AT Command Set and Register Summary for Analog Modem Network Modules

This document describes AT commands and S and :T registers for 8-port and 16-port analog modem network modules for the Cisco 2600 series, Cisco 3600 series, and Cisco 3700 series of modular routers.

If you have questions or need help, refer to the "Obtaining Technical Assistance" section on page 78 for further information.

This document contains the following sections:

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Entering AT Commands

Table 1 shows how to enter AT command mode.

Table 1Entering AT Command Mode

	Command	Purpose
Step 1	Router> **enable** Password: *password* Router#	Enter privileged EXEC (enable) mode. Enter the password. You have entered privileged EXEC mode when the Router# prompt appears.
Step 2	Router# **telnet 172.16.1.10 2001**	Enter the IP address of your LAN interface. The port unmber is 2000 + *n*, where n is the line number of the modem. You can now enter AT commands.
Step 3	**Ctrl-Shift-6 x**	To suspend a Telnet session, press **Ctrl-Shift-6 x**.
Step 4	Router# **where**	When you are finished, enter the **where** command to check for open sessions.
Step 5	Router# **disconnect line 1** Closing connection to 172.16.1.10 [confirm] **y** Router#	To disconnect a session, enter the **disconnect** command.

Note ATA, ATO, ATD, and all dial modifiers are invalid in direct-connect sessions.

- All commands except **A/** (Repeat Last Command) and **+++** (Escape Code) are preceded by the AT prefix and are run when you press **Return** or **Enter**.

- Enter commands as either uppercase or lowercase, but not mixed case.

- Commands are limited to 98 characters, not including the AT prefix, Return, and space characters.

- A missing numeric argument is assumed to be 0. For example, the Data Echo command **\E** is equivalent to **\E0**.

- The modem operates in one of two modes: idle state (no connection established with another modem) or connect state. Use the following commands to change operating states:

  – To enter command state from connect state without breaking the connection, enter **+++** (Escape Code) without pausing and do not press **Return**.

  – To return to connect mode, enter **AT0** and press **Return**.

Note The default for the **#E** command is **#E1**, which means that the escape code sequence is disabled in answer mode. For more information, refer to the "# Character Command Set" section on page 53.

Alphabetic Command Set

This section describes modem commands that begin with an alphabetic (A to Z) character.

A (Answer)

Forces the modem off-hook in answer mode, regardless of the value of register S. If result codes are enabled, the workstation displays RING (long form) or 2 (short form) when it receives a call.

A/ (Repeat Last Command)

Repeats the last command. **A/** is not preceded by the AT prefix and is not followed by **Return**.

AT (Attention)

Informs the modem that commands are being sent to it. **AT** must precede all other commands except **A/** and **+++**.

B*n* (ITU/Bell Mode)

Selects ITU or Bell connection mode when connecting at 300 and 1200 bps. **B***n* is ignored when the modem port is set to other speeds. Table 2 lists command options.

Table 2   ITI-U-Bell Mode Command Options

Command	Meaning
B0	ITU V.22 standard at 300 and 1200 bps, international default[1]
B1	Bell 212A standard at 300 and 1200 bps, USA default

1. Default is determined by country setting.

D {*dial string*} (Dial)

Dials a telephone number to establish a connection. The Dial command must be the last command on the command line. The *dial string* can contain up to 98 characters; valid characters are the digits 0 to 9, the dial modifiers listed in Table 3, and # and * for tone dialing. The modem ignores invalid characters; dial strings longer than 98 characters return an error.

For example, to dial the telephone number 1 617 555 1234, enter the following command:

```
D 16175551234
```

To cancel the Dial command, press any key or set Data Terminal Ready (DTR) to off unless **&D0** (DTR ignored) is set. After disconnect, there is a 5-sec delay before the modem is set off-hook in originate mode.

Dial Modifiers

The dial modifiers listed in Table 3 add conditions to the telephone number that you are dialing. You can use several dial modifiers with the same telephone number, and, unless otherwise noted, you can place dial modifiers anywhere in the dial string.

Table 3   *Dial Modifiers*

Modifier	Meaning
^A	Performs link negotiation at 4800 bps for this connection only. This dial modifier is equivalent to the ***H2** command (link negotiation at 4800 bps).
J	Performs link negotiation at 1200 bps for this connection only. This dial modifier is equivalent to the ***H1** command (link negotiation at 1200 bps).
K	Adjusts the power level for a single cellular connection. This option is used for modems attached to cellular interfaces.
L	Redials the last telephone number.
M	Dials in link access procedure for modem (LAPM) mode for this connection only.
Nn	Dials an alternate stored number. This modifier must follow the last character in a dial string. If the modem fails to make a connection, the **N**n modifier dials alternate telephone number n (where n is a number between 1 and 9) stored in the directory by the **&Z** or **\P**n command (Store Telephone Number). If you do not enter a value for n, the modem dials the first stored entry. For example, to dial the third stored telephone number as an alternate telephone number, enter the following command and press **Return**: **ATD 55554321N3** The **N**n modifier can also be stored in the directory at the end of a dial string. If you do not specify a value for n and the modem fails to make a connection, it dials the number in the next position, even if it is null. Stored number 1 follows stored number 9. For example, to store a telephone number and an alternate number in directory entry 4, enter the following command and press **Return**: **AT\P4 5551234N3**
P	Pulse-dials the number. The last **P** or **T** dial modifier used remains in effect until you enter a new **P** or **T** modifier or reset the modem. You can combine **P** and **T** dial modifiers within a dial string. For example, to pulse-dial a local telephone number and tone-dial an access code and telephone number, enter the following command and press **Return**: **ATD P12345 T335 6789** **Note** Pulse dialing is not supported in Japan.
Q	Dials in LAPM mode for this connection only with fallback to normal mode.
R	Dials a number in answer mode when calling an originate-only modem. The modifier must follow the last character in the dial string. For example, to dial the telephone number 5552345 in answer mode, enter the following command and press **Return**: **ATD 5552345R**
S	Dials the telephone number stored as entry 1 with the **&Z** or **\P1** command. The telephone number is displayed as it is dialed. The **S** modifier must immediately follow **D** in the dial command. You cannot add the **S** modifier to the phone number stored in the first directory position. For example, to dial the first stored telephone number, enter the following command and press **Return**: **ATDS**

Table 3   Dial Modifiers (continued)

Modifier	Meaning
T	Tone-dials the number. The last **P** or **T** dial modifier used remains in effect until you enter a new **P** or **T** modifier or reset the modem. You can combine **P** and **T** dial modifiers within a dial string. For example, to pulse-dial a local telephone number and tone-dial an access code and telephone number, enter the following command and press **Return**: `ATD P12345 T335 6789` **Note** Pulse dialing is not supported in Japan.
U	Dials in direct mode. The **U** modifier overrides the current operating mode and dials in direct mode for that connection only. For example, enter the following command and press **Return**: `ATD 12345U`
V	Dials in LAPM mode with fallback to MNP for this connection only. For example, enter the following command and press **Return**: `ATD 12345V`
W	Waits for dial tone before dialing. The **W** modifier is inserted between digits in a dial string. The modem then waits for the time specified in register S7. If it receives a dial tone before the time delay expires, it continues dialing; otherwise, it returns NO DIALTONE and hangs up. For example, enter the following command and press **Return**: `ATD 12345 W 67890`
X	Dials in autoreliable mode for this connection only. For example, enter the following command and press **Return**: `ATD 12345X`
Y	Dials in MNP-reliable mode for this connection only. For example, enter the following command and press **Return**: `ATD 12345Y`
Z	Dials in normal mode for this connection only. For example, enter the following command and press **Return**: `ATD 12345Z`
In	Dials one of the nine telephone numbers stored in the directory by the **&Z** or **\P**n command (where *n* is a number between 1 and 9). The telephone number is displayed as it is dialed.
,	Pauses during dialing for the time specified in register S8 before dialing the next digit. Use more than one comma for a longer pause. For example, use the comma when you need to dial 9 and then wait for another dial tone before dialing an outside line: `ATD 9,,5552345`
@	Waits for quiet answer before dialing. This modifier is inserted between characters in a dial string. The modem waits for the time specified in register S7 for at least one ring, followed by 5 sec of silence, before acting on the next character in the dial string. If the modem does not detect this sequence, it returns a NO ANSWER result code and hangs up. Use this modifier when the system you are calling does not provide a dial tone. For example: `ATD 5551234 @ 43210`

Table 3   Dial Modifiers (continued)

Modifier	Meaning
!	Sets the modem on-hook for 0.5 sec and then back off-hook. This is equivalent to pressing the switch-hook button on your telephone.

;	Returns to command state after dialing. Add this modifier to the end of a dial string. The modem remains in command state after it dials the digits preceding the semicolon, so that you can enter dial strings longer than 98 characters. Each dial command except the last one must end with a semicolon. After the final dial command is entered, the modem tries to establish a connection. To abort dialing before attempting to establish a connection, enter the **H** command (Hang Up). For example:
	
	`ATD 9,12345;`
	OK
	`ATD 78989 @ 12345 W 344`

Blacklisting

In Japan only, the analog modem network modules provide the blacklisting feature. If no remote modem is detected in three dial attempts to the same number in a three-minute period, the originating modem is prevented from dialing that number for the next three minutes.

E*n* (Command Echo)

Configures the modem to echo commands to the workstation. Table 4 lists command options.

Defaults   **E1**

Table 4   Command Echo Options

Command	Meaning
E0	Disables echoing commands to the workstation
E1	Enables echoing commands to the workstation

H (Hang Up)

Disconnects from the remote system and hangs up the telephone line. If the **%D**n (Disconnect Buffer Delay) time is nonzero, the hangup can be delayed until the modem has transmitted all data in its transmit buffer.

I*n* (Identification)

Displays modem information and results of checksum tests on firmware. Table 5 lists identification command options.

Table 5   Identification Command Options

Command	Meaning
I0	Displays the four-digit modem product code.
I1	Runs a checksum on firmware ROM and displays the three-digit result.
I2	Runs a checksum on firmware ROM and displays the checksum status.
I3	Displays the modem name and revision level.

O*n* (Enter Connect State)

Sets the modem to connect state. Table 6 lists command options.

Table 6   Connect State Command Options

Command	Meaning
O0	Enters connect state.
O1	Begins an equalizer retrain sequence when operating at 2400 bps or higher and then returns to connect state. Use the **O1** command to reduce loss of equalization because of excessive bit error rates.

Q*n* (Quiet)

Configures the modem to send result and status codes, such as OK, BUSY, and RING, to your workstation. Table 7 lists command options.

Defaults   **Q0**

Table 7   Quiet Mode Command Options

Command	Meaning
Q0	Enables output of result codes.
Q1	Disables output of result codes.
Q2	Disables only answer mode result codes. Status report messages are not affected.

S*n*? (Read Configuration Register)

Displays the contents of S register *n* (where n is a decimal number).

Related Commands   0 to 27

Defaults   S0

T (Tone Dial)

Sets the current dialing mode to tone. This is the default dialing mode.

V*n* (Result Code Form)

Selects the result code format sent to your workstation. The **W**n command (Error Correction Result Code Form) modifies the connect messages to reflect a reliable link connection. Table 8 lists command options.

Defaults   V1

Table 8   Result Code Form Command Options

Command	Meaning
V0	Sends short form result codes.
V1	Sends long form result codes.

W*n* (Connection Speed Reporting)

Displays the serial port or modem port speed in connect messages. When the **X0** command (Extended Result Codes) is set, CONNECT is displayed for any **W**n command option. Table 9 lists command options.

Defaults   W2

Table 9   Connection Speed Reporting Command Options

Command	Meaning
W0	Displays serial port connect messages.
W1	Displays serial port connect messages.
W2	Displays modem port connect messages.

X*n* (Extended Result Codes)

Selects the extended result code format sent to the workstation. Table 10 lists command options.

The following commands also affect the result code format:

- The **V***n* command (Result Code Form) selects short or long form result codes.
- The **\V***n* command (Result Code Form) or **-M1** command (MNP Class Connect Messages) must be set to indicate MNP reliable mode in the result code.

When the modem is set to ignore dial tone, it waits for the register S6 time delay and dials with or without a dial tone.

Defaults   **X4**

Note   The **W** dial modifier causes a wait for dial tone regardless of the **X***n* command setting.

Table 10   Extended Result Codes Command Options

Command	Meaning
X0	Sends a connect result code when a connection is established. The modem ignores dial tone and busy signals.
X1	Sends a connect result code reflecting the bps rate when a connection is established. The modem ignores dial tone and busy signals.
X2	Sends a connect result code reflecting the bps rate when a connection is established. The modem sends a NO DIALTONE result code if dial tone is not detected within 5 sec of a dial attempt. The modem ignores busy signals.
X3	Sends a connect result code reflecting the bps rate when a connection is established. The modem sends a BUSY result code if a busy signal is detected. The modem ignores dial tone.
X4	Sends a connect result code reflecting the bps rate when a connection is established. The modem sends a NO DIALTONE result code if dial tone is not detected within 5 sec of a dial attempt. The modem sends a BUSY result code if a busy signal is detected.

Y*n* (Long Space Disconnect)

Configures the modem to send a 4-sec Break on receipt of an **H** command (see the "H (Hang Up)" section on page 6). The answering modem disconnects if it receives the Break. This command is used only in normal and direct connections. Table 11 lists command options.

The 4-sec Break is also sent if **Y1** and one of the following **&D***n* commands (Data Terminal Ready Control) are set:

- **&D2** is set and DTR drops.

- **&D3** is set and DTR drops. The sending modem disconnects after the Break.

Defaults   **Y0**

Table 11   Long Space Disconnect Command Options

Command	Meaning
Y0	Disables long space disconnect on receipt of an **H** command. The normal break signal is sent.
Y1	Enables long space disconnect on receipt of an **H** command. **Y1** must be set on both modems for this command to take effect.

Z (Reset)

Hangs up the telephone line, clears the modem and the serial port buffers, and restores any settings that have been stored with the **&W** or ***W** commands. If no settings are stored, the command restores the factory default (**&F**) settings.

Caret Command Set

This section describes modem commands that begin with a caret (**^**) character.

^H (Host Port Upgrade)

Copies new firmware from a computer file to modem Flash memory.

^V (Display Bootstrap Revision)

Displays the modem Flash memory bootstrap revision.

Dollar Command Set

This section describes modem commands that begin with a dollar (**$**) character.

$B*n* (Serial Port Bps Rate)

This command is provided for compatibility and has no effect.

Related Commands	75, 300, 600, 1200, 2400, 4800, 9600, 19200, 38400
Defaults	**$B38400**

$D (Power-Up Diagnostics)

Runs power-up diagnostics.

Percent Command Set

This section describes modem commands that begin with a percent (**%**) character.

%A*n* (Autoreliable Fallback Character)

Specifies the ASCII character recognized as the autoreliable fallback character on the answering modem. In autoreliable mode, when the modem encounters an incoming autoreliable fallback character from the remote system, it automatically switches to normal mode and passes the character to the serial port. Autoreliable fallback character recognition stops if the modem receives a SYN character (decimal 22). The **\N3** (Operating Mode) and **\C2** (Autoreliable Buffer) commands must also be set.

⚠
Caution   Do not use the settings *n* = 63 or *n* = 126. They interfere with V.42.

Related Commands   0 to 127 (ASCII decimal)

Defaults   **%A0** (autoreliable fallback character is disabled)

%B*n* (Modem Port Bps Rate)

Sets the modem port data rate. Downshifting can still occur.

The **%B***n* command is affected by the following **%G***n* command (Independent Serial/Modem Port Speed) options:

- If **%G0** is set, the modem port speed is matched to the serial port speed, regardless of any previous **%B***n* setting. Setting **%M** has no effect on **%B**. See the "%Mn (Modulation Selection)" section on page 19.

- If **%G1** is set, the modem speed changes only when a **%B***n* command is entered. **%B** is then limited to the maximum data rate selected by **%M**. See the "%Mn (Modulation Selection)" section on page 19.

Related Commands   300, 600, 1200, 2400, 4800, 7200, 9600, 12000, 14400, 16800, 19200, 21600, 24000, 26400, 28800, 31200, 33600 bps

Defaults   **%B33600**

%C*n* (Compression Control)

Sets the modem to use a data compression method in reliable connections. The recommended default command setting of **%C3** allows the modem to establish a reliable connection using V.42*bis* compression or MNP Class 5 Data Compression, depending on the capability of the remote modem.

If the remote modem does not support data compression or has data compression disabled, the modem can establish a noncompression connection with any **%C*n*** setting.

Throughput is affected by the **\J*n*** command (Bps Rate Adjust) options:

- **\J0** (Disable Bps Rate Adjust) is recommended for the highest throughput.
- **\J1** (Enable Bps Rate Adjust) causes the serial port to adjust to 9600 bps when a reliable connection is established at a speed from 2400 to 14400 bps. At 16800 bps or higher, the serial port speed adjusts to 19200 bps.

Defaults   **%C3**

Table 12   Compression Control Command Options

Command	Meaning
%C0	Disables data compression.
%C1	Enables MNP Class 5 data compression only.
%C2	Enables V.42*bis* compression only.
%C3	Enables V.42*bis* compression and MNP Class 5 Data Compression. The modem matches the capability of the remote modem.

%D*n* (Disconnect Buffer Delay)

Specifies a delay time for the modem to process data in its transmit or receive buffers before disconnecting. When DTR transitions off or an **H** command (Hang Up) is entered (see the "H (Hang Up)" section on page 6), the modem attempts for *n* sec to empty its transmit buffer before disconnecting. When carrier transitions off, the modem attempts for *n* sec to empty its receive buffer before disconnecting. If the buffers are empty or if *n* = 0, the modem disconnects immediately.

If a physical disconnect occurs (for example, the connection is lost), only the receive buffer can be processed. If the delay expires before the modem empties its buffers, or if the modem is in command state at disconnect, data can be lost. The receive buffer might not empty before disconnecting if **%E1** (Autoretrain) is set during normal mode connections at 2400 bps or higher.

Related Commands   0 to 255 sec

Defaults   **%D0**

%E*n* (Autoretrain)

Sets the modem to resynchronize (autoretrain) the number of times specified in the :T79 register before hanging up. The modem resynchronizes only for connection speeds of 2400 bps or higher. The *%E*n* command is ignored in V.32 communication. Table 13 lists command options.

Defaults   **%E1**

Table 13   Autoretrain Command Options

Command	Meaning
%E0	Disables the automatic retrain sequence. Use the **O1** command (Enter Connect State) to force the retrain sequence when **%E0** is set.
%E1	Enables the automatic retrain sequence at 2400 bps or higher.

%Fn (V.23 Mode)

Configures the modem for V.23 mode. Table 14 lists the V.23 command options.

Defaults   **%F0**

Table 14   V.23 Command Options

Command	Meaning
%F0	Allows multiprotocol answering; disables V.23 mode on the originating modem.
%F1	75-bps transmit, 1200-bps receive (split speed) V.23 operation.
%F2	1200-bps transmit, 75-bps receive (split speed) V.23 operation.
%F3	1200-bps transmit, 1200-bps receive (half duplex) V.23 operation.

%G*n* (Independent Serial Port and Modem Port Speed)

Sets the modem port speed independent of the serial port speed. The modem port speed is set by the **%B***n* command (Modem Port Bps Rate). Table 15 lists command options.

Defaults   *%***G0**

Table 15   Independent Serial and Modem Port Speed Command Options

Command	Meaning
%G0	Updates serial and modem port speeds each time an AT command is entered. The serial port speed determines the modem port speed.
%G1	Updates modem port speed only when a **%B***n* (Modem Port Bps Rate) command is entered.

Table 16 lists commands to select modem protocols up to 14400 bps. If **%G0** is set, the modem port speed is locked to the serial port speed. If two protocols are available at the same speed, you must also set **B***n* to select ITU or Bell.

If **%G1** is set, you must enter a **%B***n* command to update the modem port speed. If two protocols are available at the same speed, you must also set **B***n* to select ITU or Bell.

To enable modem port speeds above 14400 to 33600 bps, **%M2** must be set. **%B***n* then sets the modem port speed.

Table 16   Modem Port Speed Commands to 14400 Bps

Protocol	%G0	%G1
V.21 (300 bps)	**B0**, serial port 300 bps	**B0%B300**
Bell 103 (300 bps)	**B1**, serial port 300 bps	**B1%B300**
V.22 (600 bps)	Serial port 600 bps	**%B600**
V.22 (1200 bps)	**B0**, serial port 1200 bps	**B0%B1200**
Bell 212A (1200 bps)	**B1**, serial port 1200 bps	**B1%B1200**
V.22*bis* (2400 bps)	Serial port 2400 bps	**%B2400**
V.32 (4800 bps)	Serial port 4800 bps	**%B4800**
V.32 (9600 bps)	Serial port 9600 bps	**%B9600**
V.32*bis* (14400 bps)	Serial port 14400 bps	**%B14400**

%L*n* (Speed Matching)

Configures the modem to use speed matching when establishing a connection. Table 17 lists options.

Defaults **%L1**

Table 17   Speed Matching Command Options

Command	Meaning
%L0	Provides partial speed matching.
%L1	Enables speed matching.
%L2	Disables speed matching.
%L3	Enables V.8 automode with fallback to ITU-T automode.
%L4	Enables V.8 automode only.

Modem Connection Modes Using Speed Matching

The following tables list protocols that the modem can establish with **%L1** or **%L3** set. Table 18 lists protocols that are established if a router modem originates the call. Table 19 lists protocols that are established if a router modem answers the call.

Table 18   Modem Connection Modes with %L1 or %L3 Set—Router Modem Originating

Mode Setting on Originating Modem	Mode Setting on Answering Modem								
	Bell 103	Bell 212A	V.22[b]	V.22[a]	V.22*bis*	V.32	V.32*bis*	V.34	K56flex
V.34 annex 12 (31200–33600)	–	–	–	–	V.22*bis*	V.32	V.32*bis*	V.34	V.34
V. 34 (2400–28800)	–	–	–	V.22[a]	V.22*bis*	V.32	V.32*bis*	V.34	V.34
V.32*bis* (4800–14400)	–	V.22[a]	–	V.22[a]	V.22*bis*	V.32	V.32*bis*	V.32*bis*	V.32*bis*
V.32 (4800–9600)	–	V.22[a]	–	V.22[a]	V.22*bis*	V.32	V.32	V.32	V.32
V.22*bis* (2400)	–	V.22[a]	–	V.22[a]	V.22*bis*	V.22*bis*	V.22*bis*	V.22*bis*	V.22*bis*
V.22[a] (1200)	–	V.22[a]	–	V.22[a]	V.22[a]	V.22[a]	V.22[a]	V.22[a]	V.22[a]
V.22[b] (600)	–	–	V.22[b]	–	–	–	–	–	–
V.23[a] (xmt 75)	–	–	–	V.23[b]	V.23[b]	V.23[b]	V.23[b]	V.23[b]	V.23[b]
V.23[b] (xmt 1200)	–	–	–	–	–	–	–	–	–
V.21(75–300)	–	V.22[a]	–	V.21	V.21	V.21	V.21	V.21	V.21
Bell 212A (1200)	Bell 212A	Bell 212A	–	V.22[a]	V.22[a]	V.22[a]	V.22[a]	V.22[a]	V.22[a]
Bell 103 (300)	Bell 103	Bell 103	–	Bell 103	Bell 103	Bell 103	Bell 103	Bell 103	Bell 103

Table 19   Modem Connection Modes with %L1 or %L3 Set—Router Modem Answering

Mode Setting on Originating Modem	Mode Setting on Answering Modem							
	Bell 103	**Bell 212A**	**V.22[b]**	**V.22[a]**	**V.22***bis*	**V.32**	**V.32***bis*	**V.34**
K56flex (32000–56000)	–	–	–	–	V.22*bis*	V.32	V.32*bis*	V.34
V.34 annex 12 (31200–33600)	–	–	–	–	V.22*bis*	V.32	V.32*bis*	V.34
V. 34 (2400–28800)	–	–	–	V.22[a]	V.22*bis*	V.32	V.32*bis*	V.34
V.32*bis* (4800–14400)	–	V.22[a]	–	V.22[a]	V.22*bis*	V.32	V.32*bis*	V.32*bis*
V.32 (4800–9600)	–	V.22[a]	–	V.22[a]	V.22*bis*	V.32	V.32	V.32
V.22*bis* (2400)	–	V.22[a]	–	V.22[a]	V.22*bis*	V.22*bis*	V.22*bis*	V.22*bis*
V.22[a] (1200)	–	V.22[a]	–	V.22[a]	V.22[a]	V.22[a]	V.22[a]	V.22[a]
V.22[b] (600)	–	–	V.22[b]	–	–	–	–	–
V.23[a] (xmt 75)	–	–	–	V.23[b]	V.23[b]	V.23[b]	V.23[b]	V.23[b]
V.23[b] (xmt 1200)	–	–	–	–	–	–	–	–
V.21(75–300)	–	V.22[a]	–	V.21	V.21	V.21	V.21	V.21
Bell 212A (1200)	Bell 212A	Bell 212A	–	V.22[a]	V.22[a]	V.22[a]	V.22[a]	V.22[a]
Bell 103 (300)	Bell 103	Bell 103	–	Bell 103	Bell 103	Bell 103	Bell 103	Bell 103

Restricted Speed Matching

Use the **%L0** or **%L2** command options on both originating and answering modems to restrict the connection speed. Table 20 lists connection speeds using the **%L0** partial speed matching option. Table 21 lists connections speeds using the **%L2** speed matching disabled option. If **%L2** is set, the modem speed matches the closest possible connection speed.

Table 20   Connection Speeds with Partial Speed Matching (%L0 Option)

Modem Speed	Possible Connection Speeds
300	300
600	600
200	1200
2400	1200, 2400
4800	4800
7200	4800, 7200
9600	4800, 7200, 9600
12000	4800, 7200, 9600, 12000
14400	4800, 7200, 9600, 12000, 14400
16800	14400, 16800
19200	14400, 16800, 19200
21600	14400, 16800, 19200, 21600
24000	14400, 16800, 19200, 21600, 24000

Table 20   Connection Speeds with Partial Speed Matching (%L0 Option) (continued)

Modem Speed	Possible Connection Speeds
26400	14400, 16800, 19200, 21600, 24000, 26400
28800	14400, 16800, 19200, 21600, 24000, 26400, 28800

Table 21   Connection Speeds with Speed Matching Disabled (%L2 Option)

Modem Speed	Possible Connection Speeds
300	300
600	600
1200	1200
2400	2400
4800	4800
7200	7200
9600	9600
12000	12000
14400	14400
16800	16800
19200	19200
21600	21600
24000	24000
26400	26400
28800	28800
31200	31200
33600	33600

%M*n* (Modulation Selection)

Sets the upper modulation used in connections. Setting **%M** causes **%B** to be set to the maximum data rate for that modulation. Table 22 lists command options.

Defaults   **%M2**

Table 22   Modulation Selection Command Options

Command	Meaning
%M0	Disables V.34 modulation
	V.32*bis*, 14.4 kbps maximum
%M1	Disables 33.6 kbps modulation
	V.34, 28.8 kbps maximum
%M2	Enables 33.6 kbps modulation
	V.34, 33.6 kbps maximum

%R*n* (Read All Registers)

Displays the contents of modem S and :T registers as a table of values in decimal and hexadecimal format. Table 23 lists command options.

Table 23   Read All Registers Command Options

Command	Meaning
%R0	Displays contents of all S registers as decimal and hexadecimal integers in tabular format
%R1	Displays contents of all :T registers as decimal and hexadecimal integers in tabular format

The following display is an example of the **%R** command:

```
at%r0

REG   DEC   HEX    REG   DEC   HEX
S00   001   01H    S14   138   8AH
S01   000   00H    S15   000   00H
S02   043   2BH    S16   000   00H
S03   013   0DH    S17   000   00H
S04   010   0AH    S18   000   00H
S05   008   08H    S19   000   00H
S06   002   02H    S20   000   00H
S07   060   3CH    S21   048   30H
S08   002   02H    S22   118   76H
S09   006   06H    S23   030   1EH
S10   060   3CH    S24   000   00H
S11   075   4BH    S25   005   05H
S12   050   32H    S26   001   01H
S13   000   00H    S27   064   40H

S13   000   00H    S27   064   40H
OK
```

%U*n* (Clear Serial Port Speed)

Sets the serial port speed. Table 24 lists command options.

Defaults   **%U1**

Table 24   Clear Serial Port Speed Options

Command	Meaning
%U0	Allows the current serial port speed to be changed to any other speed. This option is not required for speeds of 19200 bps and lower.
%U1	Keeps the current serial port speed. You must enter **%U1** each time you change the serial port speed.
%U2	Allows the current serial port speed to be changed from any other speed.

%V (Display Modem Firmware Version)

Displays the modem firmware version and country code. (For country code listings, see Table 37 on page 30.)

Defaults   **%V1**

Table 25   Display Modem Firmware Version Options

Command	Meaning
%V1	Provides detail to the x.x.x level
%V0	Provides detail to the x.x level

Ampersand Command Set

This section describes modem commands that begin with an ampersand (**&**) character.

&C*n* (Serial Port DCD Control)

Controls the Data Carrier Detect (DCD) signal level. Use this command if your workstation requires DCD to be off at certain times. Table 26 lists command options. See also the **\D***n* command.

Defaults   **&C1**

Table 26   Serial Port DCD Control Command Options

Command	Meaning
&C0	DCD is always on.
&C1	DCD follows the state of carrier from the remote system and turns on after the connect message.
&C2	DCD is on except momentarily at disconnect.

&D*n* (DTR Control)

Specifies the modem action when Data Terminal Ready (DTR) transitions off. The on-to-off transition of DTR must last as long as the value specified in register S25. Positive transitions of DTR (off-to-on) within 5 sec after disconnect are ignored. Table 27 lists command options.

Defaults   **&D3**

Table 27   DTR Control Command Options

Command	Meaning
&D0	Ignores DTR. DTR is not needed for autoanswer.
&D1	Enters command state on detecting on-to-off transition of DTR. DTR is not needed for autoanswer.
&D2	Sets the modem on-hook when detecting an on-to-off transition of DTR and prepares the serial port to accept an AT command at any speed. DTR is needed for autoanswer.
&D3	Sets the modem on-hook and resets when detecting an on-to-off transition of DTR and prepares the serial port to accept an AT command at any speed. DTR is needed for autoanswer.

&F (Restore Command Defaults)

Restores the factory default configuration. Stored telephone numbers are not cleared.

&G*n* (Guard Tone)

Sets the guard tone frequency on the answering mode. Table 28 lists command options.

Defaults   **&G0**

Table 28   Guard Tone Command Options

Command	Meaning
&G0	Disables the guard tone
&G1	Sets the guard tone on the answering modem to 550 Hz
&G2	Sets the guard tone on the answering modem to 1800 Hz

&L*n* (Leased Line)

Sets leased line mode. Table 29 lists command options.

Defaults   **&L0**

Table 29   Leased Line Command Options

Command	Meaning
&L0	Disables leased line mode (enables switched line mode).
&L1	Enables leased line mode when dial (**D**) or answer (**A**) command is run.
&L2	Enables leased line mode. The modem goes off-hook after the number of seconds specified in the :T57 register (the default is 6), in originate mode if register S0 is 0 or in answer mode if S0 is 1 or greater.

&P*n* (Dial Pulse Ratio)

Sets the ratio of off-hook (make) to on-hook (break) time that the modem uses for pulse dialing. Table 30 lists command options.

> **Note**   Pulse dialing is not supported in Japan.

Defaults   **&P0**

Table 30   Dial Pulse Ratio Command Options

Command	Meaning
&P0	Make 39 percent, break 61 percent
&P1	Make 33 percent, break 67 percent

&S*n* (DSR Options)

Sets the serial port Data Set Ready (DSR) signal. Table 31 lists command options.

Defaults   **&S0**

Table 31   DSR Command Options

Command	Meaning
&S0	DSR is always on. Equivalent to setting the Serial Port DSR/CTS command **\D**.
&S1	DSR is on with answer tone. Equivalent to setting the Serial Port DSR/CTS command **\D3**.

&T*n* (Diagnostic Test Mode)

Configures the modem to run a local or remote diagnostic test. Use the **&T0** command to stop a running diagnostic test. lists command options.

Defaults   **&T5**

Table 32   Diagnostic Test Command Options

Command	Meaning
&T0	Ends a test in progress. The test ends without terminating a connection, returning the local and remote modems to normal operation. If a self-test is in progress, **&T0** reports any errors. This command must be the last command on a command line.
&T1	Runs a local analog loopback test. The modem should display characters on your screen exactly as you enter them. The modem must be in normal or direct mode and set to 1200 bps or higher.
&T3	Local digital loopback test. Allows a remote modem that does not support the CCITT V.54 standard to perform a remote digital loopback test with the modem. The modem must be in normal or direct mode and set to 1200 bps or higher.
&T4	Allows the modem to respond to a remote request to enter remote digital loopback mode. The modem must be in normal or direct mode and set to 1200 bps or higher.
&T5	Prevents the modem from responding to a remote digital loopback request.
&T6	Instructs the remote modem to initiate a remote digital loopback test. The modem must be in normal or direct mode and set to 1200 bps or above.
&T7	Instructs the remote modem to enter a remote digital loopback with a self-test. After the test is complete, the remote modem reports errors to the local device. The modem must be in normal or direct mode and set to 1200 bps or higher.
&T8	Runs a local analog loopback with a self-test. The modem sends itself the ITU-T V.54 test pattern, verifies characters to make sure they are received correctly, and reports errors to the local device. The modem must be in normal or direct mode and set to 1200 bps or higher.

&W (Store Current Configuration)

Stores the current configuration. The **&W** command stores the active commands and S registers, except restricted S registers S2 to S12, and the serial port speed and parity and modem port speed in effect when you enter the command. Telephone numbers are stored independently with the **\P***n* and **&Z***n* commands.

Note   The **&W** command does not save registers S2 to S12; the **AT*W** command saves all registers.

Note   The **&W** and ***W** commands share the same stored configuration area. Either of these commands overwrites the other's stored settings. The ***W** command also stores settings for restricted S registers S2 to S12. If **&W** is used after ***W**, the default settings for the restricted S registers are restored. The settings stored by ***W** for the restricted registers are not saved during power-down.

Parenthesis Command Set

This section describes modem commands that begin with a right-parenthesis ()) character.

)M*n* (Power Level Adjustment for Cellular Telephone Connections)

Adjusts power levels during link negotiation for reliable connections to accommodate signaling requirements of cellular telephone equipment. Table 33 lists command options.

Defaults   )M0

Table 33   Power Level Command Options

Command	Meaning
)M0	Adjusts the power level for central site modems if the remote modem is set to)M1. Use this option for MNP Class 10 modems that connect to both cellular and noncellular site modems.
)M1	Autoadjusts the power level for cellular modems.

Asterisk Command Set

This section describes modem commands that begin with an asterisk (*****) character.

*I (Modem Identifier)

When the ***I** command is entered, the following prompt appears:

```
ID:
```

The identifier can consist of up to 25 ASCII characters. It is truncated after the 25th character. The modem identifier is also displayed by the **\S** command (Read Online Status).

Defaults   No default identifier.

*W (Store Complete Configuration)

Stores the complete modem configuration. The ***W** command stores the active commands and S registers, including the current values of restricted S registers S2 to S12 (which are not stored with **&W**), and the serial port speed and parity and modem port speed in effect when you enter the command. Telephone numbers are stored independently with the **\P**n and **&Z**n commands.

Note   The **AT*W** command saves all registers; the **&W** command does not save registers S2 to S12.

Note   The **&W** and ***W** commands share the same stored configuration area. Either of these commands overwrites the other's stored settings. The ***W** command also stores settings for restricted S registers S2 to S12. If **&W** is used after ***W**, the default settings for the restricted S registers are restored. The settings stored by ***W** for the restricted registers are not saved during power-down.

Hyphen Command Set

This section describes modem commands that begin with a hyphen (**-**) character.

-D{*dial string*} (Repeat Dial)

Redials a telephone number, up to nine times, until a connection is made. In reliable mode, the modem does not redial the number if the remote modem answers but fails to establish a reliable connection. Table 34 lists command options.

> **Note** Repeat dialing is not supported in Japan.

The dial string contains up to 98 characters. Valid dial string characters are 0–9, the dial modifiers listed in Table 3 on page 4, and the **#** and **∗** characters for tone dial. The modem ignores invalid characters.

Table 34   Repeat Dial Command Options

Command	Meaning
-D/n	*n* is an integer between 1 and 9 that specifies a telephone number stored with the **\P** command.
-DL	Redials the last number dialed.
-DS	Dials the first entry stored in the directory.

-E*n* (Modem Port Data Length)

Specifies the number of data bits used on the modem port during normal mode connections when the **\N0** command (Operating Mode) is set, and the serial port is configured for asynchronous transmission of 11-bit characters. Both modems must be set to the same number of data bits. Table 35 lists command options.

The modems cannot pass data when a **\N3** or **\N5** reliable connection is set, and falls back to a normal connection with 11-bit data characters enabled on both modems.

Defaults   **-E0**

Table 35   Modem Port Data Length Command Options

Command	Meaning
-E0	Enables 10-bit data during normal mode connections.
-E1	Enables 11-bit data during normal mode connections.

-H*n* (Smart or Dumb Mode)

Configures the modem to smart mode (recognize commands on the DTE port and send result codes) or dumb mode (ignore commands on the DTE port and do not send result codes). Table 36 lists command options.

Defaults   **-H0**

Table 36   Dumb Mode Command Options

Command	Meaning
-H0	Smart mode
-H1	Dumb mode

-I*n* (Country Code)

Sets the country code for the modem. The code does not take effect until the modem has been reset by the **Z** (Reset) command or a power cycle. Table 37 lists country codes.

Country codes that are set manually (that is, not following the procedure described in the next section) remain in effect until one of the following events occurs:

• Another -I command is sent.

• The firmware is reloaded. (Firmware reloads always reset the country code to USA.)

• The router is power cycled.

• The router is reloaded.

Note   You can also set country codes using the Cisco IOS **modem country** command. For more information, see the Cisco IOS configuration guides and command references. The **modem country** command takes effect immediately, but all active calls are dropped.

Changing Country Codes on Microcom Modems

This section describes how to change the country code for analog modem network modules. The default country code is USA. The USA country code is also used for the following countries:

- Argentina
- Brazil
- Canada
- Chile
- China
- Columbia
- Hong Kong
- India
- Indonesia
- Korea
- Malaysia
- Mexico
- Peru
- Philippines
- Singapore
- Taiwan
- Thailand

If you are using the modems in a different country, you must change the country code. Some countries also require additional configuration.

Configure

Follow these steps:

Step 1 Enter global configuration mode:

```
Router# enable
Router# config term
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#
```

Step 2 Edit the new modemcap and specify the country code and reset (**-I**n**Z**) in the miscellaneous attributes field. Replace n with one of the country codes listed in the Country Code column of Table 37. In the following example, the country code is set to "18" for the Czech/Slovak Republic:

```
Router(config)# modemcap edit micro_czech miscellaneous -I18Z
```

Table 37   Country Codes

Country	Country Code	Country Code Displayed in Banner
Australia	20	49
Austria	22	92
Belgium[1]	23	67
Czech/Slovak Republic[1]	18	91
Denmark	10	63
Finland	9	71
France[1]	25	32
Germany	17	68
Israel	15	16
Italy	3	21
Ireland	24	97
Japan	13	14
Netherlands	5	04
New Zealand	11	55
Norway	8	72
Poland	19	93
Portugal	27	94
Spain	6	76
South Africa	16	69
Sweden	7	09
Switzerland[1]	14	66
UK[2]	2	12
USA[3]	1	85

1. The S-register is set to S0=2 (answer on the second ring) by default. Additional configuration is required.

2. The UK country code is also used for Greece, Hungary, and Saudi Arabia.

3. The USA country code also applies to Argentina, Brazil, Canada, Chile, China, Columbia, Hong Kong, India, Indonesia, Korea, Malaysia, Mexico, Peru, Philippines, Singapore, Taiwan, and Thailand.

Step 3   If you are using the country code for Belgium, the Czech/Slovak Republic, France, or Switzerland, additional configuration is required. By default these country codes answer on the second ring (S0=2).

a. Edit the modemcap to asnswer calls on the second ring:

```
Router(config)# modemcap edit micro_czech autoanswer s0=2
```

b. Enter the **:T26=8** command. Note that you must reenter the country code too. Whenever you modify an attribute field, you must re-enter all values. New values are not appended to existing values.

```
Router(config)# modemcap edit micro_czech miscellaneous :T26=8-I18Z
Router(config)# exit
Router#
```

Step 4   If you are using the modem in Malaysia, add the following modemcap miscellaneous entry:

```
Router(config)# modemcap edit micro_malaysia miscellaneous :T93=10:T94=8Z
Router(config)# exit
Router#
```

Step 5   Enter global configuration mode and specify the lines on which to apply the new modemcap. Lines 1 through 48 are specified in the following example:

```
Router# config term
Router(config)# line 1 48
Router(config-line)# modem autoconfigure type micro_czech
```

Messages appear while the modems are reconfigured using the new modemcap. When the last message appears, press **Return**:

```
.
.
.
3w5d: TTY48: Done with modem configuration
```

Step 6   Save the configuration changes to NVRAM:

```
Router(config-line)# Ctrl-Z
Router# copy running-config startup-config
[OK]
```

Verify

Verify the configuration changes using one of the following methods.

The following example shows verification from the router command prompt:

```
Router# show modemcap mcom_czech
Modemcap values for mcom_czech
Factory Defaults (FD):  [not set]
Autoanswer (AA):  [not set]
Carrier detect (CD):  [not set]
Drop with DTR (DTR):  [not set]
Hardware Flowcontrol (HFL):  [not set]
Lock DTE speed (SPD):  [not set]
DTE locking speed (DTE):  [not set]
Best Error Control (BER):  [not set]
Best Compression (BCP):  [not set]
No Error Control (NER):  [not set]
No Compression (NCP):  [not set]
No Echo (NEC):  [not set]
No Result Codes (NRS):  [not set]
Software Flowcontrol (SFL):  [not set]
Caller ID (CID):  [not set]
On-hook (ONH):  [not set]
Off-hook (OFH):  [not set]
Miscellaneous (MSC):  -i18z
Template entry (TPL):  [not set]
Router#
```

✎

Note The Miscellaneous (MSC) field is the only nondefault field set in the modemcap.

The following example shows verification using debug:

Step 1 Enable modem debug:

```
Router# debug confmodem
Modem Configuration Database debugging is on
Router# debug modem
Modem control/process activation debugging is on
Router#
```

Step 2 Clear an idle line:

```
Router# clear line 1
[Confirm]
OK
```

DTR drops and modem autoconfigure runs when the modem is reset. It may take a little while before the messages appear:

```
Router#
*Mar  3 23:20:26.114: TTY1: Line reset
*Mar  3 23:20:26.118: TTY1: Modem: IDLE->HANGUP
*Mar  3 23:20:26.534: TTY1: dropping DTR, hanging up
*Mar  3 23:20:26.534: tty1: Modem: HANGUP->IDLE
*Mar  3 23:20:31.838: TTY1: restoring DTR
*Mar  3 23:20:32.958: TTY1: Modem command:  --AT&F&C1&D2:T26=8-I18Z
\Q3\N5-K0\J0%C3$B115200S0=2H0--
*Mar  3 23:20:34.234: TTY1: Modem configuration succeeded
*Mar  3 23:20:36.090: TTY1: locking speed (115200) response ---OK---
*Mar  3 23:20:36.090: TTY1: locked DTE speed at 115200
*Mar  3 23:20:36.094: TTY1: Done with modem configuration
```

Step 3 Verify that the country code has changed by entering the IP address of your LAN interface and port 2000 + *n*, where *n* is the modem line number:

```
Router# telnet 172.16.10.1 2001
You are now entering AT command mode on modem (slot 0 / port 0).
at%v1

MNP Class 10 V.34 Modem Rev x.x.x/91

OK
```

Locate "91" in the "Country Code Displayed in Banner" column of Table 37. Note that it identifies the Czech/Slovak Republic.

Step 4 Enter the disconnect command to exit the modem session:

```
Router# disconnect line 1
Router#
```

-J*n* (Detect Phase)

Configures the originating modem to send a control sequence to the answering modem to determine the type of error correction enabled, either LAPM, MNP, or none. See the **\N***n* command (Operating Mode) for information about the types of connections that can be established. Table 38 lists command options.

Defaults   -J1

Table 38   Detect Phase Command Options

Command	Meaning
-J0	Disables detect phase.
-J1	Enables detect phase.

-K*n* (MNP Extended Services)

Configures the modem to use MNP extended services that are not available when operating in LAPM mode. For example, two modems with MNP extended services enabled negotiate MNP Class 10 with V.42*bis* compression instead of LAPM. Table 39 lists command options.

Defaults   -K1

Table 39   MNP Extended Services Command Options

Command	Meaning
-K0	Disables MNP extended services.
-K1	Enables MNP extended services.
-K2	Enables MNP extended services without MNP indication during the answer detect phase.

-M*n* (MNP Class Connect Messages)

Determines whether MNP class connect messages are displayed. Table 40 lists command options.

The **-M1** setting overrides the **\V** command (Error Correction Result Code Form) for long form connection result codes and the **W***n* command (Connection Speed Reporting) for serial-port connect messages. The following commands override the **-M***n* command:

- **V0** (short form result codes enabled)
- **X0** (extended result codes disabled) displays only CONNECT

Defaults   -M0

Table 40   MNP Connect Messages Command Options

Command	Meaning
-M0	Disables MNP class connect messages
-M1	Enables the following formats for MNP class connect messages, where *n* equals MNP class (from 1 to 10), and *x* means the type of data compression (V.42*bis* or MNP Class 5): • CONNECT for normal and direct connections • CONNECT MNP*n*/*x* for MNP connections • CONNECT MNP*n* for modems that do not negotiate compression • CONNECT MNP*n*/CELLULAR/*x* if)**M1** (Power Level Adjustment) is set • CONNECT LAPM for LAPM connections with no compression active • CONNECT LAPM/V42*bis* for LAPM V.42*bis* connections

-O*n* (Serial Port Parity)

Changes the serial port parity set by the AT sequence. Use this command when the local device supports XON/XOFF flow control and detects parity to ensure that all modem-generated XON and XOFF characters have the correct parity. Table 41 lists command options.

You can also use the **-O*n*** command to change the serial port parity while the modem is connected to a remote device. Modem port parity cannot be changed after a connection is established. When the parity required for a connection is not the parity set by the sequence, you must set the correct parity when you enter the **D** command, as part of the same command line.

The AT sequence cannot be used to match space parity; instead no parity is set. You must enter **-O3** to set space parity.

Defaults   **-O4**

Table 41   Serial Port Parity Command Options

Command	Meaning
-O0	7 data bits, odd parity
-O1	7 data bits, even parity
-O2	7 data bits, mark parity
-O3	7 data bits, space parity
-O4	8 data bits, no parity
-O5	8 data bits, odd parity
-O6	8 data bits, even parity
-O7	8 data bits, mark parity

-P*n* (Check Parity)

Controls parity checking of XON and XOFF characters, the escape code sequence, and HP ACK characters. In command state, all command echoes and command responses from the modem are sent to the workstation with parity that matches the serial port parity. Table 42 lists command options.

Defaults   **-P1** (Japan)
-P0 (elsewhere)

Table 42   Check Parity Command Options

Command	Meaning
-P0	Ignores parity for special characters. All received data is passed to the workstation with parity corrected to match the serial port parity.
-P1	Processes special characters received from the workstation only if their parity matches the serial port parity. All received data is passed to the workstation at 8 data bits with no parity.
-P2	Processes special characters only if their parity matches the serial port parity. Modem port flow control characters are recognized, regardless of whether their parity matches the serial port parity. All received data is passed to the workstation with parity corrected to match the serial port parity.

-Q*n* (Fallback Modulation Speed)

Configures the modem to fall back from a V.32*bis* or V.32 MNP reliable connection at 14400, 9600, 7200, or 4800 bps to a V.22*bis* MNP reliable connection at 2400 bps or a V.22 MNP reliable connection at 1200 bps. Fallback can occur when poor telephone lines cause excessive MNP retransmissions. Table 43 lists command options.

Fallback from a V.32*bis* or V.32 MNP reliable connection to V.32*bis* or V.32 at 4800 bps is always enabled for any **-Q***n* command option. The modem always uses the V.22 standard when it falls back from a V.32 MNP reliable connection to a 1200 bps MNP reliable connection for any **B***n* setting (ITI-U/Bell mode).

Defaults   **-Q2**

Table 43   Modulation Speed Command Options

Command	Meaning
-Q0	Disables fallback from a V.32*bis* or V.32 MNP reliable connection to an MNP reliable 2400 or 1200 bps connection.
-Q1	Enables fallback from a V.32*bis* or V.32 MNP reliable connection to an MNP reliable 2400 bps connection.
-Q2	Enables fallback from a V.32*bis* or V.32 MNP reliable connection to an MNP reliable 2400 or 1200 bps connection.

-V*n* (Split Modem Port Speed with Multiprotocol Autoanswer)

Determines whether the modem port uses split transmit and receive speed operation when using the multiprotocol autoanswer feature. **%F0** must also be set. Note that V.23 is the split speed on the modem link (that is, 75/1200 bps).

Defaults

-V1 for USA
-V0 for international

Table 44   Split Modem Port Speed with Multiprotocol Autoanswer Command Options

Command	Meaning
-V0	Enables V.23 split modem port speed connections within the multiprotocol autoanswer feature.
-V1	Disables V.23 split modem port speed connections within the multiprotocol autoanswer feature.

Colon Command Set

This section describes modem commands that begin with a colon (**:**) character.

:D*n* (Manual Dial)

Sets the modem off-hook in originate mode when DTR is raised. Table 45 lists command options.

Defaults   **:D0**

Table 45   Manual Dial Command Options

Command	Meaning
:D0	The modem is not set off-hook when DTR is raised.
:D1	The modem is set off-hook in originate mode when DTR is raised. **&D***n* (DTR Control) must also be set. For example, if **&D2** is set, the modem is set off-hook 5 sec after recognizing the positive transition of DTR.
:D2	The modem is set off-hook in originate mode and dials the first stored telephone number when DTR is raised. **&D***n* must also be set.

:E*n* (Compromise Equalizer)

Configures the modem to use the compromise equalizer when it connects in V.32 mode. Table 46 lists command options.

Defaults   **:E1**

Table 46   Compromise Equalizer Command Options

Command	Meaning
:E0	Disables the compromise equalizer only when the modem is in V.32 mode. Use **:E0** only when you are performing back-to-back or PBX-to-PBX V.32 mode connections.
:E1	Enables the compromise equalizer. Use **:E1** for outside-line-to-outside-line or PBX-to-outside-line connections.

:T*n*? (Read Configuration Register)

Displays the contents of :T register *n* (where *n* is a decimal number).

@ Character Command Set

This section describes modem commands that begin with an at (@) character.

@C*n* (CTR, DSR, and DCD Connect Message Control)

Sets DSR, Clear To Send (CTS), and DCD on, before, or after a connect message. Used with the :T14 (Connect Message Delay Timer) register. Table 47 lists command options.

Defaults   @C0

Table 47   Connect Message Control Command Options

Command	Meaning
@C0	Sets CTS, DSR, and DCD on before the connect message is sent.
@C1	Sets CTS, DSR, and DCD on after the connect message is sent.

@E (Detailed Modem Call Status)

This is an unsupported modem status and debugging command that an experienced user can use to verify the detailed status of the modem during or after a call. This command may be modified from time to time and may produce results different from those described in this document. For more information, see the "Debugging" section on page 70.

@M*n* (Select Transmit Level for Cellular Connections)

Selects the initial transmit level for the connection. You can set levels from -10 to -35 dBm (decibels referred to 1 milliwatt). From @M10 to @M35, the level is the as -*n* dBm. Table 48 lists selected transmit level command options.

Defaults   @M0

Table 48   Selected Transmit Level Command Options

Command	Meaning
@M0	-26 dBm
@M1	-30 dBm
@M2	-10 dBm
@M10	-10 dBm
@M35	-35 dBm

@U*n* (Minimum Connection Speed)

Selects the minimum speed for the connection. You can set the speed *n* for 300, 600, 1200, 2400, 4800, 7200, 9600, 12000, 14400, 16800, 19200, 21600, 24000, 26400, or 28800 bps.

Backslash Command Set

This section describes modem commands that begin with a backslash (\) character.

\A*n* (Maximum MNP Block Size)

Sets the maximum block size for MNP stream link connections. Table 49 lists command options.

Defaults   \A3

Table 49   MNP Block Size Command Options

Command	Meaning
\A0	64 characters
\A1	128 characters
\A2	192 characters
\A3	256 characters

\B*n* (Transmit Break)

Sends Break to the remote system for 100*n* ms (100-ms increments). In a reliable link, Break is always sent for 300 ms. Use the **O** command (Enter Connect State) to return to connect state. See also the "\Kn (Break Control)" section on page 43.

Related Commands   1 to 9

Defaults   \B3 (300 ms)

\C*n* (Autoreliable Buffer)

Configures the modem to buffer data in autoreliable, autoanswer mode. The answering modem data buffer can be used to store data during the 3-sec link negotiation for a reliable connection. Table 50 lists command options.

For example, you can use **%A** to set the autoreliable fallback character to ASCII 13 (carriage return). Then set **\C2** and **\N3** (autoreliable mode). Non-MNP callers who connect and press **Return** to log on do not need to wait for the 3-sec autoreliable window to expire before data can pass. See the "\Nn (Operating Mode)" section on page 44 for more information about autoreliable and normal modes.

The **\J*n*** command (Bps Rate Adjust) affects the type of connection established. Reliable and direct connections can result when bps rate adjust is enabled (**\J1**). Reliable and normal connections can result when bps rate adjust is disabled (**\J0**).

Defafults   **\C0**

✎

Note   When either **\C1** or **\C2** is set, reliable and normal connections can result regardless of bps rate adjustments.

Table 50   Autoreliable Buffer Command Options

Command	Meaning
\C0	Data is not buffered during link negotiation. The modem changes to normal or direct mode if a SYN character is not detected within 3 sec.
\C1	Buffers all data on the answering modem until 200 non-SYN characters are received or a SYN character is detected within 3 sec. If 200 non-SYN characters are received, the modem changes to normal mode and passes the data to the serial port. If the modem detects a SYN character within 3 sec, it attempts to establish a reliable connection. Otherwise, the modem changes to normal mode.
\C2	Data is not buffered on the answering modem. The modem changes to normal mode when it receives an autoreliable fallback character defined by the **%A** command and passes that character to the serial port. Use the **%C2** command when the modem receives calls from both modems that support MNP and modems that do not support MNP, so that the modem can change to normal mode as soon as it detects a logon character (defined by **%A**) from a non-MNP caller, eliminating the 3-sec wait.

\D*n* (Serial Port DSR/CTS Control)

Controls the DSR and CTS signals on the serial port. Use this command when the central site computer requires DSR and CTS to be off at certain times. Table 51 lists command options.

Selecting hardware flow control for the serial port overrides the **\D**n command. When hardware flow control is selected, the CTS line indicates the ability of the modem to receive data from your workstation, and the DSR action does not change.

Defaults   **\D0**

Table 51   Serial Port DSR/CTS Control Command Options

Command	Meaning
\D0	DSR and CTS are always on.
\D1	DSR and CTS follow DCD. If the **&C1** command (Serial Port DCD Control) is also set, DSR follows off-hook.
\D2	DSR and CTS both follow DCD.
\D3	DSR follows the answer tone, CTS is always on.

Serial Port Signal Options

Use the **&C***n* and **\D***n* commands to control the serial port DCD, DSR, and CTS signal levels when your workstation requires DCD, DSR, and CTS to be off at certain times. Table 52 lists command options and signal level results.

Table 52   Serial Port Signal Options

&C*n* Option	\D*n* Option	Result
0	0	DCD on, DSR on, CTS on.
0	1	DCD on, DSR on, CTS on.
0	2	DCD on, DSR on, CTS on.
0	3	DCD on, DSR with answer tone, CTS on.
0	4	DCD on, CTS and DTR comply with ITU-T recommendations.
1	0	DCD follows modem carrier, DSR on, CTS on.
1	1	DCD follows modem carrier, DSR follows off-hook, CTS follows CD.
1	2	DCD follows modem carrier, DSR and CTS both follow CD setting.
1	3	DCD follows modem carrier, DSR with the answer tone, CTS on.
1	4	DCD follows modem carrier, CTS and DTR comply with ITU-T recommendations.
2	0	DCD on (off for a few seconds at disconnect only), DSR on, CTS on.
2	1	DCD, DSR, and CTS on (off for a few seconds at disconnect).
2	2	DCD, DSR, and CTS on (off for a few seconds at disconnect).
2	3	DCD off at disconnect then on, DSR with the answer tone, CTS on.
2	4	DCD on (off for a few seconds at disconnect only), CTS and DTR comply with ITU-T recommendations.

\E*n* (Data Echo)

Configures the modem to echo characters sent from the local workstation in connect state. Table 53 lists command options.

Defaults   **\E0**

Table 53   Data Echo Command Options

Command	Meaning
\E0	Does not echo data sent by the local workstation.
\E1	Echoes data sent by the local workstation. **\E1** functions only with normal mode connections.

\F (Display Stored Phone Numbers)

Displays the telephone numbers currently stored in the telephone directory.

\G*n* (Modem Port Flow Control)

Sets the flow control method used to pace data between modems during a normal mode connection. Table 54 lists command options.

A reliable link has its own method of flow control and ignores the **\G***n* setting. The **\Q***n* command (Serial Port Flow Control) settings determine DTE port flow control during a reliable link.

Defaults   **\G0**

Table 54   Modem Port Flow Control Command Options

Command	Meaning
\G0	Disables modem port flow control.
\G1	Sets modem port flow control to XON/XOFF. The modem sends an XOFF character to stop received data and sends an XON character to resume reception of data.
\G2	Sets modem port flow control to unidirectional XON/XOFF. The modem sends XON and XOFF characters to the remote device but ignores XON and XOFF received from the remote device.

\J*n* (BPS Rate Adjust)

Automatically adjusts the speed of the serial port to match the speed of the connection. Table 55 lists command options.

When a reliable connection is established at a speed between 4800 and 14400 bps and the bps rate adjust option is enabled, the serial port speed always adjusts to 9600 bps. If the connection is established at 14400 bps or higher, the serial port speed is adjusted to 19200 bps. If you set the serial port to the modem's highest rate of 115200 bps, turn off bps rate adjust so that the serial port stays at 115200 bps.

Defaults   **\J0**

Note   When **\J1**, **\C0** (the autoreliable buffer), and **\N3** (the autoreliable mode) are set, the modem uses direct mode instead of normal mode if a reliable connection is not established.

Table 55   BPS Rate Adjust Command Options

Command	Meaning
\J0	Disables bps rate adjust. The serial port rate is independent of the rate of the connection. This option is recommended for the highest throughput when data compression is used.
\J1	Enables bps rate adjust. The modem automatically adjusts the speed of the serial port to match the speed of the connection until the connection terminates. If your workstation does not automatically change to the adjusted bps rate, you must manually change the bps rate to the new setting. See the "%Un (Clear Serial Port Speed)" section on page 20 for information about resetting the serial port bps rate.

\K*n* (Break Control)

Determines the type of Break the modem transmits when it receives a Break. Table 56 describes the effect of *n*. The modem can buffer as many as four Breaks on both the modem port and the serial port.

Defaults   \K5

Note   In reliable link connect state, the sending modem's Break control setting determines how the receiving modem handles the Break.

Table 56   Break Control Command Options

Command	Local DTE Sends Break During Reliable or Normal Connection	Local DTE Sends \B*n*, to Local Modem in Command Mode During Reliable or Normal Connection	Local Modem Sends Break During Direct Connection	Remote Modem Sends Break During Normal Connection
\K0	Modem enters command state; no Break to the remote system.[1]	Empties data buffers; sends Break to the remote system.	SendsBreak to the remote system; sets modem to command state.	Empties data buffers; sends Break to serial port.
\K1	Empties data buffers; sends Break to the remote system.	Same as \K0.	Sends Break to the remote system.	Same as \K0.
\K2	Same as \K0.	Immediately sends Break to the remote system.	Same as \K0.	Immediately sends Break to serial port.
\K3	Immediately sends Break to the remote system.	Same as \K2.	Same as \K1.	Same as \K2.
\K4	Same as \K0.	Sends Break to the remote system in sequence with any transmit data being buffered.	Same as \K0.	Sends Break to the serial port in sequence with receive data being buffered.
\K5	Sends Break to the remote system in sequence with transmit data.	Same as \K4.	Same as \K1.	Same as \K4.

1. Forces the modem to command state. To transmit a Break and enter connect state, enter the **\B0** command. See the "\Bn (Transmit Break)" section on page 39 for details.)

\N*n* (Operating Mode)

Selects the modem operating mode. Table 57 lists command options.

Defaults   **\N3**

✎
Note   You can set the operating mode for a single call using dial modifiers. See Table 3 on page 4 for details.

Table 57   Operating Mode Command Options

Command	Meaning
\N0	Normal mode. **\N0** can be used to communicate with most modems. No error correction is performed in normal mode.
\N1	Direct mode. **\N1** ignores flow control and does not buffer data. In connect state, the serial port always adjusts to the speed of the connection for any **\J*n*** setting. No error correction is performed in direct mode. The escape code sequence is disabled in direct mode if **\J0** is set.
\N2	MNP reliable mode to provide error detection and automatic data retransmission between systems that support the MNP reliable link. The modem disconnects if it fails to establish an MNP reliable link immediately after making a connection. Some protocols are not timed to work with MNP and can interfere with its effectiveness.
	Both modems should use flow control on the serial port in an MNP reliable link. When a transmission error is detected, data is buffered during the retransmission.
\N3	Autoreliable mode. The answering modem looks for incoming MNP or LAPM protocol characters from the remote modem. If the answering modem detects the characters within approximately 3 sec, it tries to establish a reliable link connection. If both modems are set to autoreliable mode, a normal connection or no connection can result because of noise on the telephone line.
	When the modem is set to autoanswer in autoreliable mode, you can shorten the 3-sec period by using the **%A** command with the **\C2** command.
	\N3 lets the modem communicate with remote modems that may not support the MNP or LAPM reliable link.
\N4	LAPM reliable mode to provide error detection and automatic data retransmission between systems that support the LAPM reliable link. The modem disconnects if it fails to establish a LAPM reliable link immediately after making a connection.
\N5	LAPM reliable mode with fallback to normal mode.
\N6	LAPM reliable mode with fallback to MNP reliable mode.

Table 58 lists connections that can be established, depending on the operating mode enabled on each modem. When more than one operating mode is listed within a column, the first mode is for the originating modem and the second is for the answering modem. NC indicates no connection.

✎
Note   For LAPM connections listed in Table 58, if the originate and answer modems have **-K1** (MNP Extended Services) set for V.42 connections, the extended features of MNP are applied during the connection.

Table 58   Possible Connections for Operating Mode Command Options

Answering Modem	Originating Modem						
	\N0	\N1	\N2	\N3	\N4	\N5	\N6
\N0	Normal	Direct/normal	NC	Normal	NC	Normal	NC
\N1	Normal/direct	Direct	NC	Normal/direct	NC	Normal/direct	NC
\N2	NC	NC	MNP	MNP	NC	NC	MNP
\N3	Normal	Direct/normal	MNP	MNP	LAPM	LAPM	LAPM
\N4	NC	NC	NC	LAPM	LAPM	LAPM	LAPM
\N5	Normal	Direct/normal	NC	LAPM[1]	LAPM	LAPM	LAPM
\N6	NC	NC	MNP	MNP	LAPM	LAPM	LAPM

1. For the modem to establish a LAPM connection, **-K0** must be set.

\P*n*{*dial string*} (Store a Telephone Number)

Stores entry *n* in the modem's telephone directory, where *n* is an integer (1 to 9) and *dial string* is a string of as many as 98 characters. Valid dial string characters are 0 to 9, dial modifiers, and **#** and ***** for tone dialing. The modem ignores invalid characters. Dial strings longer than 98 characters return error messages. Phone numbers are not saved during a power reset.

\Q*n* (Serial Port Flow Control)

Selects the flow control method used in the serial port. In direct mode connections, the modem ignores the **\Q***n* command. Table 59 lists command options.

Defaults   \Q3

Table 59   Serial Port Flow Control Command Options

Command	Meaning
\Q0	Disables flow control.
\Q1	Enables bidirectional XON/XOFF flow control. Data transmission is stopped by an XOFF character and restarted by an XON character. The modem generates XON and XOFF characters at the same parity used on the serial port. The serial port responds to XON and XOFF characters sent by the local workstation in the same way.
\Q2	Enables unidirectional CTS/RTS hardware flow control. The modem turns CTS off to signal the local workstation to stop transmitting data, and turns CTS on to signal the local workstation to resume transmitting data.
\Q3	Enables bidirectional CTS/RTS hardware flow control. The modem uses CTS to start and stop transmission from the local workstation. When RTS is off, the modem stops transmitting. When RTS is on the modem resumes transmission.

Table 59   Serial Port Flow Control Command Options (continued)

Command	Meaning
\Q4	Enables unidirectional XON/XOFF flow control. The modem serial port generates, but does not respond to, XON/XOFF flow control characters. This setting allows for computers to transmit data that contains XON and XOFF data characters. The computer can still be set to respond to XON/XOFF flow control characters sent to it from the modem during serial port flow control.
\Q5	Enables unidirectional hardware flow control and keeps CTS off until the connection is established.
\Q6	Enables bidirectional hardware flow control and keeps CTS off until a connection is established. RTS is ignored when it is not connected.

\R*n* (Serial Port Ring Indicator)

Controls the Ring Indicator (RI) signal. RI follows the incoming ring signal on the telephone line. Table 60 lists command options.

Defaults   **\R1**

Table 60   Serial Port Ring Indicator Command Options

Command	Meaning
\R0	Turns on the ring indicator signal after the ring and keeps it on for the duration of the telephone call.
\R1	Turns off the ring indicator signal after the telephone call is answered.

\S*n* (Read Online Status)

Displays a list of modem commands and their current settings, active connection type, elapsed connect time, and telephone number most recently dialed. The **\S0** command outputs a single-screen display (press any key for the next screen). The **\S1** command outputs a continuous screen display (press **Ctrl-X** or **Break** to cancel the display). The following display is an example of **\S1** command output with factory default settings:

```
at\s1

IDLE            000:02:01
LAST DIAL       t1714756,0947

NET ADDR:       FFFFFFFFFFFF
MODEM HW: OEM 2W United States
4 RTS 5 CTS 6 DSR - CD 20 DTR - RI
MODULATION      IDLE
MODEM BPS       33600  AT%G0
MODEM FLOW      OFF    AT\G0
MODEM MODE      AUT    AT\N3
V.23 OPR.       OFF    AT%F0
AUTO ANS.       ON     ATS0=1
SERIAL BPS      115200 AT%U1
```

```
BPS ADJUST      OFF    AT\J0
SPT BPS ADJ.    0      AT\W0
ANSWER MESSGS   OFF    ATQ2
SERIAL FLOW     BHW    AT\Q3
PASS XON/XOFF   OFF    AT\X0
PARITY          8N     AT
BREAK           5      AT\K5
EXIT CHAR       043    ATS2=43
ANS DUMB MODE   ON     AT#E1
CMD ECHO        ON     ATE1
RESULTS         OFF    ATQ2
RESULT TYPE     MNPX   ATV1\V2
CONNECT MSG     MDM    ATW2
CONN MNP-       0      AT-M0
SPEED MATCH     1      AT%L1
EQUALIZER       1      AT:E1
FALLBACK        2      AT-Q2
DATA ECHO       OFF    AT\E0
INACT TIMER     00     AT\T0
AUTO RETRAIN    ON     AT%E1
COMPRESSION     ALL    AT%C3
MAX BLK SIZE    256    AT\A3
AUTO BUFF       0      AT\C0
AUTO CHAR       000    AT%A0
EMULATING HP    OFF    AT\H0
PAUSE TIME      002    ATS8=2
DTR             3      AT&D3
MABP ADDRESS    001    AT^P1
CARR DET        1      AT&C1
DSR             0      AT\D0
RING IND        1      AT\R1
SPKR CTRL       1      ATM1
SPKR VOL        2      ATL2
LNG SPC DISC    OFF    ATY0
DISC DELAY      000    AT%D0
RDLB ENABLE     OFF    AT&T5
DIAL MODE       4      ATX4
PULSE DIAL      60%    AT&P0
PULSE MODE      N      AT%W0
V23 HD EQU      ON     AT%O1
GUARD TONE      0      AT&G0
DATA CALL TONE  OFF    AT-C0
2ND FC          OFF    AT-F0
NM BIT VALUE    0      AT-E0
PAR CHK         0      AT-P0
MANUAL DIAL     0      AT:D0
UPSHIFT BPS     OFF    AT*H0
CELLULAR        OFF    AT)M0
LINETYPE        000    AT@M0
DETECT PHASE    ON     AT-J1
MNP EXT SVC     1      AT-K1
UNIV V.23       1      AT-V1
CONNECT MSG     1ST    AT@C0
DUMB MODE       OFF    AT-H0
BELL            ON     ATB1
CALL ABT DISAB  OFF    AT-Y0
REVERSE ANS     OFF    AT-W0
MIN CONN SPD    300    AT@U

OK
```

> **Note** The 00B MABP port address is a variable from 1 to 24.

\T*n* (Inactivity Timer)

Specifies the time, in minutes, that the modem waits before hanging up when data is not sent or received. The inactivity timer is available only during normal and reliable link connections. **\T0** disables the timer.

Related Commands   0 to 90 minutes

Defaults   **\T0** (disabled)

\V*n* (Error Correction Result Code Form)

Sets the result code format to display a reliable link connection. The *speed* field content is determined by the **W***n* command (Connection Speed Reporting) setting. Setting **-M1** (MNP Class Connect Messages) changes the format of the long form connection result codes. Table 61 lists command options.

Set **V0\V3** if your software requires Hayes-compatible connection result codes. When **V1** is set to select long form result codes, **\V3** is equivalent to **\V2**.

Defaults   **\V2**

Table 61   Error Correction Result Code Command Options

Command	Meaning
\V0	Displays standard long form result codes, CONNECT *speed*. Use **\V0** when your communications software does not expect a reliable link result code, even if a reliable connection is established.
\V1	Adds /REL to long form error correction result codes, CONNECT *speed* /REL. 9600/REL also indicates 4800-, 7200-, and 12000-bps reliable connections.
\V2	Displays long form error correction protocol result codes: • CONNECT *speed* /REL–MNP • CONNECT *speed*/REL–LAPM • CONNECT *speed*/REL–CELLULAR 9600/REL also indicates 4800-, 7200-, and 12000-bps reliable connections.
\V3	Adds /REL to long form error correction result codes, CONNECT *speed* /REL. Displays Hayes-compatible short form result codes. The result code displays the actual modem bps rate.

Table 61   Error Correction Result Code Command Options (continued)

Command	Meaning
\V4	Enables long form error correction result codes: • CONNECT *speed* /REL–MNP • CONNECT *speed*/REL–LAPM • CONNECT *speed*/REL–CELLULAR The result code displays the actual modem bps rate.
\V5	Enables reporting of the modulation type: • CONNECT *speed/modulation*/REL–MNP • CONNECT *speed/modulation*/REL–LAPM • CONNECT *speed/modulation*/REL–CELLULAR

Connection Result Code Tables

Analog modem network modules can display these result codes when they attempt to establish connection. The tables use the abbreviations: **rel** (reliable) and **non-rel** (non reliable).

Table 62 through Table 65 show the short and long form result codes, excluding connection result codes whose form depends on the **\V**, **W**, and **-M** commands.

- Result Codes (Table 62)
- Long Form Connect Result Codes (DTE) (Table 63)
- Short Form (Numeric) Connect Result Codes (DTE Speed) (Table 64)
- Short Form (Numeric) Connect Result Codes (Modulation) (Table 65)

Table 62   Result Codes

Short Form	Long Form
0	OK
1	CONNECT
2	RING
3	NO CARRIER
4	ERROR
6 [1]	NO DIALTONE

1. Display of these call progress monitoring result codes depends on the setting of the X command.

Table 63   Long Form Connect Result Codes (DTE)

ATV1M0W0 or ATV1M0W1
Report DTE speed

DTE Speed	nonrel \V rel	\V1 rel, \V2 rel[1] \V3 rel, \V4 rel[1], \V5 rel[2]
75	75	75 /REL
300	300	300 /REL
600	600	300 /REL
1200	1200	1200 /REL
2400	2400	2400 /REL
4800	4800	4800 /REL
9600	9600	9600 /REL
19,200	19200	19200 /REL
38,400	38400	38400 /REL
57,600	57600	57600 /REL
115,200	115200	115200 /REL
230,400	230400	230400 /REL

1. If \V2 or \V4 are set and a reliable link is established, the message is
   displayed in one of the following formats:
   CONNECT <speed>/REL - MNP or
   CONNECT <speed>/REL - LAPM or
   CONNECT <speed>/REL - CELLULAR or
   CONNECT <speed>/REL- CELLULAR EC or
   CONNECT <speed> /LAPM - CELLULAR EC

2. In nonreliable V.21 or Bell 103 connections, the message is displayed
   as CONNECT.

Table 64   Short Form (Numeric) Connect Result Codes (DTE Speed)

ATV0W0 or ATV0W1 Report DTE Speed	\V0 \V1 nonrel \V2 nonrel \V4 nonrel \V5 nonrel	\V1 rel \V2 rel \V4 rel \V5 rel	\V3
75	1	20	1
300	1	20	1
600	9	21	5
1200	5	22	5
2400	10	23	10
4800	30	31	11
9600	32	33	12
19200	36	37	14
38400	38	39	28

Table 64   Short Form (Numeric) Connect Result Codes (DTE Speed) (continued)

57600	42	43	29
115200	46	47	30
230400	48	49	51

Table 65   Short Form (Numeric) Connect Result Codes (Modulation)

ATV0W2 Report Modulation Speed	Speed	\V0 \V1 nonrel \V2 nonrel \V4 nonrel \V5 nonrel	\V1 rel \V2 rel	\V3	\V4 rel \V5 rel	Noncompression
V.21 or Bell 103	300	1	20	1	20	79
V.23 half-duplex	1200	5	–	5	–	24
V.23 split speed	75/1200	11	–	23	–	24
V.22	600	9	21	5	21	21
V.22 or Bell 212A	1200	5	22	5	22	80
V.34/V.22*bis*	2400	10	23	10	23	81
V.34/V.32	4800	30	31	11	31	82
V.34/V.32*bis*	7200	40[1]	33	24	41	83
V.34/V.32	9600	32	33	12	33	84
V.34/V.32*bis*	12000	44[1]	33	25	45	85
V.34/V.32*bis*	14400	34[1]	35	13	35	87
V.34	16800	60	61	13	61	88
V.34	19200	36	37	14	37	89
V.34	21600	62	63	13	63	90
V.34	24000	64	65	13	65	91
V.34	26400	66	67	13	67	92
V.34	28800	68	69	13	69	93
V.34	31200	70	71	13	94	94
V.34	33600	72	73	13	95	95

1.   When **\V0** is set, the following numeric codes are displayed: 14400 bps=34; 12000 bps=44; 7200 bps=40.

\W*n* (Split Serial Port Speed)

Determines whether the serial port uses split transmit and receive speed operation when **%F1** or **%F2** is set to select V.23 mode. Table 66 lists command options.

Defaults   \W0

Table 66   Split Serial Port Speed Command Options

Command	Meaning
\W0	Disables split serial port speed.
\W1	Enables split serial port speed.

\X*n* (XON/XOFF Passthrough)

Determines whether XON/XOFF flow control characters are sent to the remote or local modem. When XON/XOFF flow control is enabled on the serial port (\Q1) and XON/XOFF passthrough is enabled (\X1), the modem transmits any XON and XOFF characters that are sent to the serial port from the local device to the remote device. Table 67 lists command options.

Defaults   \X0

⚠
Caution   With **\X0** (XON/XOFF passthrough) set and XON/XOFF flow control enabled, local devices such as printers can send XON and XOFF characters to the modem serial port. If the modem is controlling the flow of data to the remote system, these local flow control characters do not interfere with the connection. However, if **\X1** is set, the local flow control characters also pass through to the remote system. These characters can turn on the flow of data from the remote system before the modem is ready to receive it, resulting in loss of data.

Table 67   XON/XOFF Passthrough Command Options

Command	Meaning
\X0	Processes XON/XOFF flow control characters.
\X1	Processes XON/XOFF flow control characters and passes them to the local or remote system.

Character Command Set

This section describes modem command that begins with the pound (**#**) character.

#E*n* (Answer Mode Escape Sequence)

Determines detection of the escape sequence (+++) when the modem is in answer mode.

Defaults   **#E1**

Table 68   Answer Mode Escape Sequence Command Options

Command	Meaning
#E0	Enables escape code sequence in answer mode.
#E1	Disables escape code sequence in answer mode.

Modem S and :T Register Summary

The modem saves configuration settings in S and :T registers similar to Hayes Smartmodem 2400 registers. Each register controls a single modem function or is bit-mapped to several functions. This section describes commands to display and change register values. Wherever possible, use the following commands only to display register contents. Use the AT command set to change register values.

Read All Registers

The **%R**n command displays the contents of a register set as a table in decimal and hexadecimal format:

- **%R0** displays the contents of all S registers.
- **%R1** displays the contents of all :T registers.

Point to a New Reference Register

The **S**n and **:T**n commands set the modem register pointer to register n. Register n then becomes the reference register for the following register commands:

- **ATS**n sets the modem register pointer to S register n.
- **AT:T**n sets the modem register pointer to :T register n.

Read a Configuration Register

The **S**n**?** and **:T**n**?** commands display the contents of register n, in decimal format only. Register n becomes the reference register.

- **ATS**n**?** displays the contents of S register n.
- **AT:T**n**?** displays the contents of :T register n.

Change the Value of a Register

The **S**n**=**x and **:T**n**=**x commands change the value of register n to x. Register n becomes the reference register.

- **ATS**n**=**x changes the value of S register n to x.
- **AT:T**n**=**x changes the value of :T register n to x.

Display the Value of the Reference Register

The **AT?** command displays the value of the last S register referenced in a read, write, or pointer command.

Change the Value of the Reference Register

The **AT=**x command changes the value of the last S register referenced to x.

S Register Descriptions

This section describes the purpose and format of each S register.

S0 (Ring to Autoanswer)

Register S0 specifies the number of rings before the modem answers. Set register S0 to 0 to disable autoanswer. Ring signals are ignored for 5 sec after disconnect.

Related Commands   0 to 255 rings

Defaults   1 ring

S1 (Ring Counter)

Counts the rings before the modem answers a call. If there is no ring within 8 sec of the last ring, S1 is reset to 0. Ring signals are ignored for 5 sec after disconnect.

S2 (Escape Code Character)

Specifies the character used for the three-character escape code sequence. When the modem is in connect state and receives the escape code sequence, it enters command state. Setting register S2 to 0 disables the escape code character. Register S12 sets the guard time that must be present before and after the escape code character.

Related Commands   0 to 255 (ASCII decimal)

Defaults   43 (+)

S3 (Carriage Return Character)

Specifies the carriage return (CR) character. The carriage return terminates command lines and result codes.

Related Commands   0 to 127 (ASCII decimal)

Defaults   13 (Carriage Return)

S4 (Line Feed Character)

Specifies the line feed (LF) character. The line feed character follows a carriage return at the end of command lines and result codes.

Related Commands   0 to 127 (ASCII decimal)

Defaults   10 (line feed)

S5 (Backspace Character)

Specifies the backspace (BS) character.

Related Commands   0 to 32 (ASCII decimal)

Defaults   8 (Backspace)

S6 (Wait Before Dialing)

Specifies the time the modem waits after transitioning off-hook before dialing. This is a minimum of 2 sec, even if register S6 is set to a value less than 2. Register S6 is used only when the **X0**, **X1**, or **X3** command (Extended Result Code) is set.

Related Commands   3 to 255 sec (Japan)
2 to 255 sec (elsewhere9crd

Defaults   3 sec (Japan)
2 sec (elsewhere)

S7 (Wait for Carrier After Dial)

Specifies the time that the modem waits for one of the following:

- Carrier from the remote modem before hanging up in originate or answer mode

- Ringback, only in originate mode, and only if **X3** or **X4** (Extended Result Codes) is set

- Dial tone when the Wait for Dial Tone (**W**) dial modifier is encountered in a dial string

- Quiet answer when the Wait for Quiet Answer (**@**) dial modifier is included in a dial string

| **Related Commands** | 5 to 50 sec (Japan) |
| | 0 to 255 sec (elsewhere) |

| **Defaults** | 50 sec (Japan) |
| | 60 sec (elsewhere) |

S8 (Pause Time for Dial Delay)

Specifies the time the modem waits when the pause dial modifier (**,**) is used in a dial string.

| **Related Commands** | 0 to 255 sec |

| **Defaults** | 0 |

S9 (Carrier Detect Response Time)

Specifies the time, in 0.1-sec increments, that a signal must be present before the modem recognizes it as carrier. Register S9 is used only in normal and direct modes.

| **Related Commands** | 0 to 255 |

| **Defaults** | 6 (0.6 sec) |

S10 (Delay for Hangup After Carrier Loss)

Specifies the time, in 0.1-sec increments, that the modem waits before hanging up after loss of carrier, allowing for a temporary loss. Both modems should have equal values set. If the S10 values of the two modems are unequal, disconnection occurs when the lower value is reached. When register S10 is set to 255, the modem functions as if carrier is always present. After disconnecting, the modem waits a minimum of 5 sec before going off-hook in originate mode.

Note Register S10 is ignored in V.34, V.32, V.32*bis*, V.22, and V.22*bis* reliable connections.

| **Related Commands** | 0 to 255 |

| **Defaults** | 60 (6 sec) |

S11 (DTMF Tone-Dialing Speed)

Specifies the time interval in milliseconds between tones when the modem is dialing over a tone line.

Related Commands   70 to 100 ms (Japan)
50 to 100 ms (elsewhere)

Defaults   70 ms (Japan)
50 ms (elsewhere)

S12 (Escape Code Guard Time and Remote Access Attention Sequence Guard Time)

Sets the minimum quiet time before and after the three-character escape code, in 0.02-sec increments. The interval between characters in the escape code or remote access attention sequence must be less than this guard time. If S12 is 0, the time to enter the escape code or attention sequence does not affect recognition.

In normal mode, register S12 sets the guard time that precedes and follows the attention character sequence. It should be set to the same value on both the originating and answering modems. Reliable mode uses its own timing and ignores register S12.

Related Commands   0 to 255

Defaults   50 (1 sec)

S14 (Bit-Mapped Register)

Register S14 is bit-mapped for the functions listed in Table 69.

✎
Note   Pulse dialing (bit 5) is not supported in Japan.

Table 69   Register S14 Functions

Bit	Meaning	Value
0	Not used	–
1	Command echo	0 No echo 1 Echo
2	Result codes	0 Result codes 1 No result codes

Table 69   Register S14 Functions (continued)

Bit	Meaning	Value
3	Result type	0 Short form 1 Long form
4	Dumb mode	0 Smart mode 1 Dumb mode
5	Dial method	0 Tone dial 1 Pulse dial
6	Not used	–
7	Originate/answer	0 Answer mode 1 Originate mode

S16 (Bit-Mapped Register for Test Options)

Register S16 is a read-only register that displays loopback test option status and is available only when the modem is in normal or direct mode. The modem does not support diagnostic tests in Bell 103, V.13, V.21, or V.23 modes. The register is bit-mapped for the functions listed in Table 70.

Table 70   Register S16 Functions

Bit	Meaning	Value
0	Local analog loopback	0 Disabled 1 Enabled
1	Not used	–
2	Local digital loopback	0 Disabled 1 Enabled
3	Remote digital loopback status (initiated by the remote modem)	0 Loopback off 1 Loopback in progress
4	Initiate remote digital loopback	0 Disabled 1 Enabled
5	Initiate remote digital loopback with self-test	0 Disabled 1 Enabled
6	Initiate local analog loopback with self-test	0 Disabled 1 Enabled
7	Not used	–

S18 (Test Timer)

Specifies the maximum elapsed time for a modem loopback diagnostic test. Register S18 is available only when the modem is in normal or direct mode. If the register is set to 0, enter the **&T0** command) to end a test. Register S18 is not supported for V.54 loopback tests by switch or circuit.

Related Commands   0 to 255 sec

Defaults   0 (disables the timer)

S21 (Bit-Mapped Register)

Register S21 is bit-mapped for the functions listed in Table 71.

Table 71   Register S21 Functions

Bit	Meaning	Decimal Value
0	Telco jack	0 Default.
		1 Not supported.
1	Not used	–
2	Clear To Send/ Request To Send	0 On-hook: CTS on. Off-hook: V.22 and V.22*bis* CTS off until connecting. After connecting: CTS is off in response to an on-to-off RTS transition; CTS is on in response to an off-to-on RTS transition after the delay time set in register S26.
		1 On-hook: CTS on. Off-hook: CTS off until connecting. After connecting: CTS on for duration of carrier signal.
3, 4	Data Terminal Ready	0 Ignores DTR.
		1 On-to-off DTR transition: modem enters command state.
		2 On-to-off DTR transition: modem is set on-hook.
		3 On-to-off DTR transition: modem reset.
5	Data Carrier Detect	0 DCD always on.
		1 DCD on indicates data carrier is present except momentarily at disconnect.
6	Not used	–
7	Long space disconnect	0 Disabled.
		1 Enabled.

S22 (Bit-Mapped Register)

Register S22 is bit-mapped for the functions listed in Table 72.

Table 72   Register S22 Functions

Bit	Meaning	Decimal Value
0, 1, 2, 3	Not used	–
4, 5, 6	Result code options	0 Same as **X0**
		4 Same as **X1**
		5 Same as **X2**
		6 Same as **X3**
		7 Same as **X4**
7	Make/break ratio	0 Make 39 percent, break 61 percent
		1 Make 33 percent, break 67 percent

S23 (Bit-Mapped Register)

Register S23 is bit-mapped for the functions listed in Table 73.

Table 73   Register S23 Functions

Bit	Meaning	Decimal Value
0	Respond to remote digital loopback (ignored in reliable connections)	0 Disabled
		1 Enabled
1, 2, 3	Serial port bps rate	0 0 to 300 bps
		1 600 bps
		2 1200 bps
		3 2400 bps
		4 4800 bps
		5 9600 bps
		6 19200 bps
		7 38400, 57600, or 115200 bps
4, 5	Parity	0 Even
		1 Space/none
		2 Odd
		3 Mark
6, 7	Guard tone	0 Disabled
		1 550 Hz
		2 1800 Hz
		3 Not used

S25 (Delay to DTR and Asynchronous/Synchronous Time Delay)

The modem ignores an on-to-off transition of DTR that is less than the register S25 time delay, measured in 0.01-sec increments for Delay to DTR, 1-sec increments for asynchronous mode.

Related Commands   0 to 255

Defaults   5 (0.05 sec for Delay to DTR, 5 sec for asynchronous mode)

S27 (Bit-Mapped Register)

Register S27 is bit-mapped for the functions listed in Table 74.

Table 74   Register S27 Functions

Bit	Meaning	Decimal Value
0, 1	Not supported	–
2, 3, 4, 5	Not used	–
6	Answer tone at 1200 bps	0 CCITT V.22*bis*/V.22
		1 Bell 212A
7	Not used	–

:T Register Descriptions

This section describes the purpose and format of each supported :T register.

:T0 (Timer for V.22*bis*, V.22, and V.32 Modes During Multi-Protocol Answer)

Register :T0 sets the time limit, in 0.1-sec increments, for the modem to establish a V.32, V.22*bis*, or V.22 connection before switching to establish a V.23 split speed or V.21 connection. In this time period, the modem sends V.22*bis* or V.22 carrier. This register setting requires 1200-bps or higher operation together with **%F0%L1**.

Related Commands   0 to 255

Defaults   40 (4 sec)

:T3 (Timer for V.21 and V.23 Answer Tone Duration)

Register :T3 is used in V.21 mode (**%F0** is set and the modem speed is 300 bps) or V.23 mode (**%F1, %F2,** or **%F3**).

In answer mode, register :T3 sets the time limit for the V.25 answer tone sent by the answering modem to the originating modem, in 0.1-sec increments. When :T3 is 0, no answer tone is sent. All V.21 and V.23 answers begin with 2 sec of silence before sending an answer tone, unless :T3 is 0.

In originate mode, register :T3 sets the time the originating modem waits after detecting an answer tone before proceeding with the connection. When :T3 is 0, the originating modem does not wait for an answer tone.

Related Commands   0 to 33

Defaults   33 (3.3 sec)

:T4 (Timer for Line Turnaround Delay and Carrier On)

Register :T4 specifies the minimum time, in 12.5-ms increments, that the modem waits for the remote modem to respond after turning carrier off before turning carrier back on again to resume sending data. Register :T4 is used only in normal mode V.23 half-duplex connections.

Related Commands   0 to 255

Defaults   20 (250 ms)

:T6 (Timer for DCD Turn On Delay)

Register :T6 specifies the time that the modem waits after it raises carrier before it starts looking for data. This register can be set to ignore noise that occurs when DCD is raised in V.23 half-duplex connections. If :T6 is set to 0, the modem waits 256 ms before looking for data. Register :T6 is used only in normal mode V.23 half-duplex connections.

Related Commands   0 to 255 ms

Defaults   200 ms

:T9 (Primary XON Flow Control Character)

Register :T9 specifies the character used for primary XON flow control on the modem and serial ports. Both modems must use the same primary flow control characters during normal connections. Use the **\Q1** or **\Q4** command (Serial Port Flow Control), and **\G1** or **\G2** command (Modem Port Flow Control) to specify primary flow control.

Related Commands   0 to 255 (decimal value of 8-bit ASCII character)

Defaults   17 (DC1 or 11 hexadecimal)

:T10 (Primary XOFF Flow Control Character)

Register :T10 specifies the character used for primary XOFF flow control on the modem and serial ports. Both modems must use the same primary flow control characters during normal connections. Use the **\Q1** or **\Q4** command (Serial Port Flow Control) options, and **\G1** or **\G2** command (Modem Port Flow Control) options to specify primary flow control.

Related Commands   0 to 255 (decimal value of an 8-bit ASCII character)

Defaults   19 (DC3 or 13 hexadecimal)

:T11 (Secondary XON Flow Control Character)

Register :T11 specifies the character used for secondary XON flow control on the modem's serial port. Use the **-F1\Q1** or **-F1\Q4** commands to specify secondary flow control.

Related Commands   0 to 255 (decimal value of an 8-bit ASCII character)

Defaults   249 (F9 hexadecimal)

:T12 (Secondary XOFF Flow Control Character)

Register :T12 specifies the character used for secondary XOFF flow control on the modem serial port. Use the **-F1\Q1** or **-F1\Q4** commands to specify secondary flow control.

Related Commands   0 to 255 (decimal value of an 8-bit ASCII character)

Defaults   251 (FB hexadecimal)

:T14 (Connect Message Delay Timer)

Register :T14 specifies the time, in 100-ms increments, that the modem waits before or after a connect message before CTS, DSR, or DCD is raised. Use this register setting with the **@C0** or **@C1** command (CTS, DSR, and DCD Message Control options).

Related Commands   0 to 255

Defaults   0

:T16 (CTS Turn On Delay Timer)

Register :T16 specifies the time, in 12.5-ms increments, that the modem waits before raising CTS after DCD or DSR has been raised in connect mode.

Related Commands   0 to 255

Defaults   0

:T17 (V.32/V.32*bis* Connection Training Timer)

Register :T17 specifies the time limit for exchanging training sequences when establishing V.32 and V.32*bis* connections.

To reduce the time required to establish a connection (but increase modem sensitivity to noise on the line), set :T17 to a value less than 28.

To reduce modem sensitivity to noise (but lengthen the time required to make a connection), set :T17 to a value greater than 28.

Related Commands   0, 1, or 5 to 32 sec

Defaults   0 (use dynamic training sequences, equivalent to a setting of 28)

:T19 (Bit-Mapped Register)

Register :T19 specifies the MNP link control. The register is bit-mapped for the functions listed in Table 75.

Table 75   Register :T19 Functions

Bit	Meaning
0	0 Keeps a non-MNP10 1200-bps connection if no MNP link activity is received from the remote modem
	1 Disconnects a non-MNP10 1200-bps connection if no MNP link activity is received from the remote modem after 2 minutes

:T22 (DSR Timer)

Register :T22 specifies the time, in 12.5-ms increments, that the modem waits before DSR transitions off after DCD or CTS transitions off in disconnect mode. For example, if **\D2** (Serial Port DSR/CTS Control) and **&C1** (Serial Port DCD Control) are set when DCD and CTS transition off, the modem waits for the time specified by register :T22 before setting DSR off.

Related Commands   0 to 255

Defaults   34 (425 ms)

:T23 (Bit-Mapped Register)

Register :T23 is bit-mapped for the functions listed in Table 76.

Table 76   Register :T23 Functions

Bit	Meaning	Value
0, 1, 2, 3	Not used	–
4	Rate negotiation at startup	1 At the start of a V.32 connection, modem examines line quality and sets speed accordingly 2 Disabled
5, 6, 7	Not used	–

:T26 (Bit-Mapped Register)

Register :T26 is bit-mapped for the functions listed in Table 77. The default should not be changed except when configuring country codes. (See Step 3 on page 30.)

Defaults   0

Table 77   Register :T26 Functions

Bit	Meaning
0	0 Enables 2-sec billing delay. 1 Disables 2-sec billing delay. This setting decreases connection time but can affect establishing connections.
1	0 Enables normal answer tone length in V.32 mode. 1 Shortens answer tone length in V.32 mode.
3	0 Disables Quick Ring detection. 1 Enables Quick Ring detection.

:T57 (Leased-Line Timer)

Register :T57 specifies the number of seconds before the modem goes off-hook in leased-line mode when **&L2** is set.

Related Commands   0 to 255

Defaults   6

:T79 (Autoretrain Attempts)

If **%E1** is set, register :T79 specifies the number of autoretrain attempts before the modem disconnects.

Related Commands   0 to 3

Defaults   3

:T89 (PoS Configuration)

Register :T89 is a bit-mapped register that controls PoS configuration options. For more information, see the "PoS Support" section on page 76.

Defaults   0010 (0x2)

Table 78   Register :T89 Functions

Bit	Description	Meaning
0	ITU or Bell mode[1]	0 ITU 1 Bell
1	300/1200 normal	0 Attempt EC 1 Normal mode, no EC
2	S-Reg 9 DCD recognition delay	0 Use S9 1 Ignore S9
3	Initial 1650-Hz Tx tone	0 2100 Hz answerback 1 1650 Hz

1.   See the "Bn (ITU/Bell Mode)" section on page 3.

Notes:

- Use ITU V.21/V.22.

- Forced normal mode at 300/1200.

- Use **S9** register delay before recognizing carrier.

- Use 2100-Hz answerback tones.

- Bit 1 of :T89 now defaults to 1 (:T89=2). This forces a normal mode connection at 300 bps. If this bit is off, an MNP connection is attempted.

- If this bit is on (answer modem), and the originate modem is set to **\N2**, no connection results.

- To support Bell 103 PoS terminals, set :T89 to 7.

- To support V.21 PoS terminals, set :T89 to 6.

- If V.23 is supported and PoS/QUICK 300 is not, normal mode is forced for a V.23 connection. :T89 has no effect in this case.

:T120 (Answerback Tone Duration)

Register :T120 is a bit-mapped register than controls 1650-Hz answerback tone duration in 100-ms increments. For more information, see the .

Defaults   11001 (0x19, 25 decimal) (2500 ms)

:T121 (Answerback Tone Configuration for PoS)

Register :T121 is a bit-mapped register that controls answerback tone configuration for PoS in 100-ms increments. For more information, see the .

Defaults   11011 (0x1B, 27 decimal) (2700 ms)

Debugging

The **@E** command (detailed modem call status) is an unofficially supported modem status and debugging command that can be used by an experienced user to verify the detailed status of the modem during or after a call. The content of this command might change as required to assist in problem resolution. Therefore, the command might produce results that differ from the description in this section.

The **@E0** command results in a single-screen display (press any key for the next screen). The **@E1** command results in continuous screen display. Press **Ctrl-X** or **Break** to cancel the display.

This is an example of an **@E** report:

at@e1

```
MNP Class 10 V.34 Modem
MODEM HW: OEM 2W United States
Firmware Rev x.x.x/85
Bootstrap Rev y.y.y
DSP C36 Part/Rev            3035 4241
DSP C58 Part/Rev            3035 2041
NET ADDR:      FFFFFFFFFFFF
Connect Time HH:MM:SS       000:02:01
4 RTS 5 CTS 6 DSR - CD 20 DTR - RI
Disconnect  Remote -  Local - 14,10,9


CONNECTION STATUS
Mod Type                    IDLE
TX/RX Spd                   600 600 BPS
TX/RX Spd Mask               NA  0000 Hex
TX/RX Symbol Rate           2400  2400 Hz
TX/RX Carrier Frequency     1800  1800 Hz
TX/RX Trellis Code States    16    16
TX/RX Nonlinear Encoding    OFF   OFF
TX/RX Precoding             OFF   OFF
TX/RX Shaping               OFF   OFF
TX Preemphasis Index         0
TX Lvl Reduction             0 dB
Secondary Channel           OFF


LINE IMPAIRMENTS
TX Lvl REG                  - 10 dBm
TX Lvl RAM                  -  0 dB
TX Lvl Reduction             0 dB
TX Lvl                      - 10 dBm
RX Lvl                      - 16 dBm
Signal/Noise Ratio           0
Signal/Distortion Ratio      0
Eye Quality                 0000 Hex
Lower Band Edge              0 Hz
Upper Band Edge              0 Hz
Phase Jitter Freq            0 Hz
Phase Jitter Amp             0.0 deg
Far Echo Offset (Phase Roll)  0.0 Hz
Far Echo Lvl = 20log(N)-81   0 N
Round Trip Delay             0 msec
Dropouts > 5dB               0
RTRNs Initiated              0
RTRNs Accepted               0
Rate Changes Initiated       0
Rate Changes Accepted        0
FF Trip/Block Error Rate    0000 Hex
```

```
EQM FUNCTION STATUS
AVG EQM Filter Pole          8A25 Hex
EQM Gain                     8A4E Hex
EQM Offset                   8A77 Hex
AVG EQM Filter Pole          8AA0 Hex
AVG EQM Baud Interval        8AC9 Hex
AVG EQM Sample Size          8AF2 Hex
AVG EQM                      8B1B Hex
EQM Threshold Lvl            8B44 Hex

OK
```

Table 79 describes components of the report. The table does not include self-explanatory fields.

Table 79   AT@E Report Description

Field	Description
Firmware Rev	Current firmware version.
Bootstrap Rev	Current boot version.
DSP C36 Part/Rev	Current DSP version.
DSP Controller Rev	Current DSP hardware.
DSP Data Pump Rev	Current DSP controller pump.
Mod Type	Modulation type—the modulation standard being implemented on the current connection. If no connection is established, it reads IDLE.
TX/RX Spd	TX/RX speed—transmitter and receiver modulation speeds for the current connection. The TX/RX speeds may be different for operating modes that support split-speed operation, such as V.34. Given in bps.
TX/RX Spd Mask	TX/RX speed mask—a hex number that shows which speeds the Rockwell DSP is configured to support on a given connection. For V.34, the LSB represents 2400 bps (1=on, 0=off); the next significant bit represents 4800 and so on up to 33.6 kbps.
Symbol Rate	TX/RX symbol rate—a hex number that shows which symbol rate (analog signal event rate) the Rockwell DSP is currently using. For most modes, this is a fixed number, but V.34 negotiates any of six different rates from 2400 to 3429 symbols/sec.
TX/RX Carrier Freq	TX/RX carrier frequency—a single-frequency sine wave that is modulated to transmit binary information in accordance with the selected operating modes. This also is usually a fixed number, except for V.34, where nine different values can be chosen. In the V.34 case, a low and a high carrier are available for each of the symbol rates. The appropriate symbol rate and its associated carrier are selected by the modem during the startup sequence. Given in hertz.
TX/RX States TX/RX Trellis Code States	TX/RX Trellis states—Trellis Encoding is a method for improving noise immunity using a convolutional coder to select a sequence of subsets in a partitioned signal constellation. The trellis encoders used in the V.34 Recommendation are used in a feedback structure where the inputs to the trellis encoder are derived from the signal points. For V.34, this parameter tells whether 16, 32, or 64 state encoding is being used.

Table 79   AT@E Report Description (continued)

Field	Description
TX/RX Nonlinear Encoding TX/RX NLE	TX/RX nonlinear encoding—a method for improving distortion immunity near the perimeter of a signal constellation by introducing a nonuniform two-dimensional (2D) signal point spacing.
TX/RX Precoding	TX/RX precoding—a nonlinear equalization method for reducing equalizer noise enhancement caused by amplitude distortion. Equalization is performed at the transmitter using precoding coefficients provided by the remote modem.
TX/RX Shaping	TX/RX shaping—a method by which the noise margin of a modem signal can be maximized by forming signal constellations in high-dimensional spaces, thereby reducing the average signal power. V.34 modems use a shell mapping mechanism to achieve a near-spherical signal constellation, yielding a shaping gain of around 1 dB.
TX Preemphasis Index	TX pre-emphasis index—reads the remote modem's PRE-emphasis Request byte value. Pre-emphasis is a linear equalization method where the transmit signal spectrum is shaped to compensate for amplitude distortion. The pre-emphasis filter is selected using a filter index provided by the remote modem; the filters conform to the 11 types outlined in the ITU specifications for the given operating mode.
Secondary Channel	Secondary channel—on or off. The auxiliary channel is a reduced bandwidth data channel which, along with the primary channel, is multiplexed into the bit stream transmitted by the modem. Data conveyed in the auxiliary channel is independent from the primary channel and may consist of secondary channel data and modem control data. The secondary channel is a portion of the auxiliary channel that is made available to the user.
TX Lvl REG	Transmit level register—the transmit level the modem is configured for. Given in dBm (decibels referenced to 1 milliwatt through 600 ohms).
TX Lvl RAM	Transmit level RAM—the transmit level gain the modem is configured for. The gain may be positive or negative and is used to adjust the transmit level separately from the transmit level configuration. Given in dBm.
Tx Lvl Reduction TX Lvl Reduct	Transmit level reduction—the reduction in transmit level (power drop), if any, that has been negotiated by the modems during handshake. Given in dBm. Valid in V.34 mode only.
TX Lvl	Transmit level—the transmit level the modem actually uses; consists of the configured level plus the tx level gain minus the negotiated power drop. Given in dBm.

Table 79   AT@E Report Description (continued)

Field	Description
RX Lvl	Receive level—the signal level the modem receiver is detecting. Given in dBm. The following table gives a range of common values for V.34: –15 to –25 dBm (excellent/optimum) –26 to –30 dBm (good) –31 to –35 dBm (fair) –36 to –42 dBm (poor) –43 to –48 dBm (connect/no connect threshold)
Signal/Noise Ratio S/NR	Signal/noise ratio—the ratio or margin between the received signal level and the noise level detected by the receiver, in dBm. The following table gives a range of common values versus connect speed (V.34): S/NR Typical V.34 connect speed* >=46 dBm 33600 45 dBm 31200 44 dBm 28800 42 dBm 26400 39 dBm 24000 35 dBm 21600 32 dBm 19200 31 dBm 16800 29 dBm 14400 27 dBm 12000 24 dBm 9600 22 dBm 7200 19 dBm 4800 16 dBm 2400 *These are empirical values measured in the absence of other impairments. Actual values may vary. Ideal conditions use ISDN-PRI.
Signal/distortion ration S/DR	Signal/distortion ratio—the ratio or margin between the received signal level and the harmonic distortion level detected by the receiver.
Eye Quality EQM	Eye quality measurement—the quality of the analog signal. A low number indicates good quality with 0 being the best possible; a high value is considered poor. The modem uses EQM in its rate decision mechanism. Given as a hex number. The following table gives a range of common values (V.34): < 1000 (good) to 2000 (fair) to 3000 (poor)

Table 79   AT@E Report Description (continued)

Field	Description
AVG EQM	Average eye quality—the output of the EQM averaging mechanism. Initial value is 0000 hex.
Lower/Upper Edge	Lower band edge/upper band edge—the channel low and high bandwidth edge estimates (in hertz) generated by the V.34 handshake probing.
Phase Jitter Freq	Phase jitter frequency—Phase jitter is a deviation in the phase of an analog signal having frequency in hertz and magnitude in degrees. It results in a pure tone having an associated FM spectrum. In some cases, this spectrum is random and in others it takes the form of discrete multiples and submultiples of AC power frequencies. It can be caused by coupling through from power line associated equipment such as ringing generators.
Phase Jitter Amp	Phase jitter amplitude—Phase jitter is a deviation in the phase of an analog signal having frequency in hertz and a magnitude in degrees. It results in a pure tone having an associated FM spectrum. In some cases, this spectrum is random and in others it takes the form of discrete multiples and submultiples of AC power frequencies. It can be caused by coupling through from power line associated equipment such as ringing generators.
Far Echo Offset (Phase Roll)	Far echo offset—how much far end echo frequency offset is present. Given in hertz.
Far Echo Lvl	Far echo level—the power level of the far echo. The value in dBm can be obtained from level = 20 log N - 81.
Round Trip Delay	Round trip delay the time delay that a signal encounters on a connection. For instance, If a call is routed over a satellite hop, the delay in one direction is approximately 500 ms; round trip delay is approximately 1000 ms. The initial value is 0 ms.
Dropouts >5dB	Dropouts >5dB—how many signal dropouts greater than 5 dBm have occurred during the current connection. The initial value is 0.
RTRNs Init/Accept	Retrains initiated—how many retrains have been initiated by the local modem during the current connection. A retrain is a repetition of most of the modem startup or handshake sequence after the modems have been connected. It usually occurs in response to disruptions of the communications channel or user intervention. Retrains accepted—how many retrains have been accepted by the local modem during the current connection.
Rate Changes Inititated/Accepted RRENs Init/Accept	Rate renegotiations initiated—how many rate renegotiations have been initiated by the local modem during the current connection. A rate renegotiation is a brief exchange of rate and signal quality information between modems and is used to upshift or downshift the modulation rate after the modems have been connected (much shorter than a full retrain). It usually occurs in response to changes in signal quality or user intervention. Rate renegotiations accepted how many rate renegotiations have been accepted by the local modem during the current connection.

Table 79   *AT@E Report Description (continued)*

Field	Description
FF Trip/Block Error Rate BLER	Block errors—how many block errors occur over a reliable connection (that is, a connection that has a successfully negotiated error correction protocol).
RBS Counter	Robbed bit signaling counter—the number of bits robbed by the channelized T1 links in the transmission path.
Digital Pad Detected	Digital pad detected—expected values are 0, 3, or 6 dB.
Avg EQM Filter Pole	Average EQM filter pole—the bandwidth of the EQM low pass filter. The default is 0000 Hex.
EQM Gain	EQM gain—adjusts the rate decision mechanism. A higher number results in a more reliable connection; a lower number results in a less reliable connection. The default is 1000 Hex.
EQM Offset	EQM offset—adjusts the rate decision mechanism. A positive number results in a more reliable connection; a negative (twos complement) number results in a less reliable connection. The default is 0000 Hex.
AVG EQM Baud Interval	Average EQM baud interval—number of symbol intervals or periods between EQM samples. These samples are used to compute a time average of the EQM value. If it is 0, the EQM averaging function is shut off. The default is 0000 Hex.
AVG EQM Sample Size	Average EQM sample size—the number of EQM samples to be run through the EQM LPF. Th default is 0000 Hex.
EQM Threshold Level	EQM threshold level—trigger threshold for the Rockwell EQMAT. When the EQM value exceeds this threshold, EQMAT bit is set. The modem uses this for performance decisions. The default is 3000 Hex.

PoS Support

Analog modems incorporate a series of adaptations for PoS quick connects in Europe that are defined best under two sets of modifications. The objective is to enable an immediate V.21 without answer tone for 300 bps PoS, and then train up to V.22 with answer tone for 1200 bps PoS. By default, the configuration is locked to 8 bit data, no parity, 1 start, 1 stop bit, and normal mode connections.

Registers :T89, :T120, and :T121 have been allocated to enable 300/1200 quick connections, error correction, pause for DCD to be true, and tone duration timers.

An incoming call is answered and the answer modem sends out 1650 Hz immediately. The PoS device can send back 980 Hz if configured to do so. Note bit 3 of :T89 in the "T89 (PoS Configuration)" section on page 68.

The answer modem detects the data carrier—in this case within 5 ms—at which time the PoS device initiates the transaction request. If the calling device is not a quick connect V.21 device, then the 1650 Hz timer expires (duration of 1650 Hz declared in :T120) and the answer modem then trains up for 1200 bps and sends out 2100 Hz answerback tones (duration of answerback tones declared in :T121). The standard answerback period of 3 sec (+/- 20 percent) is modifiable by :T121.

PoS Field Applications

The PoS feature is deployed with two main types of PoS devices. One device is a low-speed, instant connect V.21 terminal, which dictates that the modems train up, not down, as would typically be the case with central site modems.

The actual initialization string for a European client might be exactly as described in the following example. Note that the string includes the country code specific profile.

⚠ **Caution**   You cannot apply a country code **-IxZ** command in the PoS modemcap. The PoS features are either ignored or removed with the associated country reset. The specialized PoS train up and quick-connect features are ITU (V.21/V.22) specific. This dictates that you remove any country code modemcap and apply any country-specific requirements as part of your PoS modemcap.

Example of Modemcap Creation, Assignment, and Audit

Enter router configuration mode and create a global modemcap as follows:

```
Router# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config) #modemcap edit your_config factory &f&d0%d2@c0b0%m0\n0
Router(config) #modemcap edit your_config misc
%u0%g1%b1200%u1:t89=14:t121=015:t51=14
Router(config) #line 11
Router(config-line) #mod auto type your_config
Router(config-line) #exit
Router(config) #exit
```

✎ **Note**   For 300/1200 Bell devices, :T89 and associated registers have no effect.

Use the debug command **debug confmodem** to audit the modem profile:

```
Router# deb confmodem
Modem Configuration Database debugging is on
```

```
Router #cle li 11
[confirm]
[OK]
Router# Dec 11 15:58:20 PST: TTY11: Line reset by "Exec"
Dec 11 15:58:20 PST: TTY11: Modem: IDLE->HANGUP
Dec 11 15:58:20 PST: TTY11: dropping DTR, hanging up
Dec 11 15:58:20 PST: tty11: Modem: HANGUP->IDLE
Dec 11 15:58:25 PST: TTY11: restoring DTR
Dec 11 15:58:26 PST: TTY11: autoconfigure probe started
Dec 11 15:58:26 PST: TTY11: Modem command:
--AT&f&d0%d2@c0b0%m0\n0%u0%g1%b1200%u1:t89=14:t121=015:t51=14--
```

Obtaining Documentation

Cisco provides several ways to obtain documentation, technical assistance, and other technical resources. These sections explain how to obtain technical information from Cisco Systems.

Cisco.com

You can access the most current Cisco documentation on the World Wide Web at this URL:

http://www.cisco.com/univercd/home/home.htm

You can access the Cisco website at this URL:

http://www.cisco.com

International Cisco web sites can be accessed from this URL:

http://www.cisco.com/public/countries_languages.shtml

Documentation CD-ROM

Cisco documentation and additional literature are available in a Cisco Documentation CD-ROM package, which may have shipped with your product. The Documentation CD-ROM is updated monthly and may be more current than printed documentation. The CD-ROM package is available as a single unit or through an annual subscription.

Registered Cisco.com users can order the Documentation CD-ROM (product number DOC-CONDOCCD=) through the online Subscription Store:

http://www.cisco.com/go/subscription

Ordering Documentation

You can find instructions for ordering documentation at this URL:

http://www.cisco.com/univercd/cc/td/doc/es_inpck/pdi.htm

You can order Cisco documentation in these ways:

- Registered Cisco.com users (Cisco direct customers) can order Cisco product documentation from the Networking Products MarketPlace:

  http://www.cisco.com/en/US/partner/ordering/index.shtml

- Registered Cisco.com users can order the Documentation CD-ROM (Customer Order Number DOC-CONDOCCD=) through the online Subscription Store:

  http://www.cisco.com/go/subscription

- Nonregistered Cisco.com users can order documentation through a local account representative by calling Cisco Systems Corporate Headquarters (California, U.S.A.) at 408 526-7208 or, elsewhere in North America, by calling 800 553-NETS (6387).

Documentation Feedback

You can submit comments electronically on Cisco.com. On the Cisco Documentation home page, click **Feedback** at the top of the page.

You can e-mail your comments to bug-doc@cisco.com.

You can submit your comments by mail by using the response card behind the front cover of your document or by writing to the following address:

Cisco Systems
Attn: Customer Document Ordering
170 West Tasman Drive
San Jose, CA 95134-9883

We appreciate your comments.

Obtaining Technical Assistance

Cisco provides Cisco.com, which includes the Cisco Technical Assistance Center (TAC) Website, as a starting point for all technical assistance. Customers and partners can obtain online documentation, troubleshooting tips, and sample configurations from the Cisco TAC website. Cisco.com registered users have complete access to the technical support resources on the Cisco TAC website, including TAC tools and utilities.

Cisco.com

Cisco.com offers a suite of interactive, networked services that let you access Cisco information, networking solutions, services, programs, and resources at any time, from anywhere in the world.

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- Streamline business processes and improve productivity
- Resolve technical issues with online support
- Download and test software packages
- Order Cisco learning materials and merchandise
- Register for online skill assessment, training, and certification programs

To obtain customized information and service, you can self-register on Cisco.com at this URL:

http://www.cisco.com

Technical Assistance Center

The Cisco TAC is available to all customers who need technical assistance with a Cisco product, technology, or solution. Two levels of support are available: the Cisco TAC website and the Cisco TAC Escalation Center. The avenue of support that you choose depends on the priority of the problem and the conditions stated in service contracts, when applicable.

We categorize Cisco TAC inquiries according to urgency:

- Priority level 4 (P4)—You need information or assistance concerning Cisco product capabilities, product installation, or basic product configuration.
- Priority level 3 (P3)—Your network performance is degraded. Network functionality is noticeably impaired, but most business operations continue.
- Priority level 2 (P2)—Your production network is severely degraded, affecting significant aspects of business operations. No workaround is available.
- Priority level 1 (P1)—Your production network is down, and a critical impact to business operations will occur if service is not restored quickly. No workaround is available.

Cisco TAC Website

You can use the Cisco TAC website to resolve P3 and P4 issues yourself, saving both cost and time. The site provides around-the-clock access to online tools, knowledge bases, and software. To access the Cisco TAC website, go to this URL:

http://www.cisco.com/tac

All customers, partners, and resellers who have a valid Cisco service contract have complete access to the technical support resources on the Cisco TAC website. Some services on the Cisco TAC website require a Cisco.com login ID and password. If you have a valid service contract but do not have a login ID or password, go to this URL to register:

http://tools.cisco.com/RPF/register/register.do

If you are a Cisco.com registered user, and you cannot resolve your technical issues by using the Cisco TAC website, you can open a case online at this URL:

http://www.cisco.com/en/US/support/index.html

If you have Internet access, we recommend that you open P3 and P4 cases through the Cisco TAC website so that you can describe the situation in your own words and attach any necessary files.

Cisco TAC Escalation Center

The Cisco TAC Escalation Center addresses priority level 1 or priority level 2 issues. These classifications are assigned when severe network degradation significantly impacts business operations. When you contact the TAC Escalation Center with a P1 or P2 problem, a Cisco TAC engineer automatically opens a case.

To obtain a directory of toll-free Cisco TAC telephone numbers for your country, go to this URL:

http://www.cisco.com/warp/public/687/Directory/DirTAC.shtml

Before calling, please check with your network operations center to determine the level of Cisco support services to which your company is entitled: for example, SMARTnet, SMARTnet Onsite, or Network Supported Accounts (NSA). When you call the center, please have available your service agreement number and your product serial number.

Obtaining Additional Publications and Information

Information about Cisco products, technologies, and network solutions is available from various online and printed sources.

- The *Cisco Product Catalog* describes the networking products offered by Cisco Systems as well as ordering and customer support services. Access the *Cisco Product Catalog* at this URL:

  http://www.cisco.com/en/US/products/products_catalog_links_launch.html

- Cisco Press publishes a wide range of networking publications. Cisco suggests these titles for new and experienced users: *Internetworking Terms and Acronyms Dictionary, Internetworking Technology Handbook, Internetworking Troubleshooting Guide,* and the *Internetworking Design Guide.* For current Cisco Press titles and other information, go to Cisco Press online at this URL:

  http://www.ciscopress.com

- *Packet* magazine is the Cisco monthly periodical that provides industry professionals with the latest information about the field of networking. You can access *Packet* magazine at this URL:

  http://www.cisco.com/en/US/about/ac123/ac114/about_cisco_packet_magazine.html

- *iQ Magazine* is the Cisco monthly periodical that provides business leaders and decision makers with the latest information about the networking industry. You can access *iQ Magazine* at this URL:

  http://business.cisco.com/prod/tree.taf%3fasset_id=44699&public_view=true&kbns=1.html

- *Internet Protocol Journal* is a quarterly journal published by Cisco Systems for engineering professionals involved in the design, development, and operation of public and private internets and intranets. You can access the *Internet Protocol Journal* at this URL:

  http://www.cisco.com/en/US/about/ac123/ac147/about_cisco_the_internet_protocol_journal.html

- Training—Cisco offers world-class networking training, with current offerings in network training listed at this URL:

  http://www.cisco.com/en/US/learning/le31/learning_recommended_training_list.html

- AT Command Set and Register Summary for V.90 WIC-1AM and WIC-2AM Analog Modem WAN Interface Cards—Describes the host command and responses for the NM-8AM-V2, NM-16AM-V2, WIC-1AM, and WIC-2AM Analog Modem Network Modules. You can access the document at this URL:

  http://www.cisco.com/univercd/cc/td/doc/product/access/acs_mod/atcmnds/atwic.pdf