed is 14400 bps and the modem has been instructed to report the DTE speed to the DTE upon connecting.

16- CONNECT 19200

For X1, X2, X3, and X4, the modem returns this result code upon connecting when the DTE speed is 19200 bps and the modem has been instructed to report the DTE speed upon connecting.

17- CONNECT 38400

For X1, X2, X3, and X4, the modem sends this result code upon connecting when the DTE speed is 38400 bps and the modem has been instructed to report the DTE speed to the DTE upon connecting.

18- CONNECT 57600

For X1, X2, X3, and X4, the modem sends this result code upon connecting when the DTE speed is 57600 bps and the modem has been instructed to report the DTE speed to the DTE upon connecting.

19- CONNECT 115200

For X1, X2, X3, and X4, the modem sends this result code upon connecting when the DTE speed is 115200 bps and the modem has been instructed to report the DTE speed to the DTE upon connecting.

22- CONNECT 75TX/1200RX

For X1, X2, X3, and X4, the modem returns this result code upon establishing a V.23 originate connection when the modem has been instructed to report the DCE speed upon connection.

23- CONNECT 1200TX/75RX

For X1, X2, X3, and X4, the modem returns this result code upon establishing a V.23 answer connection when the modem has been instructed to report the DCE speed upon connection.

24- DELAYED

For X4, the modem returns this result code when a call fails to connect and the number dialed is considered 'delayed' due to country blacklisting requirements.

32- BLACKLISTED

For X4, the modem returns this result code when a call fails to connect and the number dialed is considered 'blacklisted'.

33- FAX

The modem returns this result code when a fax modem connection is established in a facsimile mode.

35- DATA

The modem returns this result code when a data modem connection is established in a facsimile mode.

40- CARRIER 300

The modem returns this result code when a 0-300 bps data rate has been detected on the line and carrier reporting has been enabled. (See S95 and Xn.)

44- CARRIER 1200/75

The modem sends this result code when the V.23 backward channel carrier has been detected on the line and carrier reporting has been enabled. (See S95 and Xn.)

45- CARRIER 75/1200

The modem sends this result code when the V.23 forward channel carrier has been detected on the line and carrier reporting has been enabled. (See S95 and Xn.)

46- CARRIER 1200

The modem sends this result code when a 1200 bps data rate has been detected on the line and carrier reporting has been enabled. (See S95 and Xn.)

47- CARRIER 2400

The modem sends this result code when a 2400 bps data rate has been detected on the line and carrier reporting has been enabled. (See S95 and Xn.)

48- CARRIER 4800

The modem sends this result code when a 4800 bps data rate has been detected on the line and carrier reporting has been enabled. (See S95 and Xn.)

49- CARRIER 7200

The modem sends this result code when a 7200 bps data rate has been detected on the line and carrier reporting has been enabled. (See S95 and Xn.)

50- CARRIER 9600

The modem sends this result code when a 9600 bps data rate has been detected on the line and carrier reporting has been enabled. (See S95 and Xn.)

51- CARRIER 12000

The modem sends this result code when a 12000 bps data rate has been detected on the line and carrier reporting has been enabled. (See S95 and Xn.)

52- CARRIER 14400

The modem sends this result code when a 14400 bps data rate has been detected on the line and carrier reporting has been enabled. (See S95 and Xn.)

66- COMPRESSION: CLASS 5

This message is sent to the DTE when the modem has connected in MNP Class 5 and COMPRESSION message reporting has been enabled. (See S95 and Xn.)

67- COMPRESSION: V.42 bis

This message is sent to the DTE when the modem has connected in V.42 bis and COMPRESSION message reporting has been enabled. (See S95 and Xn.)

69- COMPRESSION: NONE

This message is sent to the DTE when the modem has connected without data compression and COMPRESSION message reporting has been enabled. (See S95 and Xn.)

70- PROTOCOL: NONE

This message is sent to the DTE when the modem has connected without any form of error correction, and the PROTOCOL message reporting has been enabled. (See S95 and Xn.)

77- PROTOCOL: LAPM

This message is sent to the DTE when the modem has connected in the V.42 LAPM mode of error correction, and PROTOCOL message reporting has been enabled. (See S95 and Xn.)

80- PROTOCOL: ALT

This message is sent to the DTE when the modem has connected in the MNP mode of error correction, and PROTOCOL message reporting has been enabled. (See S95 and Xn.)

81 - PROTOCOL: ALT-CELLULAR

This message is sent to the DTE when the modem has connected in the MNP 10 mode and cellular power level adjustment is enabled (")M1 or)M2").(See S95 and Xn.)

+F4 - +FCERROR

This message is sent to the DTE when high speed fax data (V.27, V.29, V.33, or V.17) is expected and a V.21 signal is received.

4.   S-REGISTERS

The S-Registers are summarized in Table 4-1 along with their default values. Registers denoted with an '*' in Table 4-1 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 by the firmware, or are permanently overridden by PTT limitations. For the latter, control of the equivalent functionality is available with ConfigurACE Call Progress and Blacklisting options.

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.

4.1.   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 user profiles.

The defaults shown are those used by Rockwell in factory profiles zero and one. These may be overwritten by the OEM with ConfigurACE prior to placing the firmware in PROM. Minimum and maximum values may also be imposed by ConfigurACE in response to country PTT requirements.

The default values shown in Table 4-1 may vary by modem firmware configuration. Consult the MCU firmware release notes for exact configuration.

The factory default values may be loaded at any time by entering the &Fn command.

Table 4-1.   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 Modifier	0-255	s	*	2
S9	Carrier Detect Response Time	1-255	0.1 s	*	6
S10	Carrier Loss Disconnect Time	1-255	0.1 s	*	14
S11	DTMF Tone Duration	50-255	0.001 s	*	95
S12	Escape Prompt Delay	0-255	0.02 s	*	50
S13	Reserved	-	-		-
S14	General Bit Mapped Options Status	-	-	*	138 (8Ah)
S15	Reserved	-	-		-
S16	Test Mode Bit Mapped Options Status (&T)	-	-		0
S17	Reserved	-	-		-
S18	Test Timer	0-255	s	*	0
S19	AutoSync Options	-	-		0
S20	AutoSync HDLC Address or BSC Sync Character	0-255	-	*	0
S21	V.24/General Bit Mapped Options Status	-	-	*	4 (04h)
S22	Speaker/Results Bit Mapped Options Status	-	-	*	117 (75h)
S23	General Bit Mapped Options Status		-	*	54 (36h)
S24	Sleep Inactivity Timer	0-255	s	*	0
S25	Delay to DTR Off	0-255	s or 0.01 s		5
S26	RTS-to-CTS Delay	0-255	0.01 s		1
S27	General Bit Mapped Options Status	-	-	*	9 (09h)
S28	General Bit-Mapped Options Status	-	-	*	0
S29	Flash Dial Modifier Time	0-255	10 ms		0
S30	Disconnect Inactivity Timer	0-255	10 s		0
S31	General Bit-Mapped Options Status	-	-	*	2
S32	XON Character	0-255	ASCII		17 (11h)
S33	XOFF Character	0-255	ASCII		19 (13h)
S34-S35	Reserved	-	-		-
S36	LAPM Failure Control	-	-	*	7
S37	Line Connection Speed	-	-	*	0
S38	Delay Before Forced Hangup	0-255	s		20
S39	Flow Control Bit Mapped Options Status	-	-	*	3

Table 4-1. **S-Register Summary (Cont'd)**

Register	Function	Range	Units	Saved	Default**
S40	General Bit-Mapped Options Status	-	-	*	105 (69h) (Non-MNP 10 models) 107(6Bh) (MNP 10 models)
S41	General Bit-Mapped Options Status	-	-	*	3
S42-S45	Reserved	-	-		-
S46	Data Compression Control	-	-	*	138
S48	V.42 Negotiation Control	-	-	*	7
S82	LAPM Break Control	-	-		128(40h)
S86	Call Failure Reason Code	0-255	-		-
S91	PSTN Transmit Attenuation Level	0-15	dBm		10 (Country dependent)
S92	Fax Transmit Attenuation Level	0-15	dBm		10 (Country dependent)
S95	Result Code Messages Control	-	-	*	0
S201	Cellular Transmit Level	0-63		*	58

* Register value may be stored in one of two user profiles with the &W command.

•• Default values may be modified using ConfigurACE.

4.2.   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, ASCII decimal

    Default: 43 (+)

S3 - Carriage Return Character

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

    Range: 0-127, ASCII decimal

    Default: 13 (Carriage Return)

S4 - Line Feed Character

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

    Range: 0-127, ASCII decimal

    Default: 10 (Line Feed)

S5 - Backspace Character

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

    Range: 0-32, ASCII decimal

    Default: 8 (Backspace)

S6 - Wait Time for Dial Tone Before Blind Dialing, or After "W" Dial Modifier (W-Class Models)

1. Sets the length of time, in seconds, that the modem will wait before starting to dial after going off-hook when blind dialing. This operation, however, may be affected by some ATX options according to country restrictions. The "Wait for Dial Tone" call progress feature (W dial modifier in the dial string) will override the value in register S6.

2. For W-class models, S6 sets the length of time, in seconds, that the modem will wait for dial tone when encountering a "W" dial modifier before returning NO DIAL TONE result code.

The modem always pauses for a minimum of 2 seconds, even if the value of S6 is less than 2 seconds.

> Range: 2-255 seconds

> Default: 2

S7 - Wait Time For Carrier After Dial, For Silence, or For Dial Tone After "W" Dial Modifier (US Models)

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

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

3. For US models, S7 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. As this time is increased, there is less chance to detect a false carrier due to noise from the telephone line.

> Range: 1-255 tenths of a second

> Default: 6 (0.6 second)

S10 - Lost Carrier To Hang Up Delay

Sets the length of time, in tenths of a second, that the modem waits before hanging up after a loss of carrier. This allows for a temporary carrier loss without causing the local modem to disconnect. When register S10 is set to 255, the modem functions as if a carrier is always present.

The actual interval the modem waits before disconnecting is the value in register S10 minus the value in register S9. Therefore, the S10 value must be greater than the S9 value or else the modem disconnects before it recognizes the carrier.

> Range: 1-255 tenths of a second

> Default: 14 (1.4 seconds)

S11 - DTMF Tone Duration

Sets the duration of tones in DTMF dialing (US models only). This value has no effect on pulse dialing.

For W-class models, this parameter is a country parameter loaded by ConfigurACE.

> Range: 50-255 milliseconds

> Default: 95 (95 milliseconds)

S12 - Escape Prompt Delay (EPD)

Defines the maximum period, in fiftieths of a second, allowed between receipt of the last character of the three escape character sequence from the DTE and sending of the OK result code to the DTE. If any characters are detected during this time, the OK will not be sent. Note that sending of the OK result code does not affect entry into command mode. (See 3.1.3.)

      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 (8Ah) (10001010b)

         Bit 0 —   This bit is ignored.

         Bit 1 —   Command echo (En)

                  0 =   Disabled (E0)

                  1 =   Enabled (E1) (Default.)

         Bit 2 —   Quiet mode (Qn)

                  0 =   Send result codes (Q0) (Default.)

                  1 =   Do not send result codes (Q1)

         Bit 3 —   Result codes (Vn)

                  0 =   Numeric (V0)

                  1 =   Verbose (V1) (Default.)

         Bit 4 —   Reserved

         Bit 5 —   Tone (T)/Pulse (P)

                  0 =   Tone (T) (Default.)

                  1 =   Pulse (P)

         Bit 6 —   Reserved

         Bit 7 —   Originate/Answer

                  0 =   Answer

                  1 =   Originate (Default.)

S15 - Reserved

S16 - General Bit Mapped Test Options Status

Indicates the test in progress status.

      Default: 0

         Bit 0 —   Local analog loopback

                0 =   Disabled (Default.)

                1 =   Enabled (&T1)

         Bit 1 —   Not used

         Bit 2 —   Local digital loopback

                0 =   Disabled (Default.)

                1 =   Enabled (&T3)

         Bit 3 —   Remote digital loopback (RDL) status

                0 =   Modem not in RDL (Default.)

                1 =   RDL in progress

         Bit 4 —   RDL requested (AT&T6)

                0 =   RDL not requested (Default.)

                1 =   RDL requested (&T6)

         Bit 5 —   RDL with self test

                0 =   Disabled (Default.)

                1 =   Enabled (&T7)

         Bit 6 —   Local analog loopback (LAL) with self test

                0 =   Disabled (Default.)

                1 =   Enabled (&T8)

         Bit 7 —   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 an &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

Bit 0 —   Reserved

Bit 1 —   BSC/HDLC format select

0 =   BSC selected (Default.)

1 =   HDLC selected

Bit 2 —   Address detection enable/disable

0 =   Disabled (Default.)

1 =   Enabled

Bit 3 —   NRZI/NZI coding select

0 =   NRZI (Default.)

1 =   NZI

Bit 4 —   Idle indicator select

0 =   Mark idle (Default.)

1 =   Flag or sync idle

Bits 5 - 7 —   Reserved

S20 - AutoSync HDLC Address or BSC Sync Character

Defines the HDLC address (S19 bit 1 = 1) or BSC Sync Character (S19 bit 1 = 0) for AutoSync operation (see &Q4 command). S20 must be set to the desired value before &Q4 is issued.

Range: 0-255

Default: 0

S21 - V.24/General Bit Mapped Options Status

Indicates the status of command options.

Default: 4 (00000100b)

Bit 0 —   Set by &Jn command but ignored otherwise.

    0 =   &J0 (Default.)

    1 =   &J1

Bit 1 —   Reserved

Bit 2 —   CTS behavior (&Rn)

    0 =   CTS tracks RTS (&R0)

    1 =   CTS always on (&R1) (Default.)

Bits 3-4 —   DTR behavior (&Dn)

    0 =   &D0 selected (Default.)

    1 =   &D1 selected

    2 =   &D2 selected

    3 =   &D3 selected

Bit 5 —   RLSD (DCD) behavior (&Cn)

    0 =   &C0 selected (Default.)

    1 =   &C1 selected

Bit 6 —   DSR behavior (&Sn)

    0 =   &S0 selected (Default.)

    1 =   &S1 selected

Bit 7 —   Long space disconnect (Yn)

    0 =   Y0 (Default.)

    1 =   Y1

S22 - Speaker/Results Bit Mapped Options Status

Indicates the status of command options.

    Default: 117 (75h) (01110101b)

        Bits 0-1 —   Speaker volume (Ln)

                0 =   Off (L0)

                1 =   Low (L1) (Default.)

                2 =   Medium (L2)

                3 =   High (L3)

        Bits 2-3 —   Speaker control (Mn)

                0 =   Disabled (M0)

                1 =   Off on carrier (M1) (Default.)

                2 =   Always on (M2)

                3 =   On during handshake (M3)

        Bits 4-6 —   Limit result codes (Xn)

                0 =   X0

                4 =   X1

                5 =   X2

                6 =   X3

                7 =   X4 (Default.)

        Bit 7—   Reserved

S23 - General Bit Mapped Options Status

Indicates the status of command options.

Default:	54 (36h) (00110110b)	
Bit 0—	Grant RDL	
	0 =	RDL not allowed (&T5) (Default.)
	1 =	RDL allowed (&T4)
Bits 1-3 —	DTE Rate	
	0 =	0 - 300 bps
	1 =	600 bps
	2 =	1200 bps
	3 =	2400 bps (Default.)
	4 =	4800 bps
	5 =	9600 bps
	6 =	19200 bps
	7 =	38400 bps or higher
Bits 4-5 —	Assumed DTE parity	
	0 =	even
	1 =	not used
	2 =	odd
	3 =	none (Default.)
Bits 6-7 —	Guard tone (&Gn)	
	0 =	None (&G0) (Default.)
	1 =	None (&G1)
	2 =	1800 Hz (&G2)

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

Sets the length of time that the modem will ignore DTR for taking the action specified by &Dn. Its units are seconds for synchronous modes and one hundredths of a second for other modes.

Range: 0-255 (1 second for synchronous modes 1; 0.01 second otherwise)

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. Pertains to synchronous operation only.

Range: 0-255 hundredths of a second

Default: 1

S27 - Bit Mapped Options Status

Indicates the status of command options.

Default: 9 (09h) (00001001b)

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

3	1	0		
0	0	0	=	&M0 or &Q0
0	0	1	=	&M1 or &Q1
0	1	0	=	&M2 or &Q2
0	1	1	=	&M3 or &Q3
1	0	0	=	&Q4
1	0	1	=	&Q5 (Default.)
1	1	0	=	&Q6

Bit 2 —   Leased line control (&Ln)

0 =   Dial up line (&L0) (Default.)

1 =   Leased line (&L1)

Bits 4 - 5 —   Internal clock select (&Xn)

0 =   Internal clock (&X0) (Default.)

1 =   External clock (&X1)

2 =   Slave clock (&X2)

Bit 6 —   CCITT/Bell mode select (Bn)

0 =   CCITT mode (B0) (Default.)

1 =   Bell mode (B1)

Bit 7 - Reserved

S28 - Bit Mapped Options Status

   Default: 0

   Bits 0-1 —   Reserved

   Bit 2 —   Reserved (always 0).

   Bits 3 - 4 —   Pulse dialing (&Pn)

   0 =   39%-61% make/break ratio at 10 pulses per second (&P0) (Default.)

   1 =   33%-67% make/break ratio at 10 pulses per second (&P1)

   2 =   39%-61% make/break ratio at 20 pulses per second (&P2)

   3 =   33%-67% make/break ratio at 20 pulses per second (&P3)

   Bit 5 —   Reserved

   Bits 6-7 —   MNP Link Negotiation Speed (*Hn)

   0 =   Link negotiation at highest speed (*H0) (Default.)

   1 =   Link negotiation at 1200 bps (*H1)

   2=   Link negotiation at 4800 bps (*H2)

S29 - Flash Dial Modifier Time

Sets the length of time, in units of 10 ms, that the modem will go on-hook when it encounters the flash (!) dial modifier in the dial string. The time can be limited as it is a country dependent parameter.

   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 online before disconnecting when no data is sent or received. In error-correction mode, any data transmitted or received will reset the timer. In other modes, any data transmitted will reset the timer. The timer is inoperative in synchronous mode.

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

   Default: 0 (disabled)

S31 - Bit Mapped Options Status

Default: 2 (00000010b)

Bit 0 — Reserved

Bit 1 — Controls auto line speed detection (Nn)

    0 = Disabled (N0)

    1 = Enabled (N1) (Default.)

Bits 2-3 — Controls error correction progress messages (Wn)

    0 = DTE speed only (W0) (Default.)

    1 = Full reporting (W1)

    2 = DCE speed only (W2)

Bit 3 — Reserved

Bits 4-7 — Reserved

S32 - XON Character

Sets the value of the XON character.

Range: 0-255, ASCII decimal

Default: 17 (11h)

S33 - XOFF Character

Sets the value of the XOFF character.

Range: 0-255, ASCII decimal

Default: 19 (13h)

S34-S35 - Reserved

S36 - LAPM Failure Control

Default: 7 (00000111b)

Bits 0-2 — 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 = An MNP connection is attempted and if it fails, a Normal mode connection is established. (Default.)

Bits 3-7 — Reserved

S37 - Desired Line Connection Speed

Default: 0

Bits 0-4 — Desired line connection speed. This is interlinked with the Fn command. If an invalid number is entered, the number is accepted into the register, but S37 will act as if the default value has been entered.

0 = Attempt auto mode connection (F0). (Default)

1-3 = Attempt to connect at 300 bps (F1).

4 = Reserved.

5 = Attempt to connect at V.22 1200 bps (F4).

6 = Attempt to connect at V.22 bis 2400 bps (F5).

7 = Attempt to connect at V.23 (F3).

8 = Attempt to connect at V.32 bis/V.32 4800 bps (F6).

9 = Attempt to connect at V.32 bis/V.32 9600 bps (F8).

10 = Attempt to connect at V.32 bis 12000 bps (F9).

11 = Attempt to connect at V.32 bis 14400 bps (F10).

12 = Attempt to connect at V.32 bis 7200 bps (F7).

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

S40 - General Bit Mapped Options Status

Indicates the status of command options.

Default: 105 (69h) (01101001b)

Bit 0 - 1— MNP Extended Services (-Kn)

0 = Disable extended services (-K0) (Default for non-MNP 10 models.)

1 = Enable extended services (-K1) (Default for MNP 10 models.)

2 = Enable extended services (-K2)

Bit 2— Power Level Adjustment for Cellular Use ()Mn) (see S201 bit 6)

0 = Disable power level adjustment ()M0) (Default.)

1 = Enable power level adjustment ()M1 or)M2)

Bits 3-5 — Break Handling (\Kn)

0 = \K0

1 = \K1

2 = \K2

3 = \K3

4 = \K4

5 = \K5 (Default.)

Bits 6-7 — 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 command options.

Default: 131 (10000011b)

Bits 0 -1 — Compression selection (%Cn)

0 = Disabled (%C0)

1 = MNP 5 (%C1)

2 = V.42 bis (%C2)

3 = MNP 5 and V.42 bis (%C3) (Default.)

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

Bit 6 Bit 2

0 0 = Retrain and fallback/fall forward disabled (%E0) (Default.)

0 1 = Retrain enabled (%E1)

1 0 = Fallback/fall forward enabled (%E2)

Bit 3 — Reserved

Bits 4 -5 — Reserved

Bit 7 — Enable fallback to V.22 bis/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 Execute error correction protocol with no compression.

S46=138 Execute 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 If an invalid number is entered, it is accepted into the S-Register, but S48 will act as if 128 has been entered.

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 re-transmissions of the same message.
S86=14	Protocol violation.

S91 - PSTN Transmit Attenuation Level

Sets the transmit attenuation level from 0 to 15 dBm for the PSTN mode, resulting in a transmit level from 0 to -15 dBm, In some countries, the transmit level may not be changed and there are checks to prevent transmit attenuation level change using ConfigurACE.

Range: 0 to 15 dBm (Corresponding to 0 to -15 dBm transmit level.)

Default: 10 (-10 dBm transmit level.)

S92 - Fax Transmit Attenuation Level

Sets the transmit attenuation level from 0 to 15 dBm for the fax mode, resulting in a transmit level from 0 to -15 dBm. In some countries, the transmit level may not be changed and there are checks to prevent transmit attenuation level change using ConfigurACE.

Range: 0 to 15 dBm (Corresponding to 0 to -15 dBm transmit level.)

Default: 10 (-10 dBm transmit level.)

S95 - Extended Result Codes

The bits in this register can be set to override some of the Wn command options. A bit set to a 1 in this register will enable the corresponding result code regardless of the Wn setting. Also, refer to Table 3-1.

Default: 0

Bit 0 —   CONNECT result code indicates DCE speed instead of DTE speed.

Bit 1 —   Append/ARQ to CONNECT XXXX result code in error-correction mode (XXXX = rate; see Table 3–1).

Bit 2 —   Enable CARRIER XXXX result code (XXXX = rate; see Table 3-1).

Bit 3 —   Enable PROTOCOL XXXX result code (XXXX = protocol identifier; see Table 3-1).

Bit 4 —   Reserved.

Bit 5 —   Enable COMPRESSION result code (XXXX = compression type; see Table 3-1).

Bit 6 —   Reserved.

Bit 7 —   Reserved.

S201 - Cellular Transmit Level

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

Default: 20h

Bits 0 - 4 —   Initial Cellular Power Level Setting (@Mn; default = @M0)

Bit 5 —   Compromise Equalizer Enable Command (:En; default = E1)

Bit 6 —   Lock Power Level Adjustment for Cellular Use ()Mn) (see S40 bit 2)

0 =   Auto power level adjustment ()M0 or)M1) (Default.)

1 =   Lock power level adjustment ()M2)

Bit 7 —   Reserved.

A.   AT COMMAND SET SUMMARY

A.1.   BASIC AT COMMANDS

Command	Function
A/	Re-execute command.
A	Go off-hook and attempt to answer a call.
B0	Select V.22 connection at 1200 bps.
B1	Select Bell 212A connection at 1200 bps.
C1	Return OK message.
Dn	Dial modifier.
E0	Turn off command echo.
E1	Turn on command echo.
F0	Select auto-detect mode (equivalent to N1).
F1	Select V.21 or Bell 103.
F2	Reserved.
F3	Select V.23 line modulation.
F4	Select V.22 or Bell 212A 1200 bps line speed.
F5	Select V.22 bis line modulation.
F6	Select V.32 bis or V.32 4800 line modulation.
F7	Select V.32 bis 7200 line modulation.
F8	Select V.32 bis or V.32 9600 line modulation.
F9	Select V.32 bis 12000 line modulation.
F10	Select V.32 bis 14400 line modulation.
H0	Initiate a hang-up sequence.
H1	If on-hook, go off-hook and enter command mode.
I0	Report product code.
I1	Report pre-computed checksum.
I2	Report OK.
I3	Report firmware revision, model, and interface type.
I4	Report response programmed by an OEM.
I5	Report the country code parameter.
I6	Report modem data pump model and code revision.
I7	Reports the DAA code (W-class models only).
L0	Set low speaker volume.
L1	Set low speaker volume.
L2	Set medium speaker volume.
L3	Set high speaker volume.
M0	Turn speaker off.
M1	Turn speaker on during handshaking and turn speaker off while receiving carrier.
M2	Turn speaker on during handshaking and while receiving carrier.
M3	Turn speaker off during dialing and receiving carrier and turn speaker on during answering.
N0	Turn off automode detection.
N1	Turn on automode detection.
O0	Go on-line.
O1	Go on-line and initiate a retrain sequence.
P	Force pulse dialing.
Q0	Allow result codes to DTE.
Q1	Inhibit result codes to DTE.
Sn	Select S-Register as default.
Sn?	Return the value of S-Register n.

=v	Set default S-Register to value v.
?	Return the value of default S-Register.
T	Force DTMF dialing.
V0	Report short form (terse) result codes.
V1	Report long form (verbose) result codes.
W0	Report DTE speed in EC mode.
W1	Report line speed, EC protocol and DTE speed.
W2	Report DCE speed in EC mode.
X0	Report basic call progress result codes, i.e., OK, CONNECT, RING, NO CARRIER (also, for busy, if enabled, and dial tone not detected), NO ANSWER and ERROR.
X1	Report basic call progress result codes and connections speeds (OK, CONNECT, RING, NO CARRIER (also, for busy, if enabled, and dial tone not detected), NO ANSWER, CONNECT XXXX, and ERROR.
X2	Report basic call progress result codes and connections speeds, i.e., OK, CONNECT, RING, NO CARRIER (also, for busy, if enabled, and dial tone not detected), NO ANSWER, CONNECT XXXX, and ERROR.
X3	Report basic call progress result codes and connection rate, i.e., OK, CONNECT, RING, NO CARRIER, NO ANSWER, CONNECT XXXX, BUSY, and ERROR.
X4	Report all call progress result codes and connection rate, i.e., OK, CONNECT, RING, NO CARRIER, NO ANSWER, CONNECT XXXX, BUSY, NO DIAL TONE and ERROR.
Y0	Disable long space disconnect before on-hook.
Y1	Enable long space disconnect before on-hook.
Z0	Restore stored profile 0 after warm reset.
Z1	Restore stored profile 1 after warm reset.
&C0	Force RLSD active regardless of the carrier state.
&C1	Allow RLSD to follow the carrier state.
&D0	Interpret DTR ON-to-OFF transition per &Qn:

	&Q0, &Q5, &Q6	The modem ignores DTR.
	&Q1, &Q4	The modem hangs up.
	&Q2, &Q3	The modem hangs up.

&D1	Interpret DTR ON-to-OFF transition per &Qn:

	&Q0, &Q1, &Q4,.	
	&Q5, &Q6	Asynchronous escape.
	&Q2, &Q3	The modem hangs up.

&D2	Interpret DTR ON-to-OFF transition per &Qn:

	&Q0 through &Q6	The modem hangs up.

&D3	Interpret DTR ON-to-OFF transition per &Qn:.

	&Q0, &Q1, &Q4,.	
	&Q5, &Q6	The modem performs soft reset.
	&Q2, &Q3	The modem hangs up.

&F0	Restore factory configuration 0.
&F1	Restore factory configuration 1.
&G0	Disable guard tone.
&G1	Disable guard tone.
&G2	Enable 1800 Hz guard tone.
&J0	Set S-Register response only for compatibility.
&J1	Set S-Register response only for compatibility.
&K0	Disable DTE/DCE flow control.
&K3	Enable RTS/CTS DTE/DCE flow control.
&K4	Enable XON/XOFF DTE/DCE flow control.
&K5	Enable transparent XON/XOFF flow control.
&K6	Enable both RTS/CTS and XON/XOFF flow control.
&L0	Select dial up line operation.
&L1	Select leased line operation.

* Serial interface operation only.

&M0	Select direct asynchronous mode.
&M1	Select sync connect with async off-line command mode. *
&M2	Select sync connect with async off-line command mode and enable DTR dialing of directory zero. *
&M3	Select sync connect with async off-line command mode and enable DTR to act as Talk/Data switch. *
&P0	Set 10 pps pulse dial with 39%/61% make/break.
&P1	Set 10 pps pulse dial with 33%/67% make/break.
&P2	Set 20 pps pulse dial with 39%/61% make/break.
&P3	Set 20 pps pulse dial with 33%/67% make/break.
&Q0	Select direct asynchronous mode.
&Q1	Select sync connect with async off-line command mode. *
&Q2	Select sync connect with async off-line command mode and enable DTR dialing of directory zero. *
&Q3	Select sync connect with async off-line command mode and enable DTR to act as Talk/Data switch. *
&Q4	Select Hayes AutoSync mode.
&Q5	Modem negotiates an error corrected link.
&Q6	Select asynchronous operation in normal mode.
&R0	CTS tracks RTS (async) or acts per V.25 (sync).
&R1	CTS is always active.
&S0	DSR is always active.
&S1	DSR acts per V.25.
&T0	Terminate any test in progress.
&T1	Initiate local analog loopback.
&T2	Returns ERROR result code.
&T3	Initiate local digital loopback.
&T4	Allow remote digital loopback.
&T5	Disallow remote digital loopback request.
&T6	Request an RDL without self-test.
&T7	Request an RDL with self-test.
&T8	Initiate local analog loop with self-test.
&V	Display current configurations.
&W0	Store the active profile in NVRAM profile 0.
&W1	Store the active profile in NVRAM profile 1.
&X0	Select internal timing for the transmit clock.
&X1	Select external timing for the transmit clock.
&X2	Select slave receive timing for the transmit clock.
&Y0	Recall stored profile 0 upon power up.
&Y1	Recall stored profile 1 upon power up.
&Zn=x	Store dial string x (to 35) to location n (0 to 3).
%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.
%L	Return received line signal level.
%Q	Report the line signal quality.
%TTn	PTT certification test signals.

* Serial interface operation only.

\Kn	Controls break handling during three states:

When modem receives a break from the DTE:

\K0,2,4	Enter on-line command mode, no break sent to the remote modem.
\K1	Clear buffers and send break to remote modem.
\K3	Send break to remote modem immediately.
\K5	Send break to remote modem in sequence with transmitted data.

When modem receives \B in on-line command state:

\K0,1	Clear buffers and send break to remote modem.
\K2,3	Send break to remote modem immediately.
\K4,5	Send break to remote modem in sequence with transmitted data.

When modem receives break from the remote modem:

\K0,1	Clear data buffers and send break to DTE.
\K2,3	Send a break immediately to DTE.
\K4,5	Send a break with received data to the DTE.
\N0	Select normal speed buffered mode.
\N1	Select direct mode.
\N2	Select reliable link mode.
\N3	Select auto reliable mode.
\N4	Force LAPM mode.
\N5	Force MNP mode.
+H0	Disable RPI.
+H1	Enable RPI and set DTE speed to 19200 bps.
+H2	Enable RPI and set DTE speed to 38400 bps.
+H3	Enable RPI and set DTE speed to 57600 bps.
**0	Download to flash memory at last sensed speed.
**1	Download to flash memory at 38.4 kbps.
**2	Download to flash memory at 57.6 kbps.
-SDR=0	Disable Distinctive Ring.
-SDR=1	Enable Distinctive Ring Type 1.
-SDR=2	Enable Distinctive Ring Type 2.
-SDR=3	Enable Distinctive Ring Type 1 and 2.
-SDR=4	Enable Distinctive Ring Type 3.
-SDR=5	Enable Distinctive Ring Type 1 and 3.
-SDR=6	Enable Distinctive Ring Type 2 and 3.
-SDR=7	Enable Distinctive Ring Type 1, 2, and 3.

A.2.   ECC COMMANDS

%C0	Disable data compression.
%C1	Enable MNP 5 data compression.
%C2	Enable V.42 bis data compression.
%C3	Enable both V.42 bis and MNP 5 compression.
\A0	Set maximum block size in MNP to 64.
\A1	Set maximum block size in MNP to 128.
\A2	Set maximum block size in MNP to 192.
\A3	Set maximum block size in MNP to 256.
\Bn	Send break of n x 100 ms.

A.3.   MNP 10 COMMANDS

)M0	Disable MNP 10 link negotiation power adjustment.
)M1	Enable MNP 10 link negotiation power adjustment.
)M2	Enable cellular mode without power level adjustment during MNP 10 link negotiation.
*H0	Select MNP 10 link negotiation at highest rate.
*H1	Select MNP 10 link negotiation at 1200 bps.
*H2	Select MNP 10 link negotiation at 4800 bps.
-K0	Disable MNP 10 extended services.
-K1	Enable MNP 10 extended services.
-K2	Enable MNP 10 extended services detection only.
-Q0	Disable MNP 10 fallback to 2400 bps (V.22 bis)/1200 bps (V.22).
-Q1	Enable MNP 10 fallback to 2400 bps (V.22 bis)/1200 bps (V.22).
-SEC=0	Disable MNP10-EC.
-SEC=1,[<tx level>]	Enable MNP10-EC and set transmit level <tx level> 0 to 30 (0 dBm to -30 dBm).
@M0	Select initial transmit level of -26 dBm.
@M1	Select initial transmit level of -30 dBm.
@M2	Select initial transmit level of -10 dBm.
@M3 - @M10	Select initial transmit level of -10 dBm.
@M11	Select initial transmit level of -11 dBm.
@M12	Select initial transmit level of -12 dBm.
.	
.	
.	
@M30	Select initial transmit level of -30 dBm.
:E0	Disable the compromise equalizer.
:E1	Enable the compromise equalizer.

A.9.   CELLULAR COMMANDS

^C2	Download cellular phone driver.
^I	Identify cellular phone driver.
^T6	Indicate status of cellular phone.

B. COMMON CONFIGURATION SETUP STRINGS

This appendix describes setup strings to establish commonly used configurations.

1. Force V.42 bis data compression with LAP-M error correction.

   AT\N4%C2-K0

2. Force V.42 bis data compression with MNP error correction.

   AT\N5%C2

3. Force MNP 5 data compression with MNP error correction.

   AT\N5%C1

   Note: With the setup strings in examples 1-3, if the remote is unable to negotiate the desire rate mode, the modem will disconnect and respond with NO CARRIER.

4. Auto negotiate data compression and error correction.

   AT&F (factory defaults) or

   AT\N3%C3

   In this mode, the modem prefers LAP-M over MNP 10, MNP 10 over MNP 4, and V.42 bis over MNP 5. If error correction is not negotiated, the modem will connect in normal mode.

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