

## 1. INTRODUCTION

### 1.1. OVERVIEW

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

- NovaFax 2400 Bps pockets and cards
- NovaFax 14400 Bps pockets and cards

The descriptions apply to all these modems with any differences between modem product families noted.

#### 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
- V.25 commands Section 5
- Fax Class 1 commands Section 6
- Fax Class 2 commands Section 7
- Voice commands Section 8

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.

## 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). 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.

### 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), V.25 (e.g., CIC), 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 (e.g., `&"`), followed by a decimal parameter. 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 (data/fax/voice, error correction, data compression, and data throughput enhancement). The default values are typical of a fully configured modem supporting all data rates, modes, 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

Under the AT command set (with the exception of the A/ command), each command line sent by the DTE 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. The command line interpretation begins upon receipt of the carriage return character.

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 <ctrl-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 256 (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 timing of the three characters must comply with specific time constraints. There is a guard time before the first character (the pre-sequence time), a guard time following the third character (the post-sequence time), and a guard time-out between the first and second characters and between the second and third characters (the inter-character time). These times are controlled by the value recorded in register S12.

### 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 principle 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 and must be terminated by the "/" character. 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.

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 dialling only).

#        The 'gate' digit (tone dialling 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 the highest supported speed (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 dialling: pulse dial the numbers that follow until a "T" is encountered. Affects current and subsequent dialling. Some countries prevent changing dialling modes after the first digit is dialled.

T        Select tone dialling: tone dial the numbers that follow until a "P" is encountered. Affects current and subsequent dialling. Some countries prevent changing dialling modes after the first digit is dialled.

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

S=n        Dial the number stored in the directory (n = 0 to 19). (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 dialling the digits following "W". If no dial tone is 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.

@        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.

, Dial pause: the modem will pause for a time specified by S8 before dialling 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.

^ Disable calling tone: 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 S31 bit 1. 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. (Other Rockwell products use this setting for 600 bps.)

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. 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 (e.g., "14400").

I1 Reports pre-computed checksum from ROM (e.g., "007").

I2 Computes checksum and compares it with value stored in ROM. Reports result as OK or ERROR.

I3 Reports firmware revision (e.g., "V1.000S").

I4 Reports OEM defined identifier string .

I5 Reports Country Code parameter (e.g., "022").

I6 Reports modem data pump model.

Result Codes:

OK n = 0 to 6.

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 Off or 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 dialling, 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 dialling mode for that particular call (e.g., ATDT...), this command is overridden so that all future dialling will be tone dialled. (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.

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 default register.

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 S0 will be assumed. The S can be omitted in which case the last s-register accessed (default register) will be assumed.

For example:

ATS7 establishes S7 as the default register.

ATS38 establishes S38 as the default register.

AT=40 sets the contents of the default register to 40.

ATS=20 sets the contents of S0 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 dialling 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 - Error Correction Message Control.

This command controls the format of CONNECT messages. The parameter value, if valid, is written to S31 bits 2 and 3. (Also, see S95 description.)

W0 Upon connection, the modem reports only the DTE speed (e.g., CONNECT 9600). 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 2400). 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 dialling 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. This table may be modified through the ConfigurACE program. 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 dialling 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 dialling 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 CARRIER will be reported instead of NO DIAL TONE. 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 DIALTONE, NO ANSWER, and CONNECT XXXX. Blind dialling 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.

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. (Default.)

&C1 RLSD follows the state of the carrier.

Result Codes:

OK n = 0 or 1.

ERROR Otherwise.

Table 3-1. Result Codes

Short Form	Long Form	n Value in ATXn Command
		0 OK
1 CONNECT		2 RING
		3 NO CARRIER
4 ERROR		5 CONNECT 1200
		6 NO DIALTONE
7 BUSY		8 NO ANSWER
		9 CONNECT 0600
10 CONNECT 2400		11 CONNECT 4800
		12 CONNECT 9600
		13 CONNECT 7200
		14 CONNECT 12000
		15 CONNECT 14400
		16 CONNECT 19200
		17 CONNECT 38400
		18 CONNECT 57600
		22 CONNECT 1200TX/75RX
		23 CONNECT 75TX/1200RX
		24 DELAYED
		32 BLACKLISTED
		40 CARRIER 300
		44 CARRIER 1200/75
		45 CARRIER 75/1200
		46 CARRIER 1200
		47 CARRIER 2400
		48 CARRIER 4800
		49 CARRIER 7200
		50 CARRIER 9600
		51 CARRIER 12000
		52 CARRIER 14400
		66 COMPRESSION: CLASS
		67 COMPRESSION: V.42 bis
		69 COMPRESSION: NONE
		76 PROTOCOL: NONE
		77 PROTOCOL: LAPM
		80 PROTOCOL: ALT
		81 PROTOCOL: ALT-CELLULAR
		33 FAX
		+F4+FCERROR
		35 DATA

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).

#### &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.

&D0 - DTR drop is interpreted according to the current &Q setting as follows: (Default.)

&Q0, &Q5, &Q6 DTR is ignored (assumed ON). Allows operation with DTEs which don't 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 &Q 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 &Q setting as follows:

&Q0 through &Q6 DTR drop causes the modem to hang up. Auto-answer is inhibited.

&D3 DTR drop is interpreted according to the current &Q 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 according to the parameter supplied.

The Rockwell factory defaults for profile 0 (&F0) are quoted for each command and in the S register descriptions. Two profiles are available. A configuration profile consists of a subset of S-registers.

&F0 Recall factory profile 0. (Default.)

&F1 Recall factory profile 1.

Result Codes:

OK n = 0 or 1.

ERROR Otherwise or 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     Supports transparent XON/XOFF flow control.

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

Result Codes:

OK       n = 0, 3, 4, 5, or 6.

ERROR       Otherwise.

#### &Ln - Leased Line Operation

This command selects leased or dial-up line operation for compatibility. 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     Selects dial-up line operation.

&L1     Selects leased line operation.

Result Codes:

OK       n = 0 or 1.

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.

&M2     Selects synchronous connect mode with async off-line command mode. Same as &M1 except that &M2 enables DTR dialling 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.

&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.

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 dialling. 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.)

&Q0      Selects direct asynchronous operation. See &M0.

&Q1      Selects synchronous connect mode with async off-line command mode. See &M1.

&Q2      Selects synchronous connect mode with async off-line command mode. See &M2.

&Q4      Selects autosync operation. The value 100b is written to S27 bits 3, 1, and 0, respectively.

&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).

&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

If the NVRAM is installed or is operational as detected by the NVRAM test, the following message is displayed:

NVRAM SIZE IS XXXX (XXXX = 2KX8, 2KX1, or 1Kx1)

If the NVRAM is not installed or is not operational as detected by the NVRAM test, the following message is displayed:

NVRAM FAILED OR NOT INSTALLED

&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 Otherwise.

#### &Zn=x - Store telephone number

The modem can store up to 4 (US) or 20 (W-class) telephone numbers. Each telephone number dial string can contain up to 45 digits.

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

&Zn=x n = 0 to 19 (W-class) and x = dial string. (Requires 2048-byte NVRAM.)

Result Codes:

OK For n = 0 to 3 (US) or 19 (W-class) and x less than or equal to 45 digits.

ERROR If n > 3 (US) or 19 (W-class) or x greater than 45 digits.

#### 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). Applies to dial-up line only. 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. (Default.)

%E1 Enable line quality monitor and auto-retrain.

%E2 Enable line quality monitor and fallback/fall forward. (Not applicable to RC96V24AC or RC14V24AC.)

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.32bis modulation speeds. The rate renegotiations will be done without a retrain if a V.32bis connection is established.

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

%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.

%TTn - 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 %TT (T is a password), 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 A.

%TT0C DTMF digit B.

%TT0D DTMF digit C.

%TT0E DTMF digit #.

%TT0F DTMF digit D.

%TT10 V.21 channel no. 1 mark (originate) symbol.

%TT11 V.21 channel no. 2 mark symbol.

%TT12 V.23 backward channel mark symbol.

%TT13 V.23 forward channel mark symbol.

%TT14 V.22 originate (call mark) signalling at 600 bps.

%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 no. 1 space symbol.

%TT20 V.32 9600 bps.

%TT21 V.32 bis 14400 bps.

%TT22 V.17 14400 bps.

%TT1A V.21 channel no. 2 space symbol.

%TT1B V.23 backward channel space symbol.  
%TT1C V.23 forward channel space symbol.  
%TT1D V.27 ter carrier.  
%TT1E V.29 carrier.  
%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).

To permit output signal spectra measurement, data can be transmitted in the absence of a received signal by setting S10 equal to 255.

### 3.2.4. AT\ Commands

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

In non-error correction mode, the modem enables or disables the generation or recognition of modem-to-modem XON/XOFF flow control according to the parameter supplied. The parameter value, if valid, is written to S41 bit 3.

In error correction mode, the setting of modem-to-modem XON/XOFF flow control is ignored. However, the serial port flow control settings (AT&K) remain active during a reliable link.

Due to the buffering system used in the modem, modem-to-modem flow control is normally disabled.

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

\G1 Enables modem-to-modem XON/XOFF flow control.

Result Codes:

OK n = 0 or 1.

ERROR Otherwise.

#### \Jn - Enable DTE Auto Rate Adjustment

Controls whether the modem will adjust the DTE speed to match the line speed when the connection is complete. The parameter value, if valid, is written to S41 bit 5.

\J0 Disable adjustment of DTE speed to match line speed.

\J1 Enable adjustment of DTE speed to match line speed.

Result Codes:

OK n = 0 or 1.

ERROR Otherwise.

#### \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.)

Note that when S82 is modified, the modem converts the Hayes specific value to the \K format and updates S40 to match.

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.

### 3.3. 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.

##### \Ln - MNP Block/Stream Mode Select

At connection time, this command controls the selection between block and stream modes of operation in MNP. The parameter value, if valid, is written to S41 bit 4.

\L0 Use stream mode for MNP connection. (Default.)

\L1 Use interactive block mode for MNP connection. This command will accept block mode but implement stream mode.

Result Codes:

OK n = 0 or 1.

ERROR Otherwise.

### 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 during link negotiation for reliable links to accommodate the signalling requirements of cellular telephone equipment. The parameter value, if valid, is written to S40 bit 2.

)M0 Disables power level adjustment during MNP 10 link negotiation. (Default.)

)M1 Enables power level adjustment during MNP 10 link negotiation.

Result Codes:

OK n = 0 or 1.

ERROR Otherwise.

#### 3.4.2. AT- Commands

\*Hn - Link Negotiation Speed

This command controls the connection speed for link negotiations before upshift occurs between two MNP Class 10 modems. The parameter value, if valid, is written to S40 bit 2.

\*H0 Link negotiation occurs at the highest supported speed. (Default.)

\*H1 Link negotiation occurs at 1200 bps.

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 bit 0.

-K0 Disables V.42 LAPM to MNP 10 conversion.

-K1 Enables V.42 LAPM to MNP 10 conversion. (Default.)

Result Codes:

OK n = 0 or 1.

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 S40 bit 1.

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

-Q1 Enables fallback to 2400 bps (V.22bis) and 1200 bps (V.22). (Default.)

Result Codes:

OK n = 0 or 1.

ERROR Otherwise.



### 3.5. W-CLASS COMMANDS

#### 3.5.1. AT% Commands

##### %Fn - Split-Speed Direction Select

Determines which direction (transmit or receive) has the 75 bps channel, and which has the 1200 bps channel. This command is only valid if the \W1 command has been executed.

%F1 Selects 75Tx/1200Rx. Resets S28 bits 1 and 2. (Default.)

%F2 Selects 1200Tx/75Rx. Sets S28 bit 1 and resets S28 bit 2.

##### %Mn - AUXCTL Output Line Control

Configures the AUXCTL output line to be used to switch between primary and auxiliary V.24 ports or to be used as a command/data mode indicator (synchronous modes only).

%M0 Sets the AUXCTL line low. The line will go high when the modem enters data mode if synchronous is selected.(i.e., for modes &M1, &M2, or &M3). The line will return low at the end of data mode. (Default.)

%M1 Sets the AUXCTL line high. The line will go low when the modem enters data mode and will return high when the data mode terminates and the command mode is entered.

##### Result Codes:

OK n = 0 or 1.

ERROR Otherwise.

### 3.5.2. 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

#### \*C - Remote Configuration Password

This command instructs the modem to store a password. Following this command, the response "ENTER PASSWORD" is generated, after which the new password should be entered. The password supplied by a remote modem wishing to reconfigure this local modem must match the password stored by the local modem in response to the \*C command. The password must be alphanumeric and between 6 and 12 characters in length. This command works only with MNP connections. The default password is QWERTY. (Also, see \*E and \*R commands.)

#### \*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 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

#### \*E - Exit Remote Configuration Mode

Upon receipt of this command from the telephone line, the modem will exit remote configuration mode and transmit the OK result code to the line. (Also, see register S202.)

#### \*L - Display Secure Access (Callback) Directory.

The modem will display all secure access (callback) directory entries.

Format:

Entry Number - Password:Callback Number.

Example:

0-MERAS02 (Password entered; no callback number)

1-872FRD:345-7895551212 (Password entered; callback number)

2-

3-

4-

5-

6-

7-

8-

9-

10  
11-  
12-  
13-  
14-  
15-  
16-  
17-  
18-  
19-  
OK

#### \*NCnn - Country Select

Up to eight 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.

\*NCnn Select country parameters corresponding to entered country code (nn). The country codes are:

CountryCode (nn)	
Australia	40
Austria	1
Belgium	2
Canada	20
Denmark	3
Finland	4
France	5
Germany	6
Ireland	7
Italy	8
Japan	43
Luxembourg	9
Mexico	21
Netherlands	10
New Zealand	48
Norway	11
Portugal	12
Singapore	47
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.

#### \*P - Store Callback Password

This command causes the modem to store a password and to store or delete a corresponding telephone number in NVRAM. The password will be used to match that supplied by a remote modem when secure access is used. The modem will use the telephone number to dial back the remote modem. The password must be between 6 and 12 characters in length. The telephone number length is 40 characters maximum. If the number to be dialled back (along with the final colon) is omitted, a password check will be performed, but no callback will occur. Up to 20 password/telephone number pairs may be entered.

AT\*Pn: <password>:<number to be dialled back>

Parameters: 0 to 19.

Result Codes:

OK For parameters 0 to n and for dial string of less than 41 digits.

ERROR Otherwise.

**\*R - Request Remote Configuration Mode**

This command from the DTE requests that the local modem attempt to place the remote modem in remote configuration mode. This command will only be accepted if the local modem is in on-line command state during an MNP error corrected link. Enter the password (from 6 to 12 characters in length) after the REMOTE PASSWORD prompt is displayed by the local DTE. The entered password is inserted in a remote configuration request (a special MNP frame) and is sent to the remote modem.

Following a successful request, indicated by the display of the !AT prompt by the local DTE, the local DTE may send commands to the remote modem. These commands, a subset of the normal commands available, should be entered without the 'AT' header. Some commands are prohibited and others may produce unpredictable results. To exit the remote configuration mode, enter the \*E command or the escape sequence defined by register S202. The default password is QWERTY. (Also, see \*C and \*E commands and register S202.)

**\*Zn - Change Dial Codes:**

In some countries, notably Norway, there exist two methods of pulse dialing. This command allows the user to select one of the two methods as appropriate for the application.

\*Z0 Use dial code 0. (Default.)

\*Z1 Use dial code 1.

Result Codes:

OK n = 0 or 1.

ERROR Otherwise.

### 3.5.3. AT\ Commands

\F - Display Telephone Directory

The modem displays the telephone directory entries which were stored with the &Z command.

\S - Report Active Configuration

The modem reports the current (active) configuration for display.

Example:

CMD	DESCRIPTION / OPTION	
---	-----	
	DTE BPS	2400
	DTE PARITY	8NONE
	DIAL MODE	PULSE
	LINE SPEED	NONE
B	BELL MODE	OFF
E	CMD ECHO	ON
F	LINE MODE	AUTO
L	SPKR VOLUME	LOW
M	SPKR CONTROL	1
N	AUTO MODE	OFF
Q	QUIET	ON
V	RESULT FORM	LONG
W	EC MSG	0
X	EXT RESULTS	4
Y	LONG SPACE DISC	YES
%C	COMPRESSION	BOTH
%E	AUTO RETRAIN	OFF
-K	EXT. SERVICES	OFF

CMD	DESCRIPTION / OPTION
---	-----
&C	DCD OPTION 0
&D	DTR OPTION 0
&G	GUARD TONE NONE
&K	FLOW CONTROL NONE
&P	PULSE MODE 0
&Q	ASYNC/SYNC 0
&R	RTS/CTS 0
&S	DSR OPT 0
&T	ENABLE RDL YES
&X	SYNC CLOCK INT
&Y	PROFILE NVM 0
\A	MAX BLK SIZE 64
\G	REMOTE FLOW ON
\K	BRK OPT 2
\N	ECL MODE NORM
\W	SPLIT SPEED OFF
*H	NEG. SPEED HIGH
)M	CELLULAR OFF

CMD	DESCRIPTION / OPTION	
---	-----	
S0	RINGS TO ANS	002
S1	RING COUNT	000
S2	<ESC> CHAR	043
S3	<CR> CHAR	013
S4	<LF> CHAR	010
S5	<BS> CHAR	008
S8	PAUSE TIME	001
S12	ESC GUARD TIME	050
S18	TEST TIME	000
S24	SLEEP INACT	000
S30	CONNECT INACT	000
S32	<XON> CHAR	017
S33	<XOFF> CHAR	019
S36	FALLBACK ACTION	000
S37	MODE SELECT	000
S38	V.42 NEG. CTRL	000
S48	V42 NEG CTRL	128
S95	RES. CODE	000

OK



#### \Wn - Split-Speed Operation

This command supports a split-speed DCE/DTE interface for applications such as Viewdata terminals which require a transmit speed of 75 bps and receive speed of 1200 bps at the DTE interface. The parameter value, if valid, is written to S28 bit 0.

\W0 Disables split-speed mode. (Default.)

\W1 Enables split-speed mode. V.23 operation is also forced as though F3 had been entered.

Note that %Fn command determines the split screen direction.

Result Codes:

OK n = 0 or 1.

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. 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.)

#### 00- OK

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

#### 01- 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.

#### 02- 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.

#### 03- 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.

#### 04- 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.

#### 05- 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.)

#### 06- NO DIALTONE

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

#### 07- 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.

#### 08- 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.

#### 09- 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 the DTE speed is 4800 bps and the modem has been instructed to report the DTE speed upon connecting.

#### 12- CONNECT 9600

For X1, X2, X3, and X4, the modem sends this result code upon connecting when 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 upon connecting when 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 upon connecting when 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 upon connecting when 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 19,200 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.

#### 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 dialled 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 dialled 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 either a V.21 or Bell 103 carrier has been detected on the line and carrier reporting has been enabled. (See S95.)

### 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 X4.)

### 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 X4.)

### 46- CARRIER 1200

The modem sends this result code when either the high or low channel carrier in either V.22 or Bell 212 mode has been detected on the line and carrier reporting has been enabled. (See S95 and X4.)

### 47- CARRIER 2400

The modem sends this result code when either the high or low channel carrier in V.22 bis mode has been detected on the line, and carrier reporting has been enabled. (See S95 and X4.)

### 48- CARRIER 4800

The modem sends this result code when the 4800 bps data rate in V.32 bis or V.32 mode has been detected on the line, and carrier reporting has been enabled. (See S95 and X4.)

### 49- CARRIER 7200

The modem sends this result code when the 7200 bps data rate in V.32 bis mode has been detected on the line, and carrier reporting has been enabled. (See S95 and X4.)

### 50- CARRIER 9600

The modem sends this result code when the 9600 bps data rate in V.32 bis or V.32 mode has been detected on the line, and carrier reporting has been enabled. (See S95 and X4.)

### 51- CARRIER 12000

The modem sends this result code when the 12000 bps data rate in V.32 bis mode has been detected on the line, and carrier reporting has been enabled. (See S95 and X4.)

### 52- CARRIER 14400

The modem sends this result code when the 14400 bps data rate in V.32 bis mode has been detected on the line, and carrier reporting has been enabled. (See S95 and X4.)

### 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 X4.)

### 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 X4.)

### 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 X4.)

### 76- 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 X4.)

### 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 X4.)

### 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 X4.)

### 81- PROTOCOL: ALT-CELLULAR

This message is sent to the DTE when the modem has connected in the MNP 10 mode, and PROTOCOL message reporting has been enabled. (See S95 and X4.)

+FC - FCERROR

This message is sent to the DTE when the modem has detected an error in fax class 1 or fax class 2 mode.

#### 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.

All of the factory default values may be loaded at any time by entering the &F command.



Table 4-1. S Register Summary

Register	Function	Range	Units	Save	Default	S0	Rings to Auto-Answer
0	Rings to Auto-Answer	0-255	rings	*	0		
2	(W-class models) 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*	4			
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 Code Guard Time	0-255	0.02 s*	50			
S13	Reserved	-	-	-	-		
S14	General Bit Mapped Options	-	-	*	138 (8Ah)		
S15	Reserved	-	-	-	-		
S16	Test Mode Bit Mapped Options (&T)	-	-	-	0		
S17	Reserved	-	-	-	-		
S18	Test Timer	0-255	s*	0			
S19-S20	Reserved	-	-	-	-		
S21	V.24/General Bit Mapped Options	-	-	*	4 (04h)		
S22	Speaker/Results Bit Mapped Options	-	-	*	117 (75h)		
S23	General Bit Mapped Options	-	-	*	55 (37h)		
183	(B7h) (W-class models) 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	-	-	*	73 (49h)		
74	(4Ah) (US models w/o ECC)						
9	(09h) (W-class models) General Bit-Mapped Options	-	-	*	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	-	-	*	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	-	-	*	3		
S40	General Bit-Mapped Options	-	-	*	105 (69h)		
107	(6Bh) (MNP 10 models) General Bit-Mapped Options	-	-	*	3		
S42-S45	Reserved	-	-	-	-		
S46	Data Compression Control	-	-	*	138		
S48	V.42 Negotiation Control	-	-	-	7		

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

Register	Function	Range	Units	Saved	Default	S80	Soft-Switch Functions	-	-	0	S82	
	LAPM Break Control	-	-	128(40h)		S86	Call Failure Reason Code	0-255	-	-	S91	
	PSTN Transmit Attenuation Level	0-15	dBm		10	S92	Fax Transmit Attenuation Level	0-15	dBm		10	S95
	Result Code Messages Control	-	-	*	0	S99	Leased Line Transmit Level	0-15	dBm		10	S202
	Remote Access Escape Character	0-255	ASCII		170	*						

Register value may be stored in one of two user profiles with the &W command. 000000000000

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

#### 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 (US models)

2 (W-class models)

##### S1 - Ring Counter

Sets the number of the rings required before the modem answers a call. If no rings occur over an eight second interval, this register is cleared.

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  $\delta W\delta$  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  $\delta$ Wait for Dial Tone $\delta$  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  $\delta W\delta$  dial modifier before continuing with the next dial string parameter.

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: 4

S7 - Wait Time For Carrier After Dial, For Silence, or For Dial Tone After  $\delta W\delta$  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  $\delta W\delta$  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  $\delta, \delta$  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 Code Guard Time

Defines the maximum period, in fiftieths of a second, allowed between consecutive asynchronous escape characters (+) for the escape sequence to be considered valid.

Range: 0-255 1/50 of a second

Default: 50 (1 second)

S13 - Reserved

S14 - General Bit Mapped Options

Indicates the status of command options.

Default: 138 (8Ah) (10001010b)

Bit 0 ù This bit is ignored.

Bit 1 ù Command echo (En)

0 = Disabled (E0)

1 = Enabled (E1) (Default.)

Bit 2 ù Quiet mode (Qn)

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

1 = Do not send result codes (Q1)

Bit 3 ù Result codes (Vn)

0 = Numeric (V0)

1 = Verbose (V1) (Default.)

Bit 4 ù Reserved

Bit 5 ù Tone (T)/Pulse (P)

0 = Tone (T) (Default.)

1 = Pulse (P)

Bit 6 ù Reserved

Bit 7 ù Originate/Answer

0 = Answer

1 = Originate (Default.)

S15 - Reserved

S16 - General Bit Mapped Test Options

Indicates the test in progress status.

Default: 0

Bit 0 ù Local analog loopback

0 = Disabled (Default.)

1 = Enabled (&T1)

Bit 1 ù Not used

Bit 2 ù Local digital loopback

0 = Disabled (Default.)

1 = Enabled (&T3)

Bit 3 ù Remote digital loopback (RDL) status

0 = Modem not in RDL

1 = RDL in progress

Bit 4 ù RDL requested (AT&T6)

0 = RDL not requested (Default.)

1 = RDL requested (&T6)

Bit 5 ù RDL with self test

0 = Disabled (Default.)

1 = Enabled (&T7)

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

0 = Disabled (Default.)

1 = Enabled (&T8)

Bit 7 ù 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 - S20 - Reserved

## S21 - V.21/General Bit Mapped Options

Indicates the status of command options.

Default: 4 (00000100b)

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

0 = &J0 (Default.)

1 = &J1

Bit 1 ù Reserved

Bit 2 ù CTS behavior (&Rn)

0 = CTS always on (&R0)

1 = CTS tracks RTS (&R1) (Default.)

Bit 3,4 ù DTR behavior (&Dn)

0 = &D0 selected (Default.)

1 = &D1 selected

2 = &D2 selected

3 = &D3 selected

Bit 5 ù RLSD (DCD) behavior (&Cn)

0 = &C0 selected (Default.)

1 = &C1 selected

Bit 6 ù DSR behavior (&Sn)

0 = &S0 selected (Default.)

1 = &S1 selected

Bit 7 ù Long space disconnect (Yn)

0 = Y0 (Default.)

1 = Y1

## S22 - Speaker/Results Bit Mapped Options

Indicates the status of command options.

Default: 117 (75h) (01110101b)

Bit 0,1 ù Speaker volume (Ln)

0 = Off (L0)

1 = Low (L1) (Default.)

2 = Medium (L2)

3 = High (L3)

Bit 2,3 ù Speaker control (Mn)

0 = Disabled (M0)

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

2 = Always on (M2)

3 = On during handshake (M3)

Bit 4,5,6 ù Limit result codes (Xn)

0 = X0

4 = X1

5 = X2

6 = X3

7 = X4 (Default.)

Bit 7 ù Reserved

### S23 - General Bit Mapped Options

Indicates the status of command options.

Default: 55 (37h) (00110111b) (US models.)

183 (B7h) (10110111b) (W-class models.)

Bit 0 ù Grant RDL

0 = RDL not allowed (&T5)

1 = RDL allowed (&T4) (Default.)

Bit 1,2,3 ù Assumed 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

Bit 4,5 ù Assumed DTE parity

0 = even

1 = not used

2 = odd

3 = none (Default.)

Bit 6,7 ù Guard tone (&Gn)

0 = None (&G0) (Default for US models.)

1 = None (&G1)

2 = 1800 Hz (&G2) (Default for W-class models.)

### 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 before hanging up. Its units are seconds for synchronous mode 1 and one hundredths of a second for other modes.

Range: 0-255 (1 second for synchronous mode 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 Option

Indicates the status of command options.

Default: 73 (49h) (01001001b) (US models with ECC).

74 (4Ah) (01001010b) (US models without ECC).

9 (09h) (00001001b) (W-class models.)

Bit 0,1,3 ù 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 for ECC models.)
1	1	0	=	&Q6 (Default for non-ECC models.)

Bit 2 ù Leased line control (&Ln)

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

1 = Leased line (&L1)

Bit 4,5 ù Internal clock select (&Xn)

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

1 = External clock (&X1)

2 = Slave clock (&X2)

Bit 6 ù CCITT/Bell mode select (Bn)

0 = CCITT mode (B0) (Default for W-class models.)

1 = Bell mode (B1) (Default for US models.)

Bit 7 - Reserved

## S28 - Bit Mapped Options

Default: 0

Bit 0 ù V.23 split screen (\Wn)

0 = Disabled (\W0) (Default.)

1 = Enabled (\W1)

Bit 1 ù V.23 split screen direction

0 = 75 Tx /1200 Rx (%F1) (Default.)

1 = 1200 Tx /75 Rx (%F2)

Bit 2 ù Reserved (always 0).

Bit 3,4 ù 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 ù Reserved

Bit 6-7 ù 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 oh-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

Default: 2 (00000010b)

Bit 0 ù Reserved

Bit 1 ù Controls auto line speed detection (Nn)

0 = Disabled (N0)

1 = Enabled (N1) (Default.)

Bit 2,3 ù Controls error correction progress messages (Wn)

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

1 = Full reporting (W1)

2 = DCE speed only (W2)

Bit 3 ù Reserved

Bit 4-7 ù 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 (Applies to ECC Models Only)

Default: 7 (00000111b)

Bit 0-2 ù 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)

Bit 3-7 ù Reserved

### S37 - Desired Line Connection Speed

Default: 0

Bit 0-3 ù 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 1200 bps (F4).

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

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

8 = Attempt to connect at 4800 bps (F6).

9 = Attempt to connect at 9600 bps (F8).

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

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

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

Bit 4-7 ù 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

Default: 3 (00000011b)

Bits 0-2 ù 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 ù Reserved

#### S40 - General Bit Mapped Options

Indicates the status of command options.

Default: 105 (69h) (01101001b) (non-MNP 10 models.)

107 (6Bh) (01101011b) (MNP 10 models.)

Bit 0 ù 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.)

Bit 1 ù Enable fallback to V.22bis/V.22 (-Qn)

0 = Disabled (-Q0)

1 = Enabled (-Q1) (Default.)

Bit 2 ù Power Level Adjustment for Cellular Use ( )Mn)

0 = Auto-adjustment ( )M0) (Default.)

1 = Force adjustment ( )M1)

Bits 3-5 ù Break Handling (\Kn)

0 = \K0

1 = \K1

2 = \K2

3 = \K3

4 = \K4

5 = \K5 (Default.)

Bits 6-7 ù 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

Indicates the status of command options.

Default: 3 (00000011b)

Bits 0 -1 ù 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 ù 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) (Not applicable to

RC96V24AC and RC14V24AC.)

Bit 3 ù Modem-to-modem flow control

0 = Disabled (\G0) (Default.)

1 = Enabled (\G1)

Bit 4 ù Block mode control (\Ln)

0 = Stream mode (\L0) (Default.)

1 = Block mode (\L1)

Bit 5 ù Reserved

Bit 7 ù Reserved

#### 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.

### S80 - Soft-Switch Functions

S80 is applicable only if the EPROM has been so customized by ConfigurACE. S80 bits are the software equivalent of four hardware input signals. The hardware signal is indicated corresponding to each bit.

Default: 0

Bits 0-4      Reserved

Bit 5      V.25 bis/AT command mode select (AT/V25B signal)

0 =      AT selected

1 =      V.25 bis selected

Bit 6      Remote configuration permitted (REMCONF signal)

0 =      Remote configuration not permitted

1 =      Remote configuration permitted

Bit 7      Call back security enforcement (SECACC signal)

0 =      Call back security disabled

1 =      Call back security enabled

### S82 - Break Handling Options

Break signals provide a way for the user to get the attention of the remote modem. The break type depends on the specific application. LAPM specifies three methods of break signal handling: in sequence, expedited, and destructive. If an invalid number is entered, it is accepted into the S register, but S82 will act as if the default value has been entered.

Range: 3, 7, or 128

Default: 128

S82=3 Expedited: Modem sends a break immediately; data integrity is maintained both ahead of and after the break.

S82=7 Destructive: Modem sends a break immediately; data being processed by each modem at the time of the break is destroyed.

S82=128 In sequence: Modem sends a break in sequence with any transmitted data; data integrity is maintained both ahead of and after the break. (Default.)

#### 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=6 No response to feature negotiation.

S86=7 This modem is asynchronous only; the other modem is synchronous only.

S86=8 No framing technique in common.

S86=9 The modems could not find a common protocol.

S86=10 Bad response to feature negotiation.

S86=11 No sync information from remote modem.

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 ConfiguratACE.

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 ConfiguratACE.

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.

### S99 - Leased Line Transmit Level

Sets the transmit level, in dBm, for the leased line mode. In some countries this cannot be changed and there are checks to prevent transmit level change.

Range: 0 to -15 dBm

Default: 10

### S202 - Remote Access Escape Character

S202 holds the decimal value of the ASCII character used as the escape character in the escape sequence from on-line to Remote Access. S202 works similar to S2 except that the S2 escape character is used in the escape sequence from on-line to the command mode.

Range: 0-255, ASCII decimal

Default: 170 (Escape disabled)

A value over 127 disables the escape process, i.e., no escape character will be recognized. The default S202 value of 170 disables the escape process to Remote Access (whereas the default S2 value enables escape to command mode). If 128 is subtracted from 170 (i.e., bit 7 is reset), the resulting 42 is the ASCII code for the '\*' character. The '\*' character is commonly used for the Remote Access escape character.

The Remote Access escape sequence consists of four characters with a fixed escape guard time of 1 second. Only the character selected by S202 is valid. When '\*' is used for the escape character, the escape sequence is '\*\*\*\*'.

The Remote Access escape sequence works when the modems are connected in any mode (normal, LAPM or MNP) except direct mode. The modem on which the remote commands are typed (the "local modem") does not need any special code associated with the remote configuration. The "remote modem" (whose configuration will be modified remotely) must have Remote Configuration Mode (RCM) enabled (bit 2 of S80).

The escape sequence entered by the user on the local modem is recognized by the remote modem, which then sends a message to the local mode prompting for entry of the "remote password". From then on, operation is similar to RCM except for slight differences of presentation. The remote modem will send a ">" prompt before each AT command. The user must type the AT prefix before the command(s), which is not required by RCM. Several commands on the same line can be accepted.

Some potentially hazardous AT commands are barred in Remote Access: ATO, ATZ, AT&T, AT\B, AT\*C, AT\*L, AT\*P, and ATZ. (Note that ATA and ATD are automatically barred because the modem is already connected.)

To exit Remote Access, enter command AT\*X. Upon exiting Remote Access, the normal data link is re-established and the "CONNECT" message is issued to the DTE. (Note that in RCM, exit is to the command mode, but actually, in both cases, return is to the previous state before entering Remote Access/RCM). AT\*R and AT\*E commands also operate the same as in RCM.

Remote Access can be exited by typing a remote ATH command. The connection will be terminated and a "NO CARRIER" response will be issued from the local modem to the DTE since the hangup was actually performed by the remote modem.

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## 5. V.25 BIS COMMAND SET

Modem operation may be controlled through the use of the V.25 bis command set. This is implemented by command, response, and circuit signalling providing addressed call and/or answer via circuit 108/2 in accordance with V.25 bis. V.25 bis is a CCITT recommendation that defines a method of exchanging commands and indications across a DTE interface (EIA-232/V.24). V.25 bis defines modem behavior only while the modem is disconnected from the line, or while the modem is off-hook and is attempting to establish a connection. The following terms are used in the V.25 bis description.

**COMMAND:** An instruction issued by the DTE to the modem as part of the automatic calling procedure.

**INDICATION:** A response message issued by the modem to the DTE as part of the automatic calling procedure.

**PARAMETER:** A variable which may accompany commands or indications. In general, more than one parameter may be used in a command or indication.

### 5.1. DTE/DCE INTERCHANGE CIRCUITS

Communication between the DTE and modem is half duplex.

The DTE is the 'master' and the modem is the 'slave'. Only the DTE initiates V.25 bis communications, while the modem just responds.

When the modem is in data transfer mode after the connection has been established, the modem is no longer in V.25 bis mode.

During automatic calling and answering procedures, RLSD (CT109) follows the condition of RTS (CT106).

### 5.2. FORMATS FOR COMMANDS AND INDICATIONS

The modem will accept commands either in synchronous mode HDLC (NRZ or NRZI), BSC, or in asynchronous mode. The command set conforms to the CCITT recommendation with two extensions for asynchronous mode.

#### 5.2.1. Synchronous Signalling

The modem can automatically detect and switch from HDLC framing to BSC framing.

#### 5.2.2. HDLC Frames

HDLC frames, commands, and indications are HDLC frames with data fields called messages.

FLAG 7Eh

ADDRESS FFh

CONTROL 13h

MESSAGE Data. Must be an integer number of 8-bit characters between 3 and 60.

FCS Sixteen-bit cyclic redundancy check based on the polynomial:  $X^{16} + X^{12} + X^5 + X^1$

Framing Rules

Frames may be preceded and followed by any data including additional flags.

A frame with an address, control, or FCS field error is invalid. A frame with more than 60 characters in the message field is invalid. A frame with 3 or less characters in the message field is rejected with the INV indication.

Invalid frames are ignored.

For every valid command frame received, the modem responds with exactly one indication if the connection is not completed, and no indication if the connection is completed.

When the modem receives a valid command frame, it will ignore another command frame until it has completed sending its indication back to the attached DTE, or until the connection is terminated, whichever occurs last.

The modem can accept a valid command frame that follows an invalid frame if there is a pause of at least 2 bit times between the end of the invalid frame and the start of the valid frame.

The modem automatically detects whether each command frame is NRZ or NRZI encoded and follows suit for its indication.

Command and indication frames contain inserted zero bits as required by HDLC. The receiving entity (modem or DTE) strips out these extra bits.

BSC Frames

The format for synchronous character oriented format shall be in accordance with ISO 1745.

SYN 16h

SYN 16h

STX 02h

MESSAGE Data. Must be an integer number of 8-bit characters between 3 and 60.

ETX 83h

#### Framing Rules

Frames may be preceded and followed by any data including additional SYN characters.

A frame with a parity error is invalid. A frame with more than 60 characters in the message field is invalid. A frame with 3 or less characters in the message field is invalid. An invalid frame will be rejected with the INV indication.

For every valid command frame received, the modem responds with exactly one indication if the connection is not completed, and no indication if the connection is completed. The modem does not recognize or send any of the short 'ack' type messages used in character oriented protocols. When the modem receives a valid command frame, it will ignore another command frame until it has completed sending its indication back to the attached DTE, or until the connection is terminated, whichever occurs last.

The modem can accept a valid command frame that follows an invalid frame if there is a pause of at least 2-bit times between the end of the invalid frame and the start of the valid frame.

#### 5.2.2. Asynchronous Signalling

The format for the asynchronous character oriented format is:

MESSAGE <CR> <LF>

The default data rate for commands and parameters is the maximum data rate permitted by the modem.

The message field can contain between 3 and 60 8-bit characters (7-bit IA5 per T.50 plus odd parity per V.4) which define the parameters. Each frame can contain only one command followed by multiple parameters as will fill the limit.

#### Command/Indication Exchange Protocol

The modem will ignore any command issued with incorrect parity. The modem will ignore a command issued from the DTE before it has completed execution of the previous command and given an appropriate response. The modem will ignore a command from the DTE while it is sending an indication to the DTE.

A command received with a message field of less than 3 characters or more than 60 characters is regarded as an error in the message and will result in the negative acknowledgment of the command by the return of the invalid message (INV).

#### DTE Adaption

In asynchronous mode, the modem performs an autobaud/autoparity/autolength function on the first characters received following a Power-On Reset or <cntl> Z. If the modem receives a <CR> <LF> sequence, it is able to calculate the speed, parity, and the word length. If the modem receives only a <CR> character, it will calculate the speed but retain the existing parity and word length values. If the modem receives neither of these characters, it will continue to use the existing values for speed, parity, and word length. If no previous speed, parity, and/or length information is available, the modem defaults to 7-bit even operation at 9600 bps. The autolength/autoparity facility is capable of detection of 7- or 8-bit characters of even, odd, or no parity with one stop bit. The modem then accepts and sends characters according to this selection of speed, parity, and length. The adaption algorithm is re-initialized by the next OFF-to-ON transition of CT108/2.

In HDLC mode, the modem detects when DTE sends in NRZ or NRZI format, and adjusts its indication format accordingly.

#### 5.2.3. V.25 bis Escape Code Sequence

An escape sequence function for V.25 bis asynchronous operation is provided which operates exactly like the AT escape sequence. (See Section 3.1.)

#### 5.3. STANDARD V.25 BIS COMMANDS

The following commands are implemented, and parameters applicable to each command are noted following the description of the command.

##### CIC - Connect Incoming Call

The modem goes on-line in answer mode cancelling any DIC command previously issued. If no incoming call is present, the modem issues the invalid (INV) message.

##### CRI - Call Request with Number and Identification

The modem goes on-line, dials according to the dial string entered, and attempts to establish a connection in the same manner as the CRN command except a ";" character and an identification character string can be inserted after the dial string. However, everything after the ";" character is ignored, i.e., the identification is not sent.

x..x      Dial string: a string of dial characters (see CRN).

;          Separator: inserted between dial string and identification.

Example:

CRN 234-1234;4567

VAL

CRN - Call Request with Number

The modem goes on-line, dials according to the dial string entered, and attempts to establish a connection. The following dial modifiers are valid:

0-9      Digits 0 to 9.

\*          The 'star' digit: Tone dialling only.

#          The 'gate' digit: Tone dialling only.

T          Select tone dialling: Affects current and subsequent dialling.

P          Select pulse dialling: Affects current and subsequent dialling.

<          Short dial pause: Period controlled by S8: The modem will pause before dialling the digits following ô<.ö

=          Long dial pause: Period twice as long as the short dial pause.

:          Wait for dial tone: The modem will wait for dial tone before dialling the digits following ô:ö.

&          Flash: The modem will go off-line according to the value of S30.

^          Disable calling tone transmission: Applicable to current dial attempt only.

Example:

CRN 234-1234

VAL

#### CRS - Call Request with Memory Address

The modem goes on-line, dials according to the dial string entered in the dial string memory addressed (see PRN), and attempts to establish a connection.

0-19 Dial string memory address.

Example:

CRS 1 or CRS1

345-5678

VAL

#### DIC - Disregard Incoming Call

The modem, though configured for auto-answer, will disregard the incoming call. If there is no incoming call or auto-answer is not enabled, the modem will issue the INV message.

#### PRI - Program Identification

The modem returns VAL indication only.

#### PRN - Program Number

The modem stores the dial string specified into the dial string memory referenced.

0-19 Dial string memory address.

; Separator: Inserted between dial string memory address and dial string.

x..x Dial string: A string of dial characters: 0-9 \* # T P = & /: characters accepted: An empty string clears the identification memory referenced.

Example:

PRN 1;345-5678

VAL

#### RLD - List Request of Delayed Call Numbers

The modem returns the list of numbers which have been delayed by country dependent blacklisting procedures.

Example:

NO. - PHONE NUMBER - DELAY

-----  
LSD 1; 7503857609 2

LSD 2; 1349579050 1

LSD 3; 4146949385 1

LSD 4; 3479784564 3

LSD 5; 5529685740 1

VAL

#### RLF - List Request of Forbidden Numbers

The modem returns the list of numbers which have been blacklisted by country dependent blacklisting procedures.

Example:

NO. - PHONE NUMBER

-----  
LSF 1; 6209567485

LSF 2; 4227458945

LSF 3; 2137874644

LSF 4; 5256677014

LSF 5; 0114418172323

LSF 6; 7228309

VAL

#### RLI - List Request of Identification Numbers

The modem returns the VAL message only.

Example:

LSI 1; 8183400

VAL

#### RLN - List Request of Stored Numbers (Dial Strings)

The modem returns the dial string or the list of dial strings according to the parameter supplied.

0-19 Dial string memory address: If no address is supplied, a full list of all stored dial strings will be returned.

Examples:

LSN 4; 19:1=722340     Response to RLN4  
VAL

LSN 0; Response to RLN

LSN 1;

LSN 2;

LSN 3;19:1=7223400

LSN 4;

LSN 5;

LSN 6;

LSN 7;

LSN 8;93256642

LSN 9;

LSN10;

LSN11;

LSN12;

LSN13;

LSN14;

LSN15;

LSN16;

LSN17;

LSN18;

LSN19;

LSN20;

VAL

#### 5.4. EXTENDED V.25 BIS COMMANDS

There is one extension to the standard V.25 bis command set.

CNL - Local Configuration

Any AT command string may be entered as a parameter of this command. This command is valid only in asynchronous mode. The format is:

CNL<AT command>

Example:

CNLS0=2

#### 5.5. STANDARD V.25 BIS INDICATIONS

The modem provides the indications/responses listed, and parameters applicable to each message are noted following the description of the response.

CFI - Call Failure Indication

The modem sends this message when a call fails to connect. A parameter is included to give the reason for the failure.

AB     No dial tone or the call abort timer expired with no call progress tone detected or during handshaking after answer tone detected.

CB     Local circuit busy (phone off-hook).

ET     Busy (engaged tone) detected.

FC     Requested number on forbidden call list (call not placed).

NS     No number stored at dial string memory requested (call not placed).

NT     Ringback detected: Ringback stopped: Call abort timer expired with no answer tone detected.

RT     Ringback detected: Call abort timer expired with ringback still detected.

CNX - Connect

The modem returns this message when a connection has been established. The message may be followed by a value indicating the connection speed.

Example:

CNX 9600

DLC - Delayed Call

The modem returns this message when a call fails to connect and the number dialled is

considered 'delayed'. The message indicates the delay (in minutes) before the call may be re-attempted as shown in the following example:

DLCn (n = delay in minutes)

This message will be preceded by the message indicating call failure.

INC - Incoming Call

The modem sends this message when incoming ringing is detected on the line.

INV - Invalid Command

The modem sends this message if the command line contains a syntax error, or if the modem is unable to execute the command.

VAL - Valid Command

The modem sends this message when it successfully executes the command issued and there is no other applicable response (message or circuit transition).