AT Commands

for the Apple Internal Modem

Contents

Entering AT Commands

To enter an AT command, you must be using a terminal emulation application that provides you with a text area for entering commands and receiving command feedback, such as ZTERM and MacTerminal.

Typing an AT Command

The command line is made up of three elements: the prefix, the body, and the termination character. The command line prefix consists of the characters "AT" or "at" or, to repeat the execution of the previous command line, the characters "A/" or "a/" or, to escape from data mode, the characters, "+++".

For example, to answer an incoming call using the A (answer) command, you type

```
ATA
```

and then press the Return key.

Using Command Parameters

There are two type of commands: action commands and parameter commands. Action commands may be "executed", or "tested". The parameter commands may be "set" or "read".

Some parameter commands require a parameter, which is usually a single digit that determines the command's behavior. For example, the parameter n in the Hn command is either 0 (to hang up) or 1 (to go off-hook).

To hang up using this command, you type

```
ATH0
```

and then press the Return key.

Some parameter commands require parameters that are not single digits. For example, the Dn command accepts one or more single-character dialing modifiers, plus a telephone number. To use touch-tone dialing (T) to dial the telephone number 123-4567, you type

```
ATDT1234567
```

and then press the Return key.

Entering Multiple Commands

You can enter multiple AT commands on the same line, as long as the line begins with "AT" and ends with a carriage return.

You usually use multiple commands on the same line to configure your modem. For example, to request that the modem use the factory default settings (&F command) and display current configuration and stored profile (&V command), you type

```
AT&F1&V
```

and then press the Return key.

Entering and Exiting Command Mode

The modem must be in the command mode before you enter an AT command. If you are connected to another modem, you can use the +++ command to switch to command mode. (You can later return to your connection using the On command.)

For example, to enter an AT command when a connection is active, you type

```
+++
```

to enter command mode; then type the AT commands you want to issue; and finally type

```
ATO
```

to return to your connection.

AT Command Reference

AT commands control your modem's settings and operation. This section provides detailed information on all AT commands supported by the Apple internal modem.

+++ (switching to command mode)

The +++ command forces a modem that is already connected to enter the command state, so you can send commands to your modem without breaking its connection with the remote modem. In some cases, you must send "AT" after the +++ command. Unlike other AT commands, the +++ command is not preceded by the "AT" prefix. The command is accepted when the "+++" is typed, so you do not follow this command with a carriage return.

In order to prevent the modem from responding to "+++" (called the "escape sequence") in transmitted data, it requires a one-second pause before and after the sequence. Without the pause, the modem treats the "+++" sequence as data rather than a command.

You can change the escape sequence from +++ to another string of characters by setting the S2 register. You can change the pause time required for the escape sequence by setting the S12 register.

A (answering an incoming call)

The A command forces the modem to go off-hook in answer mode. Use this command to manually answer an incoming call when you know that another modem is calling. When the modem detects an incoming call, it sends the RING result code to your computer. If a telecommunications application is active, the result code appears on your screen. For example, to answer an incoming call, you type: ATA

A/ (repeating the last command)

The A/ command repeats the previous command. This command is especially useful for re-issuing a dial command that failed because of a busy line or no answer. Unlike other AT commands, the A/ command is not preceded with the "AT" prefix. The command is accepted as soon as the "A/" is typed, so you do not follow this command with a carriage return.

\An (setting maximum MNP block size)

When the modem establishes an MNP error-corrected connection, it will use the maximum block size set by this command.

- \A0—64-character block size.
- \A1 (default)—128-character block size.
- \A2—192-character block size.
- \A3—256-character block size.

For example, to instruct the modem to use the default block size when negotiating an MNP error-corrected connection, you type: AT\A1

Bn (specifying protocol for 300 or 1200 bps)

When the modem is configured to allow either option, the modem will select Bell or CCITT protocols for 300 or 1200 bps according to the parameter supplied. Any other line speed will use a CCITT protocol. The parameter value, if valid, is written to S27 bit 6. (Also, see ATFn command.)

- B0 (default for modems sold outside the US)—Selects CCITT V.22 protocol for 1200 bps connections and CCITT V.21 protocol for 300 bps connections.
- B1 (default for US modems)—Selects Bell 212A protocol for 1200 bps connections and Bell 103 protocol for 300 bps connections.

\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 \K command. In error-correction mode, the modem transmits a break signal of unspecified length through the error-correction protocol. The default value is \B3, specifying a break signal length of 300 ms.

%Cn (selecting data-compression settings)

Enable or disable 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. Reset S46 bit 1.
- %C1—Enables MNP 5 data compression. Resets S46 bit 1.
- %C2—Enables V.42bis data compression. Sets S46 bit 1.
- %C3 (default)—Enables both V.42bis and MNP 5 data compression. Sets S46 bit 1.

&Cn (modifying the carrier detection response)

The modem controls the RLSD output. The parameter value, if valid, is written to bit 5 of the S21 register.

- &C0—RLSD remains ON all the times.
- &C1 (default)—RLSD follows the state of the carrier.

Dn (entering a dialing string)

The Dn command causes the modem to dial a telephone number. n is the telephone number you want to dial. The telephone number can include the characters 0–9, A–D, #, and * (A, B, C, D, #, and * can be used only when touch-tone dialing is selected). Dashes, parentheses, and spaces are ignored. For example, to dial the telephone number 123-4567, you type: ATD 123-4567

Note: The space and dash in the telephone number are ignored.

Dialing Modifiers

You can also include a number of dialing modifiers in the n parameter to change the way dialing is handled. The following dialing modifiers can be used with the Dn command:

! (flash on-hook)

The modem will go on-hook for the time specified by the S29 register and then back off-hook. This modifier can be placed anywhere in the dialing string.

Example: ATDT!123-4567

This command instructs the modem to go on-hook and back off-hook, and then use touch-tone dialing to dial the telephone number 123-4567.

@ (wait for silence)

The modem will wait for at least 5 seconds of silence after in the call progress frequency band before continuing with the next dial string parameter. If the modem does not detect five 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 will terminate the call with the BUSY result code. If answer tone arrives during execution of this parameter, the modem handshakes.

Example: ATD1234567@8888

This command dials the telephone number 123-4567, waits for the call to be answered, and then dials the extension 8888.

, (dial pause)

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

Example: ATDT123-4567,,,888

This command uses touch-tone dialing to dial the telephone number 123-4567. It then pauses for six seconds before dialing the telephone extension 888.

; (return to command mode after dialing)

The ; dialing modifier instructs the modem to return to command state after dialing a number. You can use this modifier to issue additional AT commands while remaining off-hook. The semicolon must be placed at the end of the dial command, but can then be followed by other commands.

Example: ATD1234567;X1DT,8

This command instructs the modem to dial the telephone number 123-4567 and then return to command state. Once the modem is in command state, it pauses (indicated by the comma) and then dials the number 8, without checking for a dial tone (X1).

& (wait for credit-card tone)

Wait for credit-card dialing tone before continuing with the dialing string. If the tone is not detected within the time specified by the S7(US models) or S6(W-class), the modem will hang up and generate an error message.

Example: ATDT123-4567&112233

This command dials the telephone number 123-4567 and then waits for a credit card tone before dialing 112233.

^ (enable calling tones)

The ^ dialing modifier enables calling tones for the current dial attempt. By default, calling tones are disabled for Internal 56k modems sold in North America. You might want to enable calling tones with the ^ modifier if, for instance, the device that you are calling uses calling tones to differentiate between a voice, fax, or data call.

Example: ATDT ^ 123-4567

This command instructs the modem to emit calling tones when the remote device answers the call.

L (redial the last telephone number)

The L dialing modifier instructs the modem to redial the last telephone number dialed. The L modifier must be placed immediately after the D in the Dn command. The modem ignores any characters placed after the L modifier. To display the last-dialed number (with a terminal emulation application), use the following command: ATDL?

Example: ATDT1234567
ATDL

The first command dials the telephone number 123-4567. The second command redials the telephone number.

P (pulse dial)

The P dialing modifier instructs the modem to use pulse dialing. If you use P between the digits of a telephone number, the digits following P are pulse-dialed.

Example: ATDP123-4567

This command uses pulse dialing to dial the telephone number 123-4567.

R (originate call in answer mode)

This command will be accepted, but not acted on.

T (touch-tone dial)

The T dialing modifier instructs the modem to use touch-tone dialing.

Example: ATDT123-4567

This command uses touch-tone dialing to dial the telephone number 123-4567.

W (wait for a dial tone)

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

Example: ATDT8W123-4567

This command instructs the modem to dial 8, then wait for a dial tone before dialing the telephone number 123-4567.

&Dn (disconnecting using DTR signaling)

This command interprets the ON to OFF transition of the DTR signal from the computer. For each parameter value, the way DTR is interpreted depends on the setting of the &Qn command. When you enter a valid command parameter, it is written to S21 bits 3 and 4.

- &D0 (default)
  - For &Q0, &Q5, &Q6: DTR is ignored (assumed ON). Allows operation with computers that don't provide DTR signaling.
  - For &Q1: when DTR drops, the modem hangs up. Autoanswer is not affected.
  - For &Q2, &Q3: when DTR drops, the modem hangs up. Autoanswer is inhibited.
- &D1
  - For &Q0, &Q1, &Q5, &Q6: when DTR drops, the modem returns to the asynchronous command state without disconnecting, as if the asynchronous escape sequence had been entered.

- For &Q2, &Q3: when DTR drops, the modem hangs up.Autoanswer is inhibited.
- &D2

  For &Q0–Q6: when DTR drops, the modem hangs up. Autoanswer is inhibited.
- &D3
  - For &Q0, &Q1, &Q5, &Q6: when DTR drops, the modem performs a soft reset (as if the Zn command had been received). The &Yn setting determines which profile is loaded.
  - For &Q2, &Q3: when DTR drops, the modem hangs up. Autoanswer is inhibited.

Example: AT&D2

This command enables DTR hangup for all values of the &Qn command.

En (turning echo on and off)

The En command controls whether commands that you type are echoed back to your computer while the modem is in command mode.

- E0—Disables echo to the computer in command mode.
- E1 (default)—Enables echo to the computer in command mode.

Example: ATE1

This command instructs the modem to echo characters it receives from the computer while in command mode.

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

The %En command controls whether 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 improves (%E2).

- %E0—Disables line quality monitor and auto-retrain.
- %E1—Enables line quality monitor and auto-retrain.
- %E2 (default)—Enables line quality monitor and fallback/fallforward.

Example: AT%E1

This command tells the modem to monitor the line quality and request a retrain if the quality changes.

&Fn (loading a factory configuration)

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

- &F0 (default)—Restores factory configuration 0.
- &F1—Restores factory configuration 1.

&Gn (selecting the guard tone)

The &Gn command determines whether the modem transmits a guard tone when answering. The parameter value, if valid, is written to S23 bits 6 and 7.

- &G0—Disables guard tones (US default).
- &G1—Disables guard tones.
- &G2—Selects 1800 Hz guard tone.

Hn (disconnecting)

You use the Hn command to place the modem on-hook (hang up) or take the modem off-hook (equivalent to lifting the telephone receiver).

- H0—Places the modem on-hook (hangs up).
- H1—Takes the modem off-hook and places it in command mode.
- +++

Example: ATH0

Suppose that you want to end a connection that you have established with another modem. This example uses the +++ command to enter command mode, then uses H0 to hang up.

In (displaying information about the modem)

The In command instructs the modem to provide information about itself.

- I0—Reports product code, e.g., 56000
- I1—Reports the least significant byte of the stored checksum in decimal (see firmware release notes), e.g., Apple Version 0003,6/14/98
- I2—Reports OK if ROM checksum is valid; otherwise, reports ERROR.
- I3—Reports firmware identification codes.
- I4—Reports OEM defined identifier string, e.g., Apple Internal Modem
- I5—Reports the Country Code parameter, e.g., 008
- I6—Reports modem data pump model and internal code revision, e.g., RCV56DPF-PLL 28571A Rev 24.00/24.

\Jn (enabling DTE rate adjustment)

If you have a European modem, you can control whether the modem adjusts the DTE speed to match the line speed after making a connection. It is recommended that you disable the adjustment of the DTE speed to match the line speed (\J0). Most telecommunications applications automatically set the DTE speed to the optimum rate of data transfer, which is often higher than the line speed.

- \J0 (default)—Disables adjustment of the DTE speed to match the line speed.
- \J1—Enables adjustment of the DTE speed to match the line speed.

Example: AT\J0

This command instructs the modem to disable adjustment of the DTE speed to match the line speed.

Kn (controlling the flow control method)

You use the &Kn command to select the flow control method used for a connection between a computer and a modem. When you enter a valid command parameter, it is written to bits 0–2 of the S39 register.

- &K0—Disables flow control.
- &K3 (default)—Enables hardware flow control (RTS/CTS).
- &K4—Enables software flow control (XON/XOFF).
- &K5—Enables transparent XON/XOFF flow control.
- &K6—Enables both RTS/CTS and XON/XOFF flow control.

\Kn (controlling break signal behavior)

The \Kn command controls the behavior of the modem when it receives a break signal. The meaning of each parameter value depends upon the context of the break signal.

Receiving a break from the computer (in on-line mode)

This section describes, for each parameter value, what the modem will do when it receives a break signal from the computer while in on-line mode.

- \K0—Enter on-line command mode, without sending a break to the remote modem.
- \K1—Clear data buffers and send break to the remote modem.
- \K2—Same as \K0.
- \K3—Send break to the remote modem immediately.
- \K4—Same as \K0.
- \K5 (default)—Sends break to remote modem in sequence with transmitted data.

Receiving a break from the computer (in command mode)

This section describes, for each parameter value, what the modem will do when it receives a break signal from the computer while in command mode.

- \K0—Clear data buffers, then send a break to the remote modem.
- \K1—Same as \K0.
- \K2—Send break to the remote modem immediately.
- \K3—Same as \K2.
- \K4—Send a break to the remote modem in sequence with transmitted data.
- \K5 (default)—Same as \K4.

Receiving a break from the remote modem

This section describes, for each parameter value, what the modem will do when it receives a break signal from the remote modem during a non-error-correcting connection.

- \K0—Clear data buffers, then send a break to the computer.
- \K1—Same as \K0.
- \K2—Send break to the computer immediately.
- \K3—Same as \K2.
- \K4—Send break to the computer in sequence with received data.
- \K5 (default)—Same as \K4.

Example: AT\K5

This command resets the modem to its default break signal behavior:

- When the modem receives a break from the computer, it sends a break to the remote modem in sequence with data.
- When the modem receives a break from the remote modem, it sends a break to the computer in sequence with data.

-Kn (enabling V.42 to MNP 10 conversion)

You use the -Kn command to enable or disable the conversion of a V.42 LAP-M connection to an MNP 10 connection. When you enter a valid command, its parameter value is written to bits 0–1 of the S40 register.

- -K0 (default)—Disables V.42 LAP-M to MNP 10 conversion.
- -K1—Enables V.42 LAP-M to MNP 10 conversion.
- -K2—Enables V.42 LAP-M to MNP 10 conversion; inhibits the initiation of MNP extended services during V.42 LAP-M answer mode detection phase.

Ln (adjusting the speaker volume)

You use the Ln command to adjust the modem speaker volume. (If you want to turn the modem speaker on or off, see the Mn command.) The parameter value, if valid, is written to S22 bits 0 and 1.

- L0—Lowest speaker volume.
- L1 (default)—Low speaker volume.
- L2—Medium speaker volume.
- L3—High speaker volume.

%L (reporting the line signal level)

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

Mn (turning the speaker on or off)

You use the Mn command to turn the modem speaker on or off. (If you want to change the speaker volume, see the Ln command.) The parameter value, if valid, is written to S22 bits 2 and 3.

- M0—Speaker is always off.
- M1 (default)—Speaker is on during call establishment, until the modem detects a carrier tone.
- M2—Speaker is always on.
- M3—Speaker is off during receiving carrier and dialing, but on during answering.

&Mn (selecting asynchronous mode)

You can use the &Mn command to determine the DTR operating mode. The modem treats the &Mn command as a subset of the &Qn command.

- &M0—Selects direct asynchronous operation.

  Note that the command sequence "&M0\N0" selects normal buffer mode, but the command sequence \N0&M0 select 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.

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

- &M2—Selects synchronous connect mode with async off-line command mode. Same as &M1 except that &M2 enables DTR dialing of directory slot 0. The modem will disconnect if DTR is OFF for more than the period in S25 (in units of hundredths of a second): the data connection will be synchronous. The value 010b is written to S27 bits 3, 1, and 0, respectively. (Serial interface operation only.)

- &M3—Selects synchronous connect mode. This mode allows DTR to act as a talk/data switch. The call is manually initiated while DTR is inactive. When DTR becomes active, the handshake proceeds in originate or answer mode according to S14 bit 7. The value 011b is written to S27 bits 3, 1, and 0, respectively. (Serial interface operation only.)

+MS (Select Modulation)

This extended format command selects the modulation and, optionally, enables or disables automode, specifies the lowest and highest receive rates, selects _-Law or A-Law codec type, and, specifies the highest transmit rate using one to five subparameters. The command format is:

+MS= <mod>
,[<automode>][,[<min_RX_rate>][,[<max_RX_rate>][,[<x_law>][,[<reserved>],
[<max_TX_rate>]]]]]]<CR>

Notes:

1. For 14400 bps and lower speeds, the Nn command and S37 register can alternatively be used, in which case the +MS subparameters will be modified to reflect the Nn and S37=x settings. Use of the Nn and S37=x commands is not recommended but is provided for compatibility with existing communication software. (S37 is not updated by the +MS command.)

2. Subparameters not entered (enter a comma only or <CR> to skip the last subparameter) remain at their current values.

Reporting Selected Options

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

The response is:
+MS:
<mod>,<automode>,<min_RX_rate>,<max_RX_rate>,<x_law>,<reserved>,
<max_TX_rate>

For example:

+MS: 56,1,300,56000,0,0,33600 [default for RC56 with V.90/K56flex or K56flex only loaded]

+MS: 12,1,300,56000,0,0,33600 [default for RC56 with V.90 only loaded]

+MS: 11,1,300,33600,0,0,33600 [default for RC336]

Reporting Supported Options

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

The response is:

+MS: (list of supported <mod> values), (list of supported <automode> values),(list of supported <min_RX_rate> values), (list of supported <min_RX_rate> values), (list of supported <reserved> values), (list of supported <max_TX_rate> values

For example:

+MS	0,1,2,3,9,10,11,12,56,64,69), (0,1), (300-33600), (300-56000), (0,1), (0,1), (300-33600)	[Modem with V.90/K56flex loaded]

Subparameter Definitions

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

  The options are:

<mod>	Modulation	Possible rates (bps) (See Note 1)	Notes
0	V.21	300	
1	V.22	1200	
2	V.22 bis	2400 or 1200	
3	V.23	1200	See Note 2
9	V.32	9600 or 4800	
10	V.32 bis	14400, 12000, 9600, 7200, or 4800	
11	V.34	33600, 31200, 28800, 26400, 24000, 21600, 19200, 16800, 14400, 12000, 9600, 7200, 4800, or 2400	Default for RC336
12	V.90	56000, 54667, 53333, 52000, 50667, 49333, 48000, 46667, 45333, 42667, 41333, 40000, 38667, 37333, 36000, 34667, 33333, 32000, 30667, 29333, 28000	Default for RC56 with V.90 only or V.90/K56flex loaded

<mod>	Modulation	Possible rates (bps) (See Note 1)	Notes
56	K56flex	56000, 54000, 52000, 50000, 48000, 46000, 44000, 42000, 40000, 38000, 36000, 34000, 32000	Default for RC56 with K56flex only loaded
64	Bell 103	300	
69	Bell 212	1200	

1. See optional <automode>, <min_RX_rate>, <max_RX_rate>, and <max_TX_rate> subparameters.

2. For V.23, originating modes transmit at 75 bps and receive at 1200 bps; answering modes transmit at 1200 bps and receive at 75 bps. The rate is always specified as 1200 bps

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

a. The modem may not be able to automatically switch from the current modulation (specified by <mod>) to some other modulation. For example, there is no standard way to automode from Bell 103 to V.23.

b. The DTE may disable automode operation (see <automode> below).

c. The DTE may constrain the range of modulations available by specifying the lowest and highest rates (see <min_RX_rate> and <max_RX_rate> below).

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

The options are:

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

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

For <automode> = 0 (automode disabled, i.e., fixed modulation):

- a. If <max_RX_rate> is within the rates supported by the selected modulation, the selected rate is that specified by <max_RX_rate>.
  For example: +MS=10,0,1200,4800 selects V.32 bis 4800 bps fixed rate.

- b. If <max_RX_rate> is greater than the highest speed supported by the modulation specified by <mod>, the starting rate is the highest rate supported by the selected modulation.
  For example: +MS=10,0,2400,14400 selects V.32 bis 14400, 12000, 9600, 7200, or 4800 bps.

To emulate issuance of the N0S37=x command sequence to select fixed mode operation, specify the <max_RX_rate> and <min_RX_rate> both to be the (same) requested speed, and <mod> to be the modulation for +MS=11,0,16800,16800 selects V.34 16800 bps fixed mode (no comparable S37 command).

For example: +MS=10,0,12000,12000 selects V.32 bis 12000 bps fixed mode (same as N0S37=10).

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

- a. If <max_RX_rate> is greater than the highest rate supported by the modulation specified by <mod>, the modem automodes down from the highest rate of the selected modulation.
  For example: +MS=10,1,1200,24000 selects automoding down from V.32 bis 14400 bps.

- b. To emulate issuance of the N1S37=x sequence command, specify the modulation and the rate to start automoding down from using <mod> and <max_RX_rate>, respectively. Set min_RX_rate> to 300 to allow automoding all the way down to V.21 300 bps.
  For example:
  +MS=11,1,300,16800 selects automode starting at V.34 16800 bps (no comparable S37 command).
  +MS=9,1,300,12000 selects automode starting at V.32 bis 12000 bps (same as N1S37=10).

- 3. <min_RX_rate> is an optional number which specifies the lowest rate at which the modem may establish a receive connection. The value is decimal coded, in units of bps, e.g., 2400 specifies the lowest rate to be 2400 bps. The default is 300.

- 4. <max_RX_rate> is an optional number which specifies the highest rate at which the modem may establish a receive connection. The value is decimal coded, in units of bps, e.g., 28800 specifies the highest rate to be 288400 bps. The default is 56000.

- 5. <x_law> is an optional number which specifies the codec type. The options are:
  0 = _-Law

$1 = $ A-Law

Note that ATZ will restore the x-law value from NVRAM if NVRAM is available, otherwise the country default value will be used. Also note that the <x-law> parameter in a +MS command overrides a previous %Un command and a %Un command overrides the <x-law> setting specified in a previous +MS command.

- 6. <reserved> must not be changed from the default value of 0.

- 7. <max_TX_rate> is an optional number which specifies the highest rate at which the modem may establish a transmit connection. The value is decimal coded, in units of bps, e.g., 33600 specifies the highest rate to be 33600 bps. The default is 33600.

*NCn (country select)

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

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

Select country parameters corresponding to entered country code (n).

Country	Code (n)
Australia/New Zealand	40
Austria	1
Belgium	2
Denmark	3
Finland	4
France	5
Germany	6
Italy	8
Japan	43
netherlands	10

Country	Code (n)
Norway	11
Spain	13
Sweden	14
Switzerland	15
United Kingdom	16

The following countries are supported by United States firmware, Code (n) 22: United States, Taiwan, Canada, Hong Kong, Mexico/Latin America, and Singapore.

Result Codes

- OK (If parameters corresponding to entered country code are present in EPROM.)
- ERROR (otherwise)

Nn (selecting variable or fixed connection speed)

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

- N0—Automode detection is disabled (equivalent to setting the +MS <automode> subparameter to 0). 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 (default)—Automode detection is enabled (equivalent to setting the +MS <automode> subparameter to 1). A subsequent handshake will be conducted according the automode algorithm supported by the modem, e.g., according to the contents of S37 or, if S37 is zero, starting at 33600 bps V.34 (RC336).

    Notes:

    1 The Nn and S37=x commands override the +MS command settings. When the N0 or N1 command is issued, the +MS subparameters are updated to reflect the Nn and S37 values (see +MS command and S37 register). *For example:*
    N1S37=10 updates the +MS command subparameters to reflect
    +MS=10,1,300,12000
    N0S37=10 updates the +MS command subparameters to reflect
    +MS=10,0,12000,12000

    2 Use of the +MS command is recommended instead of the Nn and S37=x commands. Nn and S37=x commands are supported for compatibility with existing communication software.

\Nn (setting error-correction mode)

You use the \Nn command to specify the type of error correction to be negotiated. Each parameter setting forces the corresponding setting for the &Qn command. Some parameter settings also set S-registers 36 and 48.

- \N0—Selects normal speed-buffered mode; disable error correction mode. (Forces &Q6).
- \N1—Selects direct mode; no error correction used.(Forces &Q0).
- \N2—Selects reliable (error-correction) mode. The modem will first attempt a LAP-M 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 command operates the same as \N2, except that if the modem cannot make a reliable connection, it falls back to the speed-buffered normal mode. (Forces &Q5, S36=7, and S48=7).
- \N4—Selects LAP-M error-correction mode. Failure to make a LAP-M error-correction connection results in the modem hanging up. (Forces &Q5 and S48=0).
- \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).

Example: AT\N2

This command sets the modem to make a reliable connection. If the modem cannot make a reliable connection, it will not connect.

On (switching to on-line mode)

The On command returns the modem to the on-line state from the command state. If the modem is not connected to another modem, the command returns the ERROR result code.

- O0—Returns the modem to the on-line state without retraining.
- O1—Returns the modem to the on-line state after retraining.

P (using pulse dialing)

The P command makes pulse dialing the default dialing method. To indicate that all subsequent dialing should be conducted in pulse dial mode, the P command sets bit 5 of the S14 register. You can override the P command for a specific dial attempt by adding the T modifier to the dialing string.

Example: ATP

  ATD123-4567

This example sets the default dialing method to pulse dialing and then dials the telephone number 123-4567.

&Pn (selecting the pulse mode make/break ratio)

You use the &Pn command to specify the make/break ratio used for pulse dialing. The parameter, if valid, is written to bits 3 and 4 of the S28 register.

- &P0 (default)—Make = 39% and Break = 61% at 10 pulses per second (for US and Canada).
- &P1—Make = 33% and Break = 67% at 10 pulses per second (for UK and Hong Kong).
- &P2—Make = 39% and Break = 61% at 20 pulses per second (for Japan).
- &P3—Make = 33% and Break = 67% at 20 pulses per second.

Qn (displaying result codes)

The Qn command determines whether the modem sends a result code back to the computer after performing each AT command. (The format of the result codes is determined by the Vn command.)

- Q0 (default)—Result codes enabled.
- Q1—Result codes disabled.

Example: ATQ0

This command sets the modem to display result codes after each AT command.

&Qn (setting synchronous/asynchronous mode)

The &Qn command selects the operating mode and determines how the modem will treat transmitted and received data while in the on-line state.

- &Q0—Selects asynchronous mode (no error control, disables V.42 and MNP); returns OK result code. The value 000b is written to S27 bits 3, 1, and 0, respectively. See &M0.
- &Q1—Selects synchronous on-line mode with asynchronous off-line command mode. The value 001b is written to S27 bits 3, 1, and 0, respectively. See &M1. (Serial interface operation only.)
- &Q2—Selects synchronous on-line mode with asynchronous off-line command mode and enables DTR dialing of directory 0. The value 010b is written to S27 bits 3, 1, and 0, respectively. See &M2. (Serial interface operation only.)
- &Q3—Selects synchronous on-line mode with asynchronous off-line command mode and enables DTR to act as Talk/Data switch. The value 011b is written to S27 bits 3, 1, and 0, respectively. See &M3. (Serial interface operation only.)
- &Q5 (default)—The modem will try to negotiate an error-corrected link in synchronous mode. You can set the S36 register to determine the result if the modem fails to establish an error-corrected link. The value 101b is written to S27 bits 3, 1, and 0, respectively.
- &Q6—Selects synchronous operation in normal mode (speed buffering). The value 110b is written to S27 bits 3, 1, and 0, respectively.

Example: AT&Q5

This command instructs the modem to use the default connection behavior. If S36=7 (the default value), the modem will attempt to negotiate an MNP 5 error-corrected link in synchronous mode. If it fails to do so, it will attempt to negotiate a normal (non-error-corrected) link.

%Q (reporting the line signal quality)

The %Q command reports the line signal quality (DAA-dependent), returning the higher-order byte of the EQM value. Based on the EQM value, the modem may initiate a retrain (if enabled by %E1) or fallback/fallforward (if enabled by %E2).

&Rn (controlling hardware RTS/CTS signaling)

The &Rn command selects how the modem controls CTS signaling when hardware flow control is selected. (The behavior of CTS depends on whether the connection is synchronous or asynchronous.) The parameter value, if valid, is written to S21 bit 2.

- &R0—In synchronous mode, CTS will track the state of RTS; the RTS-to-CTS delay is defined by the S26 register. In asynchronous mode, CTS is normally ON and will turn OFF only if required by flow control.
- &R1 (default)—In synchronous mode, CTS will always be on and RTS transitions will be ignored. In asynchronous mode, CTS will drop only if required by flow control.

Sn (read/write S-register)

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

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

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

For example:

ATS7	establishes S7 as the last accessed register.

AT=40	Sets the contents of the last register accessed to 40.
ATS=20	Sets the contents of the last register accessed to 20.

T (using touch-tone dialing)

The T command makes touch-tone dialing the default dialing method. To indicate that all subsequent dialing should be conducted in touch-tone mode, the T command clears S14 bit 5. You can override the T command for a specific dial attempt by adding the P modifier to the dialing.

Example: ATT
ATD123-4567

This example sets the default dialing method to touch-tone and then dials the telephone number 123-4567.

Vn (setting result code format)

The Vn command determines whether result codes are displayed as numbers (numeric form) or words (verbose form).

- V0—Switches to short form(numeric). (No line feed character is issued following the code.)
- V1 (default)—Switches to long form(verbose). (A line feed character is issued following the code.)

Example: ATV1

This command instructs the modem to display result codes as words.

&V (displaying a user profile)

The &V command displays the active profile, including command and S-register settings.

Wn (specifying connection result codes)

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

- W0 (default)—Upon connection, the modem reports the DTE speed (for example, CONNECT 57600).
- W1—Upon connection, the modem reports the line speed (for example, CARRIER 14400), error-control protocol (for example, PROTOCOL LAP-M), data-compression protocol (for example, COMPRESSION V.42BIS), and DTE speed (for example, CONNECT 57600).

- W2—Upon connection, the modem reports the line speed (for example, CONNECT 14400).

Xn (using extended result codes)

You use the Xn command to set which result codes the modem can return. This command also enables or disables busy-tone and dial-tone detection during the dialing process.

- X0—Disables monitoring of busy tones unless forced otherwise by country requirements; send only OK, CONNECT, RING, NO CARRIER, ERROR, and NO ANSWER result codes. Blind dialing is enabled/disabled by country parameters. If busy tone detection is enforced and busy tone is detected, NO CARRIER will be reported. If dial tone detection is enforced or selected and dial tone is not detected, NO CARRIER will be reported instead of NO DIAL TONE. The value 000b is written to S22 bits 6, 5, and 4, respectively.

- X1—Disables monitoring of busy tones unless forced otherwise by country requirements; send only OK, CONNECT, RING, NO CARRIER, ERROR, NO ANSWER, and CONNECT XXXX (XXXX = rate). Blind dialing enabled/disabled by country parameters. If busy tone detection is enforced and busy tone is detected, NO CARRIER will be reported instead of BUSY. If dial tone detection is enforced or selected and dial tone is not detected, NO CARRIER will be reported instead of NO DIAL TONE. The value 100b is written to S22 bits 6, 5, and 4, respectively.

- X2—Disables monitoring of busy tones unless forced otherwise by country requirements; send only OK, CONNECT, RING, NO CARRIER, ERROR, NO DIALTONE, NO ANSWER, and CONNECT XXXX. If busy tone detection is enforced and busy tone is detected, NO CARRIER will be reported instead of BUSY. If dial tone detection is enforced or selected and dial tone is not detected, NO DIAL TONE will be reported instead of NO CARRIER. The value 101b is written to S22 bits 6, 5, and 4, respectively.

- X3—Enables monitoring of busy tones; send only OK, CONNECT, RING, NO CARRIER, ERROR, NO ANSWER, and CONNECT XXXX. Blind dialing is enabled/disabled by country parameters. If dial tone detection is enforced and dial tone is not detected, NO CARRIER will be reported. The value 110b is written to S22 bits 6, 5, and 4, respectively.

- X4 (default)—Enables monitoring of busy tones; send all messages. The value 111b is written to S22 bits 6, 5, and 4, respectively. (Default.)

Example: ATX1DT5556767

This command disables busy-tone and dial-tone detection, enables all result codes, and dials the number 555-6767.

This can be a useful addition to a dial string when the modem is failing to make a connection because it is misinterpreting the ring as a busy tone or not recognizing the dial tone.

Yn (disconnecting at a long space)

The Yn command determines whether the modem will disconnect when it receives a long-space signal (1.6-second break) or transmit a 4.0-second space when it initiates a disconnect.

- Y0 (default)—Disables long-space disconnect.
- Y1—Enables long-space disconnect. In non-error-correction mode, the modem replies to a long space by sending a break of four seconds, disconnecting, and returning to command state. In error-correction mode, the modem replies to a long space by going on-hook.

Z (loading a user 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.

S-Registers

S-registers store configuration options for your modem. You use the Sn=x command to change the value of an S-register, and the Sn? command to see an S-register's current setting. Reserved bits are reserved for use by the modem manufacturer. Do not try to change reserved bits; doing so may cause your modem to misbehave.

S0 register (Number of rings before answering)

S0 sets the number of the rings required before the modem automatically answers a call. Setting this register to zero disables auto-answer mode.

S1 register (Ring count)

The S1 register counts the number of incoming rings. When S0 and S1 are equal, the modem answers the call (unless both registers are set to zero). The S1 register is reset to zero when the modem answers or if no rings occur over a five-second interval.

S2 register (Escape character)

The S2 register specifies the ASCII value of the character used in the escape code sequence. (You use the escape code sequence to return to the command state after creating an active connection with another modem.) The default is S2=43, where 43 is the ASCII value of the + character.

A value over 127 disables the escape process, i.e.; no escape character will be recognized.

S3 register (Carriage return character)

The S3 register specifies the ASCII value of the character that you send to terminate a command line. The default is S3=13, where 13 is the ASCII value of the Return character.

S4 register (Line feed character)

The S4 register specifies the ASCII value of the character the modem sends after at the end of a result code if verbose result codes are used. The default is S4=10, where 10 is the ASCII value of the line feed character.

S5 register (Backspace character)

The S5 register specifies the ASCII value of the backspace — or delete — character. The default is S5＝8, where 8 is the ASCII value of the backspace character.

S6 register (Wait Time before Blind Dialing or for Dial Tone)

The S6 register specifies the amount of time (in seconds) that the modem should wait between going off-hook and dialing the telephone number of a remote modem. In this case, the modem "blind dials" — that is, it waits the specified number of seconds and then begins dialing without checking for a dial tone first.

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

S7 register (Time to wait for carrier)

The S7 register specifies the amount of time (in seconds) that the modem should wait for a carrier signal from a remote modem after dialing. If your modem does not receive a carrier signal within the time limit, it hangs up.

S8 register (Pause time for comma)

S8 sets the time, in seconds, that the modem must pause when the "," dial modifier is encountered in the dial string.

S9 register (Carrier recovery time)

S9 is supported for backward compatibility only. No value can be written. Responds with default value.

S10 register (Lost-carrier hang-up delay)

S10 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.

S11 register (Touch-tone dialing speed)

The S11 register specifies the duration (in milliseconds) of dialing tones used in touch-tone dialing. (This register applies only to touch-tone dialing.)

S12 register (Guard time)

S12 defines the maximum period, in fiftieths of a second, allowed between receipt of the last character of the three escapes character sequence from the DTE and sending of the OK result code to the DTE. If any characters are detected during this time, the OK will not be sent. Note that sending of the OK result code does not affect entry into command mode.

S14 register (General options)

The S14 register indicates the status of command options.

Default: 138 (8Ah) (10001010b)

Bit 0 This bit is ignored.

Bit 1 Command echo (En)
0: Command echo disabled (E0).
1: Command echo enabled (E1). Default.

Bit 2 Quiet mode (Qn)
0: Send result codes (Q0). Default.
1: Do not send result codes (Q1).

Bit 3 3 Result codes (Vn)
0: Numeric result codes (V0).
1: Verbose result codes (V1). Default.

Bit 4 Reserved

Bit 5 Tone (T)/Pulse (P)
0: Tone dialing (T). Default.
1: Pulse dialing (P).

Bit 6 Reserved

Bit 7 Originate/Answer
0: Answer.
1: Originate. Default.

S16 register (General Bit Mapped Test Options Status)

S16 indicates the test in progress status.

Bit 0 Local analog loopback
0 = Disabled (Default.)
1 = Enabled (&T1)

Bit 1 Not used

Bit 2 Local digital loopback
0 = Disabled (Default.)
1 = Enabled (&T3)

Bit 3 Remote digital loopback (RDL) status
0 = Modem not in RDL (Default.)
1 = RDL in progress

Bit 4 RDL requested (AT&T6)
0 = RDL not requested (Default.)
1 = RDL requested (&T6)

Bit 5 RDL with self test
0 = Disabled (Default.)
1 = Enabled (&T7)

Bit 6 Local analog loopback (LAL) with self test
0 = Disabled (Default.)
1 = Enabled (&T8)

Bit 7 Not used

S18 register (Test Timer)

S18 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.

S19 register (AutoSync Bit Mapped Options)

S19 is supported for backward compatibility only. No value can be written. Responds with default value.

S20 register (AutoSync HDLC Address or BSC Sync Character)

S20 is supported for backward compatibility only. No value can be written. Responds with default value.

S21 register (V.24 options)

The S21 register indicates the status of several command options.

Default: 52-(34h) (00110100b)

Bit 0,1 Reserved.

Bit 2 CTS behavior (&Rn)
0: CTS tracks RTS (&R0).
1: CTS always on (&R1). Default.

Bits 3, 4 DTR behavior (&Dn)
0: &D0 is selected.
1: &D1 is selected.
2: &D2 is selected. Default.
3: &D3 is selected.

Bit 5 RLSD (DCD) behavior (&Cn)
0: &C0 is selected.
1: &C1 is selected. Default.

Bit 6 DSR behavior (&Sn)
0 = &S0 selected (Default.)
1 = &S1 selected

Bit 7 Long space disconnect (Yn)
0: Y0 is selected. Default.
1: Y1 is selected.

S22 register (Speaker/results options)

The S22 register indicates the status of several command options.
Default: 117-(75h) (01110101b)

Bits 0, 1 Speaker volume (Ln)
0: off (L0).
1: low (L1). Default.
2: medium (L2).
3: high (L3).

Bits 2, 3 Speaker control (Mn)
0: disabled (M0).
1: off when carrier is present (M1). Default.
2: always on (M2).
3: off during dialing (M3).

Bits 4–6 Limit result codes (Xn)
0: X0 is selected.
4: X1 is selected.
5: X2 is selected.
6: X3 is selected.
7: X4 is selected. Default.

Bits7 Reserved

S23 register (General Bit Map options)

The S23 register indicates the status of several command options.
Default: 62 (3Dh) (00111110b)

Bit 0 Grant RDL
0 = RDL not allowed (&T5) (Default.)
1 = RDL allowed (&T4)

Bits 1–3 DTE Rate
Assumed DTE rate. 0: 0–300 bps; 1: 600 bps; 2: 1200 bps; 3: 2400bps; 4: 4800 bps;
5: 9600 bps; 6: 19,200 bps; 7: 38,400 bps or higher(default).

Bits 4, 5 Assumed DTE parity
0: Even parity.
1: Not used.
2: Odd parity.
3: None. Default.

Bits 6, 7 Guard tone (&Gn)
0: No guard tone (&G0). Default.
1: No guard tone (&G1).
2: 1800 Hz guard tone (&G2).

S24 register (Sleep inactivity timer)

The S24 register sets the length of time, in seconds, that the modem will operate in normal
mode with no detected telephone line or DTE line activity before entering low-power sleep
mode. The timer is reset upon any DTE line or telephone line activity. If the S24 value is zero,
neither DTE line nor telephone inactivity will cause the modem to enter the sleep mode.

S25 register (Delay to DTR)

The S25 register sets the length of time that the modem will ignore DTR before taking the
action specified by &Dn. Its units are seconds for synchronous modes and hundredths of
seconds for other modes. The range of values for this register is 0–255. The default value is 5.

S26 register (RTS to CTS delay)

The S26 register sets the time delay, in hundredths seconds, before the modem turns CTS
ON after detecting an OFF-to-ON transition on RTS when &R0 is commanded. Pertains to
synchronous operation only. The range of values for this register is 0–255. The default value
is 1.

S27 register (General options)

The S27 register indicates the status of several command options.
Default: 73-(49h) (01001001b)

Bits 3, 1, 0 Synchronous/asynchronous selection (&Mn/&Qn)
000: &M0 or &Q0.
001: &M1 or &Q1.
010: &M2 or &Q2.
011: &M3 or &Q3.
100: Reserved.
101: &Q5 (default).
110: &Q6.

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

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

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

Bit 7 Reserved

S28 register (General options)

The S28 register indicates the status of command options. Default: 0

Bits 0-1 Reserved

Bits 2 Reserved (Always 0)

Bits 3, 4 Pulse dialing (&Pn)
0: 39%/61% at 10 pulses per second (&P0). Default for modems sold in the US.
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).

Bits 5-7 Reserved

S29 register (Flash dial modifier time)

The S29 register sets the length of time, in units of 10 milliseconds, that the modem will go on-hook when it encounters the flash (!) dial modifier in the dial string. The range of values for this register is 0–255. The default is 70.

S30 register (Disconnect inactivity timer)

The S30 register sets the length of time, in tens of seconds, that the modem will stay on-line before disconnecting when no data is sent or received. Any data transmitted will reset the timer. The timer is inoperative in synchronous mode. The range of values for this register is 0–255. If S30 equals 0, the function is disabled; this is the default setting.

S31 register (General options)

The S31 register indicates the status of command options. Default: 194-(C2h) (11000010b)

Bit 0 Single line connect message enable/disable (\Vn)
0: Connect messages controlled by S95 register, Wn and Vn (\V0). Default.
1: Single line connect message. (\V1)

Bit 1 Auto line speed detection (Nn)
0: Automode disabled (N0).
1: Automode enabled (N1). Default.

Bits 2, 3 Error correction progress messages (Wn)
0: DTE speed messages only (W0). Default.
1: Full message reporting (W1).
2: DCE speed only (W2).

Bits 4, 5 Caller ID (#CID)
0 = Caller ID disabled (#CID=0) (Default)
1 = Short (formatted) Caller ID enabled (#CID=1)
2 = Long (unformatted) Caller ID enabled (#CID=2)

Bits 6, 7 Reserved.

S32 register (XON character)

The S32 register specifies the ASCII code of the character used for XON signaling. The range of values for this register is 0–255. The default is 17.

S33 register (XOFF character)

The S33 register specifies the ASCII code of the character used for XOFF signaling. The range of values for this register is 0–255. The default is 19.

S36 register (LAP-M failure control)

The S36 register determines how the modem should react to a LAP-M failure. The fallback options are initiated immediately upon connection if S48 = 128. If an invalid number is entered, the number is accepted into the register, but S36 will act as if the default value has been entered.

Default: 7 (00000111b)

Bits 0–2
0: Modem disconnects.
1: Modem stays on-line and a direct mode connection is established.
2: Reserved.
3: Modem stays on-line and a normal mode connection is established.
4: An MNP connection is attempted and if it fails, the modem disconnects.
5: An MNP connection is attempted and if it fails, a direct mode connection is established.
6: Reserved.
7: An MNP connection is attempted and if it fails, a normal mode connection is established. (This is the default.)

Bits 3–7 Reserved.

S37 register (Preferred line speed)

S37 specifies the desired line connection speed.

1 When the Nn command is issued or the S37 register value is modified, the +MS command subparameters are updated to reflect the speed and modulation specified by the S37 value (see +MS command). For example:

If N0 command is active, S37=10 updates the +MS command subparameters to reflect +MS=10,1,300,12000

If N1 command is active, S37=10 updates the +MS command subparameters to reflect +MS=10,0,12000,12000

2 S37 is not updated by the +MS command.

3 Use of the +MS command is recommended instead of the Nn and S37=x commands. Nn and S37=x commands are supported for compatibility with existing communication software.

Default: 0

Bits 0-4 Desired line connection speed. This is interlinked with the Fn command (RC144). 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 automode connection. If N0 is active, connection is attempted at the most recently sensed DTE speed (+MS command settings are updated to the appropriate values). If N1 is active, connection is attempted at the highest possible speed (+MS settings are updated to 11,1,300,2880 to reflect V.34, automode, 300 bps minimum   speed and 28800 bps maximum speed). Default.

1–3: Attempts to connect at 300 bps.

4: Reserved.

5: Attempts to connect at V.22 1200 bps.

6: Attempts to connect at V.22bis 2400 bps.

7: Attempts to connect at V.23.

8: Attempts to connect at V.32bis/V.32 4800 bps.

9: Attempts to connect at V.32bis/V.32 9600 bps.

10: Attempts to connect at V.32bis 12,000 bps.

11: Attempts to connect at V.32bis 14,400 bps.

12: Attempts to connect at V.32bis 7200 bps.

Bits 5–7 Reserved.

S38 register (Delay before hangup)

For all error-correcting connections, if the modem receives a command to hang up but data remains to be transmitted, the modem will attempt to transmit the remaining data before hanging up. The S38 register specifies the maximum delay the modem will allow between receiving an H0 command (or DTR hangup request) and the actual disconnection. The range for this register is 0–255. The default is 20.

- If S38 is between 0 and 254, the modem disconnects after the specified number of seconds. If the modem was in the process of transmitting data, the NO CARRIER result code is issued to indicate that data has been lost. If all data is transmitted prior to the disconnection, the OK result code is issued.

- If S38 equals 255, the modem does not disconnect until all data is transmitted or the connection is lost.

S39 register (Flow control options)

The S39 register indicates the status of command options.
Default: 3 (00000011b) Bit Mapped

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

Bits 3–7 Reserved.

S40 register (General options)

The S40 register indicates the status of command options.
Default: 104-(68h) (01101000b)

Bits 0–1 MNP Extended Services (-Kn)
0: -K0(Default); 1: -K1; 2: -K2.

Bit 2 Reserved.

Bits 3–5 Break Handling (\Kn)
0: \K0; 1: \K1; 2: \K2; 3: \K3; 4: \K4; 5: \K5.

Bits 6, 7 MNP block size (\An)
0: 64 characters (\A0).
1: 128 characters (\A1). Default.
2: 192 characters (\A2).
3: 256 characters (\A3).

S41 register (General options)

The S41 register indicates the status of command options. Default is 195.

Bits 0–1 Compression selection (%Cn)
0: Data compression disabled (%C0).
1: MNP 5 data compression (%C1).
2: V.42bis data compression (%C2).
3: MNP 5 and V.42bis data compression (%C3). Default.

Bits 6, 2 Auto retrain and fallback/fall forward (%En)
00: Auto-retrain and fallback/fallforward disabled (%E0).
01: Auto-retrain enabled (%E1).
10: Fallback/fallforward enabled (%E2). Default.

Bits 3-5 Reserved.

Bit 7 Reserved.

S46 register (Data compression control)

The S46 register controls whether data compression is used. This register can have one of two values: 136 or 138.
136: Error correction with no data compression.
138: Error correction with data compression. Default.

S48 register (V.42 negotiation action)

The S48 register controls V.42 negotiation.

0: Disables negotiation; bypass the detection and negotiation phases; and proceeds with LAP-M.
7: Enables negotiation. Default.
128: Disables negotiation and proceeds with the fallback action specified by S36.

S82 register (Break handling options)

The S82 register is included for compatibility purposes only. Changing this register has no effect.

S86 register (Reason for last disconnection)

When the NO CARRIER result code is issued, the S86 register records the reason for the failed connection. S86 records the first event that contributes to the NO CARRIER message.

0: Normal disconnect; no error occurred.

4: Loss of carrier.

5: V.42 negotiation failed to detect an error-correction modem at the other end.

9: The modems could not find a common protocol.

12: Normal disconnect, initiated by remote modem.

13: Remote modem did not respond after 10 retransmissions of the same message.

14: Protocol violation.

S91 register (Telephone transmit attenuation level)

The S91 register sets the transmit attenuation level from 0 to 15
dBm for the telephone mode, resulting in a transmit level from 0 to 15 dBm.

S92 register (Fax transmit attenuation level)

The S92 register sets the transmit attenuation level from 0 to 15 dBm for the fax mode,
resulting in a transmit level from 0 to –15 dBm. The default is 10.

S95 register (Extended result codes)

The S95 register can be set to override Wn command options. A bit set to 1 enables the
corresponding result code, regardless of the Wn setting.
Default: 0

Bit 0—CONNECT result code indicates DCE speed instead of DTE speed.
Bit 1—Appends "/ARQ" to the verbose CONNECT result code when an error-control
connection is established. (XXXX = rate).
Bit 2—Enables CARRIER XXXX result code where "XXXX" indicates the DCE rate. (XXXX =
rate).
Bit 3—Enables PROTOCOL XXXX result code. (XXXX= protocol identifier).
Bit 4—Reserved.
Bit 5—Enables COMPRESSION result code. (XXXX = compression type).
Bits 6, 7—Reserved.

S-Register Summary

Register	Function	Range	Units	Saved	Default
S0	Rings to auto answer	0-255	rings	*	0
S1	Ring counter	0-255	rings		0
S2	Escape character	0-255	ASCII	*	43
S3	Carriage return character	0-127	ASCII		13

Register	Function	Range	Units	Saved	Default
S4	Line feed character	0-127	ASCII		10
S5	Backspace character	0-255	ASCII		8
S6	Wait time for dial tone	2-255	s	*	2
S7	Wait time for carrier	1-255	s	*	50
S8	Pause time for dial delay modifier	0-255	s	*	2
S9	Carrier detect response time	1-255	0.1s	*	6
S10	Carrier loss disconnect time	1-255	0.1s	*	14
S11	DTMF tone duration	50-255	0.001s	*	95
S12	Escape prompt delay	0-255	0.02s	*	50
S14	General bit-mapped options status	-	-	*	138 (8Ah)
S16	Test mode bit-mapped options status (&T)	-	-		0
S18	Test timer	0-255	s	*	0
S19	AutoSync options	-	-		0
S20	AutoSync HDLC address or BSC sync character	-	-	*	0
S21	V.24/General bit-mapped options status	-	-	*	52 (34h)

Register	Function	Range	Units	Saved	Default
S22	Speaker/results bit-mapped options status	-	-	*	117 (75h)
S23	General bit-mapped options status	-	*	62	(3Dh)
S24	Sleep inactivity timer	0-255	s	*	0
S25	Delay to DTR off	0-255	S or 0.01s		5
S26	RTS-to-CTS delay	0-255	0.01s		1
S27	General bit-mapped options status	-	-	*	73 (49h)
S28	General bit-mapped options status	-	-	*	0
S29	Flash dial modifier time	0-255	10 ms		70
S30	Disconnect inactivity timer	0-255	10 s		0
S31	General bit-mapped options status	-	-	*	194 (C2h)
S32	XON character	0-255	ASCII		17 (11h)
S33	XOFF character	0-255	ASCII		19 (13h)
S36	LAPM failure control	-	-	*	7
S37	Line connection speed	-	-	*	0
S38	Delay before forced hang-up	0-255	s		20

Register	Function	Range	Units	Saved	Default
S39	Flow control bit-mapped options status	-	-	*	3
S40	General bit-mapped options status	-	-	*	104 (68h)
S41	General bit-mapped options status	-	-	*	195 (C3h)
S46	Data compression control	-	-	*	138
S48	V.42 negotiation control	-	-	*	7
S82	LAPM break control	-	-		128 (40h)
S86	Call failure reason code	0-255	-		-
S91	PSTN transmit attenuation level	0-15	dBm		10 (country dependent)
S92	Fax transmit attenuation level	0-15	dBm		10 (country dependent)
S95	Result code messages control	-	-	*	0

4

Result Codes

When the modem receives and processes an AT command, it sends a result code to your computer. Telecommunications programs that send AT commands to the modem interpret the result codes to determine whether or not the command was successful.

The modem sends either the number or the phrase corresponding to the result code, depending on the setting of the Vn command. The Xn command affects which result codes are displayed.

Code	Result
0 OK	The command line executed with no errors.
1 CONNECT	A connection has been established.
2 RING	A ringing signal has been detected.
3 NO CARRIER	The carrier has been lost or was never present.
4 ERROR	Invalid command, error in the command line, or command line exceeds 48 characters.
5 CONNECT 1200	The computer to modem connection is 1200 bps.
6 NO DIALTONE	No dial tone is detected within the S7 register time limit.
7 BUSY	A busy signal has been detected.
8 NO ANSWER	Ringing did not stop, indicating that the remote modem did not answer.
9 CONNECT 600	The computer to modem connection is 600 bps.
10 CONNECT 2400	The computer to modem connection is 2400 bps.
11 CONNECT 4800	The computer to modem connection is 4800 bps.

Code	Result
12 CONNECT 9600	The computer to modem connection is 9600 bps.
13 CONNECT 7200	The computer to modem connection is 7200 bps.
14 CONNECT 12000	The computer to modem connection is 12,000 bps.
15 CONNECT 14400	The computer to modem connection is 14,400 bps.
16 CONNECT 19200	The computer to modem connection is 19,200 bps.
17 CONNECT 38400	The computer to modem connection is 38,400 bps.
18 CONNECT 57600	The computer to modem connection is 57,600 bps.
19 CONNECT 115200	The computer to modem connection is 115,200 bps.
20 CONNECT 230400	The computer to modem connection is 230,400 bps.
22 CONNECT 75TX/1200RX	The originating modem connected with 75 bps receiving and 1200 bps transmitting capabilities; the answering modem connected with 1200 bps receiving and 75 bps transmitting capabilities.
23 CONNECT 1200TX/75RX	The originating modem connected with 1200 bps receiving and 75 bps transmitting capabilities; the answering modem connected with 75 bps receiving and 1200 bps transmitting capabilities.
24 DELAYED [hh:mm:ss]	The connection failed, and because of country blacklisting requirements, the modem will not dial the number again until the required time (displayed after the result code) has elapsed.
32 BLACKLISTED	The connection failed, and because of country blacklisting requirements, the modem will not dial the number again until the modem is turned off and then on again.
33 FAX	A fax connection has been established in facsimile mode.
35 DATA	A data connection has been established in facsimile mode.
40 CARRIER 300	Carrier detected at 300 bps.
44 CARRIER 1200/75	Carrier detected at 1200 bps receiving and 75 bps transmitting (originating); carrier detected at 75 bps receiving and 1200 bps transmitting (answering).

Code	Result
45 CARRIER 75/1200	Carrier detected at 75 bps receiving and 1200 bps transmitting (originating); carrier detected at 1200 bps receiving and 75 bps transmitting (answering).
46 CARRIER 1200	Carrier detected at 1200 bps.
47 CARRIER 2400	Carrier detected at 2400 bps.
48 CARRIER 4800	Carrier detected at 4800 bps.
49 CARRIER 7200	Carrier detected at 7200 bps.
50 CARRIER 9600	Carrier detected at 9600 bps.
51 CARRIER 12000	Carrier detected at 12,000 bps.
52 CARRIER 14400	Carrier detected at 14,400 bps.
53 CARRIER 16800	Carrier detected at 16,800 bps.
54 CARRIER 19200	Carrier detected at 19,200 bps.
55 CARRIER 21600	Carrier detected at 21,600 bps.
56 CARRIER 24000	Carrier detected at 24,000 bps.
57 CARRIER 26400	Carrier detected at 26,400 bps.
58 CARRIER 28800	Carrier detected at 28,800 bps.
59 CONNECT 16800	The computer to modem connection is 16,800 bps.
61 CONNECT 21600	The computer to modem connection is 21,600 bps.
62 CONNECT 24000	The computer to modem connection is 24,000 bps.
63 CONNECT 26400	The computer to modem connection is 26,400 bps.
64 CONNECT 28800	The computer to modem connection is 28,800 bps.
66 COMPRESSION: CLASS 5	MNP 5 data compression has been negotiated.
67 COMPRESSION: V.42BIS	V.42bis data compression has been negotiated.
69 COMPRESSION: NONE	No data compression has been negotiated.
70 PROTOCOL: NONE	No error correction has been negotiated.
77 PROTOCOL: LAP-M	LAP-M error correction has been negotiated.

Code	Result
78 CARRIER 31200	Carrier detected at 31,200 bps.
79 CARRIER 33600	Carrier detected at 33,600 bps.
80 PROTOCOL: ALT	MNP 4 error correction has been negotiated.
81 PROTOCOL: ALT-CELLULAR	MNP 10 error correction has been negotiated and cellular power-level adjustment has been enabled.
84 CONNECT 33600	The computer to modem connection is 33,600 bps.
91 CONNECT 31200	The computer to modem connection is 31,200 bps.
150 CARRIER 32000	Carrier detected at 32,000 bps.
151 CARRIER 34000	Carrier detected at 34,000 bps.
152 CARRIER 36000	Carrier detected at 36,000 bps.
153 CARRIER 38000	Carrier detected at 38,000 bps.
154 CARRIER 40000	Carrier detected at 40,000 bps.
155 CARRIER 42000	Carrier detected at 42,000 bps.
156 CARRIER 44000	Carrier detected at 44,000 bps.
157 CARRIER 46000	Carrier detected at 46,000 bps.
158 CARRIER 48000	Carrier detected at 48,000 bps.
159 CARRIER 50000	Carrier detected at 50,000 bps.
160 CARRIER 52000	Carrier detected at 52,000 bps.
161 CARRIER 54000	Carrier detected at 54,000 bps.
162 CARRIER 56000	Carrier detected at 56,000 bps.
165 CONNECT 32000	The computer to modem connection is 32,000 bps.
166 CONNECT 34000	The computer to modem connection is 34,000 bps.
167 CONNECT 36000	The computer to modem connection is 36,000 bps.
168 CONNECT 38000	The computer to modem connection is 38,000 bps.
169 CONNECT 40000	The computer to modem connection is 40,000 bps.

Code	Result
170 CONNECT 42000	The computer to modem connection is 42,000 bps.
171 CONNECT 44000	The computer to modem connection is 44,000 bps.
172 CONNECT 46000	The computer to modem connection is 46,000 bps.
173 CONNECT 48000	The computer to modem connection is 48,000 bps.
174 CONNECT 50000	The computer to modem connection is 50,000 bps.
175 CONNECT 52000	The computer to modem connection is 52,000 bps.
176 CONNECT 54000	The computer to modem connection is 54,000 bps.
177 CONNECT 56000	The computer to modem connection is 56,000 bps.
178 CONNECT 230400	The computer to modem connection is 230,400 bps.
180 CARRIER 28000	Carrier detected at 28,000 bps.
181 CARRIER 29333	Carrier detected at 29,333 bps.
182 CARRIER 34667	Carrier detected at 34,667 bps.
183 CARRIER 37333	Carrier detected at 37,333 bps.
184 CARRIER 34667	Carrier detected at 34,667 bps.
185 CARRIER 37333	Carrier detected at 37,333 bps.
186 CARRIER 38667	Carrier detected at 38,667 bps.
187 CARRIER 41333	Carrier detected at 41,333 bps.
188 CARRIER 42667	Carrier detected at 42,667 bps.
189 CARRIER 45333	Carrier detected at 45,333 bps.
190 CARRIER 46667	Carrier detected at 46,667 bps.
191CARRIER 49333	Carrier detected at 49,333 bps.
192 CARRIER 50667	Carrier detected at 50,667 bps.
193 CARRIER 53333	Carrier detected at 53,333 bps.
194 CARRIER 54667	Carrier detected at 54,667 bps.

Glossary

asynchronous & synchronous modes

Two connected modems can communicate in either asynchronous or synchronous mode.

- In asynchronous mode, both modems can send data at the same time and pause at any time. To ensure that data is not lost, extra bits —called start and stop bits — are used to frame each character sent.

- In synchronous mode, only one modem can send data at a time. The modem sends a continuous stream and does not stop until it is finished; the other modem cannot send until the first modem is finished. No extra bits are used to frame characters.

Bell protocols

Bell 103 and Bell 212 are communications protocols that provide a US standard for communicating at specific speeds.

- Bell 103 can be used for communicating at 300 bps.

- Bell 212 can be used for communicating at 1200 bps.

bps (bits per second)

Bits per second (bps) is a measure of the speed of a connection, expressed as the number of bits that can be transferred per second. The higher the number, the faster the connection.

break signal

A break signal is a pause in the data flow that lasts longer than the amount of time required to send one character (including its start and stop bits).

calling tone

A calling tone is a high-pitched, intermittent sound that can be produced by a modem that is originating a data call. Some international telephone agencies require that your modem emit a calling tone so that a person answering your modem's call can immediately identify your modem as a machine and not a human caller.

carrier

The carrier is the telephone line signal used to transfer data between two connected modems. The sound you hear through the modem's speaker when it connects is the carrier signal.

CCITT

The CCITT (International Telegraph and Telephone Consultative Committee) is an international organization which studies telecommunications technology and recommends international telecommunications standards. (See ITU.)

command mode

In command mode, the modem interprets data from the computer as AT commands, instead of transmitting the data to the remote modem. When you first open a telecommunications application, the modem is automatically placed in command mode. When you establish a connection with another modem, your modem switches to on-line mode. Before entering an AT command, you must use the $+++$ command to return the modem to command mode.

data compression

Data compression is the process by which data is reduced in size when it is sent from your computer to your modem, and then expanded to its original size by the receiving modem. Since the transmitted data has been compressed, it takes less time to send.

DCE (Data Communication Equipment)

Data Communication Equipment (DCE) is the modem connected to your computer. The DCE speed is the speed of data transfer between the modem and the telephone line. The DCE speed is also called the line speed.

DTE (Data Terminal Equipment)

Data Terminal Equipment (DTE) is the computer to which your modem is connected. The DTE speed is the speed of data transfer between your computer and your modem.

DTR (Data Terminal Ready)

A Data Terminal Ready (DTR) signal is sent by the computer to the modem to indicate that the computer (the "data terminal") is ready to communicate with the modem. DTR can also be used for other purposes, such as signaling the modem to hang up the phone (called "hardware hangup").

echoing

When the modem is in command mode, it can transmit characters it receives back to the computer. This is called echoing. For example, if you enter a modem command in a telecommunications application, your keystrokes appear in the application window if echoing is turned on. You use the En command to turn echoing on and off.

error correction

Error correction is the process by which errors that occur during data transfer are detected and, if possible, corrected. Modems use error-correction protocols to correct errors. These protocols monitor the received data and request the retransmission of faulty data.

fallback/fallforward

Fallback/fallforward is a process by which two connected modems can increase (fall forward) or decrease (fall back) the speed they are using, without reconnecting. This process takes place when the line conditions change: for example, if the amount of static on the line increases, the modems can fall back to a speed that is reliable even with the increased noise level. The process is almost instantaneous. You use the %En, -Kn, and -Qn commands to control fallback/fallforward.

guard tone

A guard tone is a tone emitted by the modem when it detects a carrier. Different countries use guard tones of different frequencies. For instance, the default guard tone for the United Kingdom is 1800 Hz.

handshaking

Handshaking is a method of controlling the speed of data transfer by signaling when each side of the connection is ready to receive data. This ensures that both sides can keep up and no data is lost. In hardware handshaking, the modem and computer exchange RTS and CTS signals over the connecting cable. In software handshaking, the modem and computer exchange XON and XOFF characters to start and stop data transfer.

ITU

The ITU (International Telecommunications Union), formerly known as CCITT, is an international organization which studies telecommunications technology and recommends international telecommunications standards. These standards enable different devices from different manufacturers to communicate with each other.

k56flex

k56flex is a communications protocol that provides a standard way of transferring data at speeds of 32,000 bps to 56,000 bps.

make/break ratio

The make/break ratio is used in pulse dialing. It specifies the ratio of off-hook (make) time to on-hook (break) time for each pulse. You use the &Pn command to set the make/break ratio. Phone systems in different countries require different make/break ratios.

MNP 4 protocol

MNP 4 is an error-correction protocol, providing a standard way of correcting errors that can occur as data is transmitted or received. MNP 4 provides less efficient error correction than V.42.

MNP 5 protocol

MNP 5 is a data-compression protocol, providing a standard way of compressing data for transmission in order to save transfer time. MNP 5 provides less efficient data compression than V.42bis.

MNP 10 protocol

MNP 10 is an error-correction protocol designed to overcome the problems associated with poor telephone line conditions. This protocol is often used for cellular telephone connections. MNP 10 provides less efficient error correction than MNP 10EC.

MNP 10 EC protocol

MNP 10EC is an error-correction protocol that is designed for correcting errors that can occur as data is transmitted or received over cellular telephone lines. MNP 10EC provides more efficient error correction than MNP 10.

off-hook

When a modem goes off-hook, it claims the telephone line to which it is connected. Taking a modem off-hook is equivalent to picking up a telephone to make or answer a call.

on-hook

When a modem goes on-hook, it releases the telephone line to which it is connected, freeing the telephone line for other uses. This action, which is equivalent to hanging up a telephone, terminates the current data connection.

on-line mode

In on-line mode, data sent from the computer to the modem is transmitted to the remote modem, instead of being interpreted as AT commands. When you establish a connection with another modem, the modem is automatically placed in on-line mode.

parameter

A parameter is an additional value that you must provide along with a command. For example, in the Hn command, the letter n stands for a parameter whose value can be either 0 or 1. You type the actual command as either "H0" or "H1". Most AT commands require at least one parameter, denoted in command descriptions by the letter n. When you enter an AT command, you must substitute a valid parameter value for n. (A few commands require a second parameter, denoted by x.)

pulse dialing

Pulse dialing is a method of dialing in which the modem sends a set of pulses for each number (one pulse for the number 1, two pulses for 2, and so on).

result codes

A result code is a message the modem sends to the computer, indicating the result of an AT command or the status of a connection. If a telecommunications application is active on your computer, the result code appears on your screen. Result codes are reported either as numbers (numeric) or as words (verbose). You use the Vn command to switch between these modes.

retraining

Retraining is a process by which two connected modems can renegotiate the protocol and speed they are using, without having to reconnect. Retraining takes place when the line conditions change: for example, if the amount of static on the line increases. The process normally takes several seconds. You use the %En command to control retraining.

RTS (Request to Send) & CTS (Clear to Send)

Request to Send (RTS) and Clear to Send (CTS) are hardware-handshaking signals. When the computer is ready to send data, it sends a Request to Send (RTS) signal to the modem. When the modem is ready to receive data, it sends a Clear to Send (CTS) signal to the computer.

space

A space is a long period of silence encountered during a modem connection.

S-registers

S-registers are memory locations in the modem where modem settings are stored. You use the Sn=x command to change the setting in an S-register.

touch-tone dialing

Touch-tone dialing is a method of dialing in which each character (0–9, *, #, A, B, C, D) is represented by a different tone.

V.21 protocol

V.21 is a communications protocol that provides a standard way of transferring data at 300 bps.

V.22 protocol

V.22 is a communications protocol that provides a standard way of transferring data at 1200 bps.

V.22bis protocol

V.22bis is a communications protocol that provides a standard way of transferring data at 1200 bps or 2400 bps.

V.32 protocol

V.32 is a communications protocol that provides a standard way of transferring data at 4800 bps or 9600 bps.

V.32bis protocol

V.32bis is a communications protocol that provides a standard way of transferring data at speeds of 4800 bps to 14,400 bps.

V.34 protocol

V.34 is an error-correction and data-compression protocol that provides a standard way of transferring data at speeds of 2400 bps to 28,800 bps. As an error-correction protocol, V.34 provides a standard way of correcting errors that can occur as data is transmitted or received. As a data-compression protocol, V.34 provides a standard way of compressing data before it is transmitted and decompressing data before it is received.

V.34 annex 12 protocol

V.34 annex 12 is a communications protocol that provides a standard way of transferring data at speeds of 2400 bps to 33,600 bps.

V.42 protocol

V.42 is an error-correction protocol that provides a standard way of correcting errors that can occur as data is transmitted or received. V.42 provides more efficient error correction than MNP 4.

V.42bis protocol

V.42bis is a data-compression protocol, providing a standard way of compressing data before it is transmitted and decompressing data after it is received. V.42bis provides more efficient data compression than MNP 5.

V.90 protocol

V.90 is a communications protocol that provides a standard way of transferring data at speeds of 32,000 bps to 56,000 bps.

XON & XOFF

XON and XOFF are characters used in software handshaking. When the computer is ready to receive data, it sends an XON character. To request a pause in the data flow, it sends XOFF.