Tixi 56k-AT Manual

AT Commands For Tixi Analog Modems 56k

HMxx	JMxx
HSM	SMxx
HMM	EMxx
HNM	H5-BM1

V2.1

Table Of Contents

1   AT COMMAND SYNTAX

Commands can be entered alone or in strings, and they must be preceded - except the A/ command - by the character sequence AT (or at) and ended with the content of the S3 register, which usually is <CR/LF>. For example:

ATX1<CR>
ATQ0<CR>

The maximum length of a command line is 80 characters. If more commands are issued, the modem responds with an error message. The commands can be sent with or without spaces between commands and in upper-case or lower-case letters. Use the Backspace key to delete errors. The following commands produce the same results:

ATX1QODP12345<CR>
AT X1 Q0 DP 12345<CR>

The legacy commands are set without using the "=" between the command and its intended value. If an "=" sign is erroneously used, it will actually set the current S register instead. The current setting of these commands is queried by issuing "AT&V," which shows all command values at once. No method is provided to query the range of possible values. Note again the exception of the S command to this rule.

Example
ATQ1   Sets Q to 1
ATS0=1   S command is the one exception to this rule.

If a parameter is not given for a command which requires one, zero ("0") will be assumed automatically.

The modem operates mainly in two modes: Command mode, which sends commands to the modem, and Data mode, which exchanges data with a remote modem. The communications software chooses the correct mode depending on the operation being performed.

In Command mode, all the characters sent from the computer are interpreted as commands, and nothing is transferred to the remote modem. The modem may respond to a command by issuing a screen message.

To enter Data mode, the modem must first connect to a remote peer. When the modem makes a connection, it automatically switches to Data mode and transfers all the characters it receives to the remote modem.

To switch to Command mode from Data mode, the escape sequence ("+++") must be entered. For the escape sequence to be recognized by the modem, certain time restrictions must be observed when typing the '+++' characters. Enter each character with a one-second pause before and after that sequence. The modem will not recognize longer pauses.

To undo changes to the modem settings made using AT commands or S-registers, return the modem to factory default settings by sending the AT&F command.

2   DATA MODE COMMANDS

2.1   Command Summary

A	Answer mode
A/	Repeat last command
B	Select ITU-T or Bell
D	Dial command
E	Command mode echo
H	Switch hook control
I	Identification/checksum option
L	Speaker volume control
M	Speaker control
N	Select data rate handshake
O	Go online
P	Select pulse dialing
Q	Result code display control
S	Select an S-register
T	Select tone dialing
TREBOOT	Restarts the modem without deleting the memory
V	Result code form
W	Response code data rate
X	Result code type
Z	Recall stored profile
+++	Escape Sequence to return temporarily to Command mode
&C	DCD (data carrier detect) option
&D	DTR (data terminal ready) option
&F	Load factory defaults
&G	Guard tone option (1200 bps and 2400 bps only)
&K	Select serial port flow control
&P	Dial pulse ratio
&S	DSR (data set ready) option
&U	Disable Trellis coding
&V	View active and stored profiles
&W	Store active profile
&Y	Select stored profile on power-up
&Z	Store telephone number (up to 30 digits) to location 'n' (0–3)
%E	Auto-retrain control
%G	Rate renegotiation
-C	Generate data mode calling tone
+ES	Error control selection
+MS	Modulation selection
*NC	Country code setting
@D	Accept a new firmware image to flash

2.2   Data Mode Command Descriptions

The following descriptions explain the function of each Data mode command.

An asterisk (*) indicates the command's default value.

A – Answer Mode

This command causes the modem to immediately go off-hook and initiate an answer mode handshake without waiting for an incoming ring signal. This command is useful for manually answering a call or establishing a back-to-back connection with an originate-mode modem.

A/ – Repeat Last Command

This command re-executes the last AT command string stored in the command buffer. A/ is the only command not preceded by AT and ended by a carriage return. Sending any character (such as a carriage return) after A/ and before a modem response is sent to the DTE causes the modem to abort the remainder of the command string in the modem internal command buffer.

A command line remains in the buffer until it is replaced by a new command.

B – Select IUT-T or Bell Mode

This command causes the modem to select ITU-T or Bell mode for 300bps and 1200bps connections.

n = 0*	Selects ITU-T at 1200 and 00bps.
n = 1	Selects Bell at 1200 and 300bps.
n = 2	Selects ITU-T V.23 modulation connections only. The original modem transmits at 75bps and receives at 1200bps, while the answering modem transmits at 1200 and receives at 75.
n =	Selects ITU-T V.32 modulation connection only. The original modem transmits at 1200bps and receives at 75bps, while the answering modem transmits at 75 and receives at 1200.

D – Dial Command

This command causes the modem to immediately go off-hook as an originating modem and dial a telephone number with corresponding dial modifiers. Dial modifiers are parameters that define how the modem should dial the telephone number.

Dial Modifiers

0–9	Dialing Digits
A, B, C, D, *, #	Tone Dial Characters
P	Pulse Dial: configures the modem to use pulse dialing to dial a telephone number.
R	Reverse Originate Mode: places the modem in answer mode. This modifier should be the last character in the dialing string (for example, ATDT 12345678R). After dialing the telephone number, the modem goes into data modem answer mode instead of originate mode.
S = n	Dial NVRAM Telephone Number: causes the modem to dial a telephone number previously stored in the NVRAM with the AT&Zn=x command.
T	Tone Dial: configures the modem to use DTMF tones to dial a telephone number.
W	Wait for Dial Tone: causes the modem to look for dial tone for a specified amount of time. If dial tone or the amount of time specified by the S6 register times out, the modem processes the next command in the dial string. If a busy signal is detected, the modem responds to the DTE with a busy response code and then enters off-line command mode.

,	Pause: causes the modem to pause or delay implementing the next parameter in the dial string by the time specified in S-register S8.
!	Flash Hook: causes the modem to go on-hook for 0.50 seconds.
Wait for Quiet Answer: causes the modem to wait for specified amount of time (S-register S7) followed by 5 seconds of silence before processing the next dial modifier.	
;	Return to Idle State: causes the modem to enter online command mode without initiating a data modem handshake (used for phone directory auto-dialers).
<space> - ( )	Ignored by Modem: these four characters are ignored by the modem. Spaces also may be included in the dial string to separate area codes and numbers.
L	Dials the last number used for dialling.

Example

ATD T0, P 02212971

With this example, a PBX telephone system using tone dialing dials zero to obtain an exchange line. The modem then waits one second to dial the rest of the telephone number in pulse-dialing mode.

Where appropriate, ask the manufacturer of your PBX what features need to be considered in the dialing procedure.

Note: When dialing the same number two times, there must be a 10s break before the 3rd and all further attempts to dial this number (DELAYED CALL). Additionally, if dialling the same number ten times within a short period of time, this number will become BLACKLISTED.

E – Command Mode Echo

This command selects whether the modem echoes AT commands back to the host in either online or off-line command mode.

n = 0   Echo disabled

n = 1*   Echo enabled

H – Switch Hook Control

This command controls the telephone line relay (OHREL*) and causes the modem to either hang up or pick up the telephone line. The H command can be issued only after the escape sequence has been entered.

n = 0*   Hang up telephone line (go on-hook)

n = 1   Pick up telephone line (go off-hook)

I – Identification/Checksum Option

This command causes the modem to send product code and hardware setup information to the DTE.

n = 0*   Report model ID

n = 1   Modem chip firmware version #

n = 2   Report basic functions

n = 3   Report hardware

n = 4   Product name

n = 5   Reports the following hardware configuration: programmed host interface (HOST I/F), program memory (P Mem), data memory (D Mem), and DSP code location. (Modem Mode only)

n = 6   Report country code (Modem Mode only)

n = 7   Manufacturer

n = 8   Modem firmware features

n = 9   Serial PnP String

n = 12 Reserved

n = 20 Reserved

L – Speaker Volume Control

This command selects the modem's speaker volume.

n = 0	Low speaker volume
n = 1	Low speaker volume
n = 2*	Medium speaker volume
n = 3	High speaker volume

M – Speaker Control

This command determines when the speaker is on or off.

n = 0	Speaker always off
n = 1*	Speaker on until carrier present
n = 2	Speaker always on
n = 3	Speaker off during dialing, and on until carrier

N - Select Data Rate Handshake

This command specifies whether the resulting modem -to-modem modulation can be different from the modulation specified in the **+MS=m**<carrier> parameter.

n = 0	When originating or answering, connect only at the data rates specified by the modulation.
n = 1*	When originating or answering, begin handshaking at the modulation data rate. If the remote modem does not support the specified modulation data rate, fall down in data rate or modulation to the highest compatible data rate.

O – Go Online

This command causes the modem to return back to online data mode from online command mode.

n = 0*	Returns the modem to data mode
n = 1	Begins an equalizer retrain sequence, then returns to data mode

P – Select Pulse Dialing

This command configures the modem to use pulse dialing next time the modem dials a telephone number.

Q – Result Code Display Control

This command selects whether the modem sends result codes to the DTE.

n = 0*	Result codes enabled
n = 1	Result codes disabled

S – Select an S-Register

This command selects the current S-register.

ATSn=v   This sets register n to the (decimal) value v

ATSn?   This reads register n and gives its value in decimal form

T – Select Tone Dialing

This command configures the modem to use DTMF tones the next time the modem dials a telephone number (touch tone dialing).

V – Result Code Form

This command selects whether modem response codes are in numeric or verbose (text) form.

n = 0   Numeric form
n = 1*   Verbose (text) form

W – Response Code Data Rate

This command selects whether the modem sends to the DTE independent modem connection result codes for speed, error control protocol, or data compression.

n = 0*   CONNECT result code reports DTE speed.

n = 2   CONNECT result code reports DCE speed.

n = 3   CONNECT result code reports DTE data rate, modulation mode, error correction, data compression, DCE transmitter speed and DCE receiver speed when the mode is configured for verbose V1 (text) response codes. For numeric responses V0, the modem responds with the W0 numeric response codes. The verbose response codes use the following format:

CONNECT (DTE data rate) / (modulation)/(error correction) / (data compression) / TX=(DCE transmit data rate) / RX=(DCE receive data rate)
Modulation types include: V21, V22, V22B, V23C, V32, V32B, V34, and V90
Error correction types include: NONE, LAP-M, MNP
Data compression types include: NONE, V44, V42BIS, MNP5

For example:
      CONNECT 115200/V34/LAP-M/V42BIS/TX=28800/RX=28000

n = 4   CONNECT result code reports DCE protocol, data compression, and DCE data rate when the mode is configured for verbose V1 (text response codes). For numeric responses V0, the modem responds with the W0 numeric response codes. The verbose response codes use the following format:

      (DCE protocol)
      (data compression)
      (line speed)

Error correction types include: NONE, LAP-M, MNP
Data compression types include: NONE, V44, V42BIS, MNP5

For example:
      PROTOCOL: LAP-M
      COMPRESSION: V42BIS
      CONNECT 33,600

X – Result Code Type

This command determines which modem result codes are enabled. Additionally, this command specifies whether busy and dial tone detection are enabled or disabled.

n = 0   Result codes 0–4 enabled. Busy and dial tone detect disabled

n = 1   Result codes 0–5, 10 and above enabled. Busy and dial tone detect disabled

n = 2   Result codes 0–6, 10 and above enabled. Busy detect disabled and dial tone detect enabled

n = 3   Result codes 0–5, 7, 10 and above enabled. Busy detect enabled and dial tone detect disabled

n = 4*   Result codes 0–7, 10 and above enabled. Busy and dial tone detect enabled.

Z – Recall Stored Profile

This command causes the modem to go on-hook (hang-up), perform a warm reset, and load user-configuration profile 'n' (previously stored in the NVRAM) into the active profile. The Zn command must be the last command in command string, as it causes all subsequent commands to be ignored.

n = 0*   Resets the modem and recalls user profile 0

n = 1   Resets the modem and recalls user profile 1

&C – Data Carrier Detect (DCD) Option

This command controls how the modem functions in relation to the DCD or RLSD signal.

n = 0   State of carrier from remote modem is ignored. DCD is always on. Line-LED goes on.

n = 1*   State of carrier from remote modem is tracked. DCD reflects the state of the received carrier. Modem Mode LED goes out.

&D - DTR (Data Terminal Ready) Option

This command controls how the modem responds to DTR. After toggling DTR, the host should wait 200 ms before modifying the UART registers or sending a new command to the modem. This is done because the modem does not send an 'OK' message to indicate it has performed the requested function.

n = 0   The modem ignores DTR.

n = 1   The modem switches from data to command mode when an on-to-off transition of DTR occurs.

n = 2*   An on-to-off transition of DTR causes the modem to go on-hook (hang up). While DTR is off, auto-answer is disabled.

n = 3   An on-to-off transition of DTR re-initializes the modem. The re-initialize procedure performs the same function as a power-up reset, except that the UART registers are not reconfigured.

&F – Load Factory Defaults

This command loads command defaults and S-register factory defaults into the active configuration and configures the modem for data mode. See &V command for a list of the two default command profiles. Note that this command does not reset the +TBAUD and +TFORMAT settings, which would require a hardware reset.

&G – Guard Tone Option

This command controls whether the modem sends out guard tones while connected to a remote modem (for ITU-T V.22 bis [1200 bps] and V.22 bis [2400 bps] connections only). Guard tones may be required in some countries but are not needed in the United States. Guard tones are sent by the answer modem to disable Central Office echo cancelers.

n = 0*   Guard tone disabled

n = 1   550-Hz guard tone enabled

n = 2   1800-Hz guard tone enabled

&K – Select Serial Port Flow Control

This command specifies the DTE-to-modem flow control. Software flow control uses the characters XOFF (13h) and XON (11h) to stop and start data transmission, respectively, both to and from the DTE. Bi-directional hardware flow control uses RTS/CTS to stop and start data from the modem.

n = 0   Disables flow control

n = 3*   Bi-directional hardware flow control — RTS/CTS

n = 4   XON/XOFF software flow control

& P - Dial Pulse Ratio

This command determines the make/break (that is, off-hook/on-hook) ratio during pulse dialing.

n = 0*   Make = 39%; Break = 61% at 10 pulses per second—for use in the United States.

n = 1   Make = 33%; Break = 67% at 10 pulses per second—for use in the United Kingdom and

        Hong Kong.

&S – DSR (Data Set Ready) Option

This command controls how the modem treats the DSR signal.

n = 0*   DSR circuit always on

n = 1   DSR circuit is on during handshaking, off in test or idle modes. DSR is off when the carrier is lost.

&U - Disable Trellis Coding

This command selects whether the modem transmits or receives modulated9600 bps carrier with QAM or Trellis encoding for V.32.

n = 0*   Enabled (Trellis modulation with QAM modulation as a fallback)

n = 1   Disabled (QAM modulation only)

&V – View Active and Stored Profiles

This command causes the modem to display the command and S-register information contained in the active user profile and in one of two stored profiles. The command &V0 displays the active profile and the stored profile 0; &V1 displays the active profile and the stored profile 1. The information in the active profile is stored into the user profiles with the &Wn command. &W0 stores the active profile into the stored profile 0; &W1, the stored profile 1.

n = 0*   Stored profile 0

n = 1   Stored profile 1

    <u>Example</u>

    AT&V0

    ACTIVE PROFILE:

    B1 E1 L2 M1 N1 P Q0 V1 W3 X4 Y0 &C1 &D2 &G0 &J0 &P0 &Q0 &S0 &U0 &Y0

    %A013 %C1 %E1 %G1 \A3 \C0 \G0 \J0 \K5 \N3 \Q3 \T000 \X0 -C1 -J1 "H3 "O032

    S00:001 S01:000 S02:043 S03:013 S04:010 S05:008 S06:002 S07:060 S08:002 S09:006 S10:014 S11:070 S12:050 S18:000 S25:005 S30:000 S33:010 S37:000

    STORED PROFILE 0:

    B1 E1 L2 M1 N1 P Q0 V1 W3 X4 Y0 &C1 &D2 &G0 &J0 &P0 &Q0 &S0 &U0
    %A013 %C1 %E1 %G1 \A3 \C0 \G0 \J0 \K5 \N3 \Q3 \T000 \X0 -C1 -J1 "H3 "O032
    S00:001 S02:043 S06:002 S07:060 S08:002 S09:006 S10:014
    S11:070 S12:050 S18:000 S25:005 S30:000 S33:000 S37:000
    TELEPHONE NUMBERS:
    &Z0= 12345
    &Z1= T4444444
    &Z2= T12345
    &Z3= T11234567890
    OK

&W – Store Active Profile

This command causes the modem to store a subset of the active profile command and S-register configurations into the NVRAM user profile 'n'.

n = 0*   Store in user profile 0

n = 1   Store in user profile 1

&Y – Select Stored Profile on Power-Up

This command selects the particular stored user profile from the NVRAM to be loaded into the active profile upon modem power-up.

n = 0*   Select profile 0

n = 1   Select profile 1

&Z – Store Telephone Number

This command stores a telephone number up to 30 digits (including dial modifiers) in the NVRAM. To dial the stored telephone number, use the ATDS=n command. Use the &V command to display the stored telephone number.

n = 0–3

x = 0–9 A B C D # * T P R W @ , ! ;

> Example
>
> AT&Z2=P06897 123456
>
> The telephone number P (for pulse dialing) 06897 123456 is stored in memory location 2.

%E – Auto-Retrain Control

This command controls whether the modem automatically initiates a modem retrain whenever the received data signal quality falls below a threshold that can affect data reliability. The value for 'n' is stored in the NVRAM.

n = 0   Disabled

n = 1*   Enabled

%G - Rate Renegotiation

This command selects whether the modem automatically initiates a change to a higher speed or lower speed depending on received signal quality (that is, rate negotiation). The modem always responds to any rate change initiated by the remote modem.

n = 0   Disabled

n = 1*   Enabled

-C - Generate Data Modem Calling Tone

This command allows the DTE to select whether the modem sends a 1300 Hz calling tone or V.8 calling tone when originating a data modem connection.

n = 0*   Calling tone disabled

n = 1   1300 Hz calling tone sent for all data modem connections

n = 2   V.8 calling tone sent for V.34 modulation and 1300 Hz calling tone sent for all other modulations.

+MS – Modulation Selections

Set the modulation type and transmission speed range using the +MS command. This command contains four parameters that are typed as follows:

+MS= <carrier>, <automode>, <min rate>, <max rate>, <min rx rate>, <max rx rate>

The <carrier> parameter sets the modulation type.

The <automode> parameter enables or disables automatic rate negotiation, when the modem negotiates with the remote modem to obtain the highest data rate possible. By default, automode is enabled.

The <min rate> and <max rate> parameters set the lowest/highest rates at which to establish a connection. If the value for either of these parameters is 0, max/min rate depends on modulation and automode setting. For V.90 modulation <min rate> is not available.

The <min rx rate> and <max rx rate> set the lowest/highest rate at which the modem can receive data.

Modulation and <min rate> will not be stored to the modem profile.

The following table lists the modulation types and data rates for that modem type.

Modulation	Possible Rates (bps)
V21	300
V22	1200
V22B	1200 or 2400
V23C	1200 forward, 300 reverse
V32	9600 or 4800
V32B	14400, 12000, 9600, 7200
V34	V.34 asymmetrical connections: 28,800, 26,400, 24,000, 21,600, 19,200, 16,800, 14,400, 12,000, 9600, 7200, 4800, or 2400
V90	56-kbps V.90 asymmetrical connections (transmit): 33,600, 31,200, 28,800, 26,400, 24,000, 21,600, 19,200, 16,800, 14,400, 12,000, 9600, 7200, and 4800 bps
	56-kbps V.90 asymmetrical connections (receive): 28,000, 29,333, 30,667, 32,000, 33,333, 34667, 36000, 37,333, 38,667, 40,000, 41,333, 42,667, 44,000, 45,333, 46,667, 48,000, 49,333, 50,667, 52,000, or 53,333 bps

+TBAUD - Set the baudrate

This command sets the baudrate for communication between the modem and the DTE. Possible values are: AUTO, 300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200, 230400. Default is AUTO, which means autobauding. When being used along with other commands in a single line, this one must be the last command in that line. Bringing this setting back to it's default value requires a hardware reset.

+TFORMAT - Sets the data format

This command sets the baudrate for communication between the modem and the DTE.

AT+TFORMAT=<databits>,<parity>,<stopbits>

Where possible values are:

        <databits>   5, 6, 7, 8
        <parity>   N, E, O, X (X means automatic)
        <stopbits>   1, 2

The default is 8X1. If Parity is set to X, these formats are supported: 7E1, 7O1, 7N2, 8N1, 8E1, 8O1

When being used along with other commands in a single line, this one must be the last command in that line. Bringing this setting back to it's default value requires a hardware reset.

+TERASE – Factory reset the modem

This command restarts the modem and loads its factory defaults.

+TREBOOT – Restarts the modem

This command restarts the modem without clearing its memory..

@D – Accept new firmware image

This command puts the modem into a special mode so that it can accept a new firmware image and burn this to the flash. Note that the firmware must be uploaded via Z-Modem protocol.

*NC - Country Select

This command sets the country code of the modem.

n = 0	USA
n = 1	Japan
n = 2	United Kingdom
n = 3	Germany
n = 4	Sweden
n = 5	Danmark
n = 6	Finland
n = 7	Norway
n = 8	Austria
n = 9*	CTR21 (Europe)
n = 10	Russia
n = 11	Australia
n = 12	Malaysia
n = 13	Taiwan
n = 14	Singapore

Note that this setting becomes effective only after being written to the nonvolatile RAM by using the **AT&W** command.

3 DATA MODE ERROR CORRECTION/COMPRESSION

3.1 Command Summary

The modem supports data mode error correction (MNP 2–4 and V.42) and data compression (V.44, MNP 5, and V.42bis). V.42 error correction uses LAPM as the primary error- control protocol and uses MNP 2-4 as an alternative. V.44 provides enhanced data compression over the existing V.42bis standard. Data compression is up to on average 40% faster than previous methods. This provides for faster web browsing and data downloading. The +DS44 command configures the operation of V.44. V.42bis data compression requires V.42 (LAPM only). MNP 5 data compression requires MNP 2-4.

The modem supports four operating modes: buffer (normal), MNP reliable, V.42 auto-reliable, and V.42 reliable. They allow the DCE to communicate with remote modems that may or may not support error correction and data compression. Speed buffering, which is used for all operating modes, allows the DTE-to-modem data rate to be different from the modem-to-modem data rate. This is accomplished by using transmitter and receiver buffers in the modem. Thus, the DTE-to- modem data rate can be set for 2400 bps when the modem-to-modem data rate is 300 bps without causing any data errors. In all data modes, the DTE-to-modem data rate can be set for any valid speed between 300 bps to 230400 bps (that is, the modem autobauds up to 230400 bps).   Each operating mode is explained in more detail in the following tables.

%A	Set auto-reliable fallback character
%C	MNP5 data compression control
\A	MNP block size
\B	Transmit break
\C	Set auto-reliable buffer
\G	Set modem port flow control
\J	bps rate adjust control
\K	Set break control
\N	Set operating mode
\O	Originate MNP link
\Q	Set serial port flow control
\T	Set inactivity timer
\U	Accept reliable link
\X	Set XON/XOFF pass-through
\Y	Switch to reliable mode
\Z	Switch to normal mode
-J	Set V.42 detect phase
"H	V.42bis compression control
"O	V.42bis string length

3.2 Data Mode Error Correction/Compression Command Descriptions

An asterisk (*) after an option indicates the command's default value.

%A – Set auto-reliable fallback character

This command sets the fallback character. In auto-reliable mode (+ES=3,0,2) with auto-reliable fallback character enabled (\C2), receipt of the fallback character from the line during the V.42 detection phase causes the modem to switch to buffer (normal) mode. This allows a remote user with a non-V.42 modem to connect immediately with a V.42 modem. A space or carriage return is usually chosen for the fallback character.

n = 13*

Range: n = 0–127 (ASCII character)

%C - MNP 5 Data Compression Control

This command controls whether the data sent during the MNP frames is compressed using MNP Class 5 compression standard. MNP 5 data compression can improve throughput by as much as 150%.

n = 0   No compression

n = 1*   MNP Class 5 compression

\A – MNP Block Size

This command specifies the maximum number of data bytes in an MNP data frame. A smaller frame size may improve throughput on high-impairment (noisy) telephone lines.

n = 0   Maximum 64 characters

n = 1   Maximum 128 characters

n = 2   Maximum 192 characters

n = 3*   Maximum 256 characters

\B - Transmit Break

This command causes the modem to send a break (attention signal) to the remote for duration specified by 'n'. 'n' is specified in 100 ms units. When n = 0, the default break length is used. Range: 0–9

\C - Set Auto-Reliable Buffer (requires a license from Microcom*):

In auto-reliable mode (+ES=3,0,2), this command determines the fallback method and enables data buffering. The settings for this command are used by the modem during the V.42 detection phase.

n = 0*   Does not buffer data.

n = 1   Reserved.

n = 2   Does not buffer data. Switches to buffer (normal) mode upon receipt of auto-reliable fallback character and passes it to serial port. This feature allows non-V.42 modems to connect immediately to a V.42 modem without data loss.

\G – Set Modem Port Flow Control

In buffer (normal) mode (either \N0 or after fallback), this command enables modem-to-modem flow control using XOFF (13h) to stop and XON (11h) to start transmission between modems.

n = 0*   Disables port flow control

n = 1   Sets port flow control to XON/XOFF

\J – bps Rate Adjust Control

If this command is enabled, the serial port speed automatically changes to the modem-connection speed. This forces the user to change the DTE-to-modem bps rate, if needed. If the command is disabled, the serial port speed is independent of the connection speed, which allows much greater throughput when using error correction and data compression.

n = 0*   Turns off feature

n = 1   Turns on feature

\K - Set break control

This command defines what action the modem takes when a break (attention signal) is sent or received, as described below:

where n =,

> In connect state, transmits break to remote (if in reliable mode):
> 0, 2, 4   Enters command mode, no break sent
> 1   Destructive/expedited
> 3   Nondestructive/expedited
> 5   Nondestructive/nonexpedited
>
> In command state, transmits break to remote (if in reliable mode):
> 0, 1   Destructive/expedited
> 2, 3   Nondestructive/expedited
> 4, 5   Nondestructive/nonexpedited
>
> In connect state, receives break at modem port and sends to serial port:
> 0, 1   Destructive/expedited
> 2, 3   Nondestructive/expedited
> 4, 5   Nondestructive/nonexpedited

\N - Set Operating Mode

This command determines the type of connection attempted by the modem.

n = 0,1   Buffer (Normal) Mode - no data compression or error correction, but uses speed buffering

n = 2   MNP Reliable mode - the modem attempts to negotiate aqn MNP error-correction "reliable" link, hanging up if it fails

n = 3*   V.42 Auto-reliable mode - if V.42 detection is enabled (-Jn), a LAPM or MNP link can be detected and negotiated; otherwise, only LAPM is attempted. If configured for -J0 and a protocol connection is not made, the modem hangs up. If configured for -J1 and a protocol connection is not made, the modem falls back to speed buffering mode.

n = 4   V.42 Reliable mode - the modem attempts to negotiate LAPM error correction, hanging up if it fails.

\O – Originate MNP Reliable link

In buffer mode, the modem attempts to originate an MNP link.

\Q – Set serial port flow control

This command specifies the DTE-to-modem flow control. Software flow control uses the XOFF (13h) command to stop and the XON (11h) characters to start data transmission, both to and from the DTE. Unidirectional hardware flow control uses the CTS control line to stop or start data transmission from the DTE only, while bidirectional hardware flow control also uses the RTS control to stop or start data from the modem.

n = 0   Disables flow control

n = 1   XON/XOFF software flow control

n = 2   Unidirectional hardware flow control (CTS)

n = 3*   Bidirectional hardware flow control (RTS/CTS)

\T - Set Inactivity Timer

During a buffer (normal) or reliable connection, if no data is sent or received within the inactivity time period, the link is disconnected. The default, '0', disables this feature.

Range: 0–90 Length in minutes

n = 0*   Disables inactivity timer

\U - Accept auto-reliable link

In buffer mode (normal, \N0 or \N1), the modem attempts to answer an MNP link request, regardless of whether the modem originated or answered the telephone call (physical connection). The remote modem must originate the MNP link request for the link to be established (refer to the \O command).

\X - Set XON/XOFF Pass-Through

If software flow control is enabled (\Q1), this command defines whether the XON (11h) and XOFF (13h) characters received from the DTE are sent to the remote modem. In addition, if the modem port flow control is enabled (\G1) in normal mode, the command specifies whether the XON and XOFF characters received from the remote modem are sent to the DTE. In both cases, flow control operation is not affected.

n = 0*   Processes flow control characters*

n = 1   Processes flow control characters and passes them through to the local or remote so they can process the characters.

\Y – Switch to Reliable Mode

This command attempts to originate/answer a reliable connection.

\Z – Switch to Buffer Mode

This command attempts to switch to a normal connection.

-J - Set V.42 Detect Phase

In V.42 modes (+ES=3,0,2 and +ES=3,2,4), this command specifies whether the modem detects V.42, MNP, or no error-correcting protocols from the remote modem and changes to the appropriate mode. Otherwise, only V.42 is attempted.

n = 0   Disables the V.42 detect phase

n = 1*   Enables the V.42 detect phase

"H - V.42 bis Compression Control

This command specifies whether the data in the LAPM frames are compressed using V.42 bis data compression. This can improve throughput by as much as 400%. Compression can be negotiated to operate in one direction or both.

n = 0   Disables V.42 bis
n = 1   Enables V.42 bis only when transmitting data
n = 2   Enables V.42 bis only when receiving data
n = 3*   Enables V.42 bis for both transmitting and receiving data

"O - V.42 bis String Length

This command specifies the maximum number of characters that can be compressed into one V.42 bis code word. The default value of 32 optimizes throughput for most file types.

Range: 6–250 Number of characters

n = 32* Default number of characters

4 FAX MODE COMMANDS

4.1 Command Summary

The following table contains the fax mode commands. The command

+FCLASS=1 is used to enter fax mode. See the following section for full descriptions of each command.

+FAE	Fax/Data Auto-Recognition
+FCLASS	Data/Fax/Voice modem selection
+FMFR?/+FMI	Identify Modem Manufacturer
+FMDL?/FMM	Identify Product Name
+FREV?/FMR	Identify Product Version Number
+FRH	Receive HDLC Data
+FRM	Receive Data
+FRS	Wait For Silence
+FTH	Transmit HDLC Data
+FTM	Transmit Data
+FTS	Stop Transmission and Pause

4.2 Fax Mode Command Descriptions

The following descriptions explain the function of each Fax mode command.

Note: An asterisk (*) indicates the command's default value.

+FAE - Fax/Data Auto-Recognition

This command allows the modem to determine automatically whether an incoming call is data or fax and to answer accordingly. When disabled, the modem answers as a fax modem only.

n = 0*   Disable data/fax auto-recognition mode

n = 1   Enable data/fax auto-recognition mode

+FCLASS - Data/Fax/Voice modem selection

This command places the modem into one of three modes: data, fax, or voice.

n = 0*   data mode
n = 1   fax class 1 mode
n = 8   voice mode

+FMFR?/+FMI – Identify Modem Manufacturer

This command causes the DCE to send a message to the DTE indicating the DCEmanufacturer. This is a same as the +GMI command.

+FMDL?/FMM – Identify Product Model

This command causes the DCE to report the modem chipset name. This is the same as the+GMM command.

+FREV?/FMR – Identify Product Revision

This command causes the DCE to report the modem chipset revision level. This is the same as the +GMR and ATI1 commands.

+FRH – Receive HDLC Data

This command causes the modem to receive HDLC-framed data using the modulation mode selected. The modem then delivers the next-received frame to the DTE.

If the modem detects the selected carrier signal with an HDLC flag, the modem sends a

'CONNECT' result code to the DTE. If the modem detects a different signal, the modem sends the '+FCERROR' (fax connect error) result code to the DTE and returns to command mode. Upon loss of carrier, the modem returns to command mode and sends a 'NO CARRIER' result code to the DTE.

After receiving the HDLC flags, the modem strips away the flags and buffers the received frames. The modem then transfers the received data to the DTE, starting with the first non- flag byte and continuing through the last FCS byte. The DTE should ignore the value of the FCS bytes. The modem also performs HDLC zero-bit deletion and error checking.

After the FCS bytes are transferred, the modem marks the end of the frame with

<DLE><ETX> and reports the status of the frame reception to the DTE. If the frame was received correctly (FCS is correct), the modem returns a 'OK' result code. If the frame was received in error (FCS is not correct, carrier lost, or data lost due to data overflow), the DCE returns an 'ERROR' result code. The DTE should then discard this frame.

After sending the status result code, the modem is ready to accept new commands from the

DTE.

The modem obeys the configured flow control from the DTE. If the DTE sends any character to the modem other than DC1 or DC3 while the modem is in this mode, the modem enters command mode and return an 'OK' result code.

After sending the result code indicating that frame reception is complete, the modem continues to receive and buffer the data in the selected mode. If the DTE issues another

+FRH command, the modem returns another 'CONNECT' result code and continues with HDLC reception. If the DTE issues any command that changes modulation, the DCE stops the receive process; the DCE then discards any buffered data and processes the command. Range: 3

+FRM – Receive Data

This command causes the modem to enter receive mode using the modulation scheme specified.

When the selected carrier is detected, the modem sends a 'CONNECT' result to the DTE. If a different signal is detected, the modem sends a '+FCERROR' (connect error) result code to the DTE and returns to command mode.

After receiving the selected carrier, the modem transfers all received data patterns to the DTE as consecutive start-stop framed bytes, including leading marking conditions or flags. The modem marks the end of the data stream with <DLE><ETX>.

Upon loss of carrier, the modem returns to command state and sends a 'NO CARRIER'

result code to the DTE.

NOTE: If the modem is on-hook, then the modem always returns an 'ERROR' message to the DTE after receiving the command.

Range: 24, 48, 72, 73, 74, 96, 97, 98, 121, 122, 145, 146

+FRS – Wait For Silence

This command causes the modem to send an 'OK' result code to the DTE when silence has been detected on the line for the amount of time specified. The value is in 10 ms intervals. The command terminates when the required amount of silence has been detected on the line or the DTE sends the modem another character that is discarded. In either event, the DTE returns the 'OK' result code.

Range: 1–255 (10 ms)

+FRH – Receive HDLC Data

This command causes the modem to transmit data framed in HDLC protocol using the modulation mode selected.

After receiving the +FTH command, the modem sends a 'CONNECT' result code to the DTE. The modem then transmits signal converter training (if required) followed by flags until the first byte of data is sent by the DTE. The modem terminates the +FTH command upon detecting <DLE><ETX> characters in the data stream.

When the buffer is empty, the modem computes and appends the FCS (Frame Check Sequence) and a closing flag to the frame. The modem ensures that the minimum number of flags required by T.30 are sent before the data from the DTE begins to be transmitted.

The modem checks the final frame bit in the control field of each frame; this is the fifth received bit of the second byte of each frame. If the final frame bit is a '1', the modem ceases transmission after the frame is sent, returns to command state, and sends the 'OK' result code to the DTE. If the final frame bit is a '0', the modem sends another 'CONNECT' result code to the DTE after the current frame is sent. The modem continues to transmit flags until the DTE takes one of the following actions:

•   The DTE sends additional data. The modem then transmits another frame.

•   The DTE sends only <DLE><ETX> (a null frame). The modem then turns off the transmit carrier andsend the'OK'result code to the DTE.

•   If the DTEtransmits no additional data within 5 seconds from when the modem reported the 'CONNECT' result code, the modem turns off the transmit carrier mode, returns to command mode, and sends the 'ERROR' result code to the DTE.

In HDLC transmit mode, the modem performs HDLC transparency functions, FCS generation, and buffers the transmit data. The modem uses the configured method of flow control to pause the DTE as necessary.

NOTE: If the modem is on-hook, it always returns an 'ERROR' message to the DTE after receiving the +FTH command.

Range: 3

+FTM – Transmit Data

This command causes the modem to transmit data using the modulation selected.

The modem returns a 'CONNECT' result code and transmits the proper training sequence in the selected mode, followed by constant '1' bits until data is received from the DTE. The modem terminates this command upon detecting <DLE><ETX> characters in the data stream.

If the modem's transmit buffer empties and the last transmitted character is an ASCII NULL

(00), the modem continues to transmit NULLs until the DTE sends more data or 5 seconds have elapsed. After 5 seconds have elapsed with an empty transmit buffer, the DCE turns off the transmit carrier, returns to command state, and returns an 'ERROR' result code to the modem.

NOTE: Hex $00 replication does not provide the required timing needed for generating the

TCF frame (1.5 seconds of '0's).

If the modem's transmit buffer empties and the last transmitted character was not aNULL, the modem turns off the transmit carrier, returns to command state, and sends the 'OK' result code to the DTE.

NOTE: If the modem is on-hook, the modem always returns an 'ERROR' message to the

DTE after receiving the +FTM command.

Range: <mod> = 24, 48, 72, 73, 74, 96, 97, 98, 121, 122, 145, 146

+FTS – Stop Transmission and Pause

This command causes the modem to stop all transmissions. The modem waits for the specified amount of time, then sends an 'OK' result code to the DTE. The value is in 10 ms intervals.

Range: 0–255 (in 10 ms intervals)

5   VOICE MODE

Basically, this modem is voice capable.

It complies to the basic voice commandset and to DCE-DTE-comands.

The appropriate commandset is available to OEM customers by request at

www.tixi.com

6   CALLER ID

This chapter describes caller ID for the United States. Caller ID is a service that lets the called party know the telephone number of the caller before the call is answered. The information transmitted to the called party via Caller ID includes the call date, the call time, and the calling number. This service is not available everywhere, due to central office telephone equipment limitations and legal prohobition in some locations.

The **+VCID=n** command controls the reporting and presentation of data associated with the Caller ID services in United States and Canada in the ICLID (incoming call line ID) data format. The ICLID data comes in one of two formats: SDM (single data message) format or MDM (multiple data message) format. In both formats, data is provided as data items and packet control information.

When enabled, the DCE reports any Caller ID information detected after the first ring message (note that more <CR/LF> may occur after the RING result code). All data items are reported using the <tag> <=> <value> pair format. Spaces are present on both sides of the equal sign.

This chipset allows for two types of Caller ID reporting formats, formatted and unformatted. In formatted reporting, DCE does not report any Caller ID information if a check sum error is detected in the Caller ID packet. If the DCE receives multiple copies of the Caller ID packets. the DCE sends only one of the correct packets to the DTE. If the DCE has never presented a correct packet but has received the line seizure information at least once, the DCE returns <MESG> <=> <CALID_202>.

The DCE braks up the presentationof the date and time into two separate <Tag><Value> pairs for those data items where the date and time appear together.

6.1　Caller ID Tags

Tag	Description
DATE	Date=MMDD where MM is the month number, 01 through 12, and DD is the day number ranging from 01 to 31. All numbers are in ASCII decimal. For numbers less than 10, a filling ASCII zero is to be used.
TIME	TIME=HHMM where HH is the hour, 00 through 23, and MM is the minute ranging from 00 through 59. All numbers are in ASCII decimal. For numbers less than 10, a filling ASCII zero is to be used.
NMBR	NMBR=<number> or P or O (ASCII 4Fh) where <number> is the telephone number of the caller, where P indicates that the calling number information is not available since the originating caller has requested private service, and where O indicates that the calling number is not available since the out of area code or the service is unavailable.
NAME	NAME=<listing name> where <listing name> is the subscription listing name.
MESG	MESG=<data tag> <length of message> <data> <checksum> in printable ASCII (to avoid possible problems with binary output numbers).

If a data tag is unrecognizable, the DCE represents the given data item's information using the MESG tag. The DCE follows the conventions of the unformatted reporting form (defined below) where applicable for the given data item only.

6.2   *Examples Of Report Formatting*

The following example of formatted form report (**AT+VCID=1**) illustrates the case when the DCE does not recognize the tag of one given data item from a packet of data items (data or fax command mode).

```
RING
DATE = 0321
TIME = 1405
NMBR = 5045551234
NAME = DOE JOHN
MESG = 060342424231
RING
RING
```

The following example of formatted form report illustrates the case when the DCE does not recognize the tag of the packet (data or fax command mode).

```
RING
MESG = 060342424231
RING
RING
```

For unformatted form reporting (**AT+VCID=2**), the DCE presents all information contained in the Caller ID packet as ASCII hex in printable characters. This information includes all message type information, message length, data and checksum.

The following example illustrates unformatted form reporting (data or fax command mode).

```
RING
MESG = 04123033323131334303593134353531323334 35
RING
RING
```

7   MODEM RESPONSE MESSAGES

The modem responds to some AT commands with Response Messages. Use the V commands to report responses using either words or numbers.

In addition, the modem issues Connection Messages when it recognizes activities on the telephone line. The X commands determine whether the modem reports connection messages for busy tone and dial tone.

The W command ensures that messages are reported. By sending the W3 command, you can report messages regarding modulation, error correction, data compression, and data rate (the last entry in each response code table). The W0–W2 and W4 commands send conventional response messages.

Example
CONNECT 38400/V34B/LAPM/V42B/TX=33600/RX=28800

Code	Verbose message	Code	Verbose message
0	OK	34	CONNECT 37333
1	CONNECT	35	CONNECT 41333
2	RING	36	CONNECT 42666
3	NO CARRIER	37	CONNECT 44000
4	ERROR	38	CONNECT 45333
5	CONNECT 1200	39	CONNECT 46666
6	NO DIALTONE	42	CONNECT 48000
7	BUSY	43	CONNECT 49333
8	NO ANSWER	45	RINGBACK
9	CONNECT 600	53	CONNECT 50666
10	CONNECT 2400	54	CONNECT 52000
11	CONNECT 4800	55	CONNECT 53333
12	CONNECT 9600	56	CONNECT 54666
13	CONNECT 14400	57	CONNECT 56000
14	CONNECT 19200	58	CONNECT 57333
18	CONNECT 57600	59	CONNECT 16800
22	CONNECT 1200/75	60	CONNECT 21600
23	CONNECT 75/1200	62	CONNECT 24000
24	CONNECT 7200	63	CONNECT 26400
25	CONNECT 12000	64	CONNECT 28800
28	CONNECT 38400	65	CONNECT 31200
31	CONNECT 115200	66	CONNECT 33600
33	CONNECT 33333		

The W3 AT command reports the special verbose code listed, which is used to evaluate the modem connection. The W0, W1, W2, and W4 AT commands report all other 'CONNECT' messages. When the modem is configured for text responses V1, the W3 verbose response provides information about the DTE data rate, connection modulation, error correction protocol, data compression, and modem-to-modem data rate. When the modem is configured for W3 and numeric responses V0, the modem responds as if it were set up for W0.

8 S REGISTER

8.1 S-Register Summary

The modem stores its settings in memory locations called S-registers. Some S-registers are stored in non-volatile memory (NVRAM), which can be interrogated with Z, &Y, and &W commands. Look at the S command description for the correct way to read or change S-register values. The values of most S-registers can be modified using AT commands.

Register	Function	Default	Range
S0	No. of rings to auto-answer on	0	0–255
S1	Ring count	0	0–255
S2	Escape character	43	0–127
S3	Carriage Return Character	13	0-127
S4	Line feed character	10	0–127
S5	Backspace character	8	0–32, 127
S6	Wait before dialing	2	2-255
S7	Wait for carrier	60	0–100
S8	Pause time for dial modifier	2	0-255
S9	Carrier recovery time	6	1–255
S10	Lost carrier hang up delay	14	0–255
S12	Guard Time	50	0–255
S14	Bit-mapped options	138	–
S21	Bit-mapped options	48	–
S22	Bit-mapped options	118	–
S23	Bit-mapped options	none	–
S25	Detect DTR change	5	0–255
S33	Sleep mode timer	0	0–90
S37	Maximum line speed attempted	0	0-35

8.2 S-Register Descriptions

An asterisk (*) after an option indicates the command's default value.

S0 – Number of Rings to Auto-Answer On

Assigning S0 a value from 1 to 255 configures the modem for auto-answer mode. The modem automatically goes off-hook and initiates a data mode-answer mode handshake after detecting the specified number of rings. This S-register is meant for data modem mode only and should be set to '0' for fax mode.

Range: 0–255 rings

n = 0   Auto-answer mode disabled

S1 – Ring Count

Reports the number of ring signals detected by the modem. This register is cleared to zero if no new ring signals are detected within an 8-second time interval.

Range: 0–255 rings

Default: 0 rings

S2 – Escape Character

S2 specifies an ASCII value for the Hayes or TIES escape character. The factory default is '+' or ASCII decimal 43. The escape character may range between 0–127. Any value over 127 disables the escape sequence.

Range: 0–127

Default: 43 ('+')

S3 – Carriage Return Character

S3 specifies the carriage return character, which is used for verbose (text) modem result codes. This command is will not be stored to the modem profile.

Range: 0-127

Default: 13 (carriage return)

S4 – Line Feed Character

S4 specifies the line feed character, which is used for verbose (text) modem result codes.

Range: 0-127

Default: 10 (line feed)

S5 – Backspace Character

S5 specifies the backspace character used to delete the last-entered character. After receiving a backspace character, the modem sends three characters to the DTE: a backspace character, a space character, and then another backspace character.

Range: 0–32, 127

Default: 8 (BS)

S6 – Wait before Blind Dialing

S6 specifies the length of time after the modem goes off-hook before the modem starts dialing the first telephone number. The modem waits for at least 2 seconds before dialing the first number, even if S6 is set for a value less than 2. S6 is only used for result code type commands X0, X1, and X3 (that is, blind-dialing types of result codes). Result code types X2 and X4 enable dial-tone detection and ignore the contents of S6.

Range: 2–255 seconds
Default: 2 seconds

The legal range of values depends on the countrycode set:

USA: 2...255 (default: 2)
Germany: 3...9 (default: 3)
CTR21:   3...5 (default: 3)

S7 – Wait for Carrier/Dial Tone

S7 specifies the length of time that the modem waits to detect the remote modem carrier after dialing the telephone number. If the remote modem carrier is not detected within the S7 time limit, the modem hangs up and sends a 'NO CARRIER' response code to the DTE. If the remote modem carrier is detected, the modem goes into online data mode and sends a 'CONNECT' message to the DTE.

S7 also specifies the time duration for the '@' (wait for quiet answer) dial modifier.

Range: 1–255 seconds
Default: 60 seconds

S8 – Pause Time for Dial Modifier

S8 specifies the length of time that the modem pauses during the dialing process each time the ',' dial modifier is detected in the dialing string.

Range: 0–255 seconds
Default: 2 seconds

S9 – Carrier Detect Recovery Time

S9 specifies the length of time the remote modem carrier must be present on the telephone line before the modem detects it and turns on DCD. The greater the time duration, the less likely it is that a false carrier detection will occur due to noise on the telephone line.

Range: 1–255 (1/10 of a second)
Default: 6 (equals 0.6 seconds)

S10 – Lost Carrier Hang Up Delay

For modes V.32 and below, S10 specifies the length of time the modem waits before hanging up after the loss of the remote modem carrier. This delay allows for the temporary loss of the remote modem carrier without causing the local modem to hang up.

S10 reports the time in 1/10-second units beyond 20 seconds. For example, when S10 = 0, the wait time is 20 seconds. When S10 = 100, the wait time is 30 seconds.

In V.34 and V.90 modes, the modem automatically retries the connection for 45 seconds when S10 = 1–254.

For all modes, the modem does not disconnect upon loss of the remote modem carrier if S10 is 255.

Range: 1–255 (1/10 of a second)

Default: 14 (equals 1.4 seconds plus the 20-second minimum)

S12 – Guard Time

S12 is used to specify guard and detect times used for the Hayes and TIES escape sequences.

For the Hayes Escape Sequence, S12 specifies the minimum-delay timer (or guard time) before and after the three escape characters that is required for the modem to detect the Hayes Escape Sequence.

For TIES, S12 specifies the maximum time limit that must elapse after receiving the three escape characters (and no other characters) before sending an OK message to the DTE.

Range: 0–255 (1/50 of a second)

Default: 50 (equals 1 second)

Note that a value of S12=0 means "switching off" the escape sequence, so it wont be recognized then.

S14 – Bit-Mapped Options

S14 is a read-only register that indicates AT command settings.

Bit 0	0	Reserved
Bit 1	0	E0 is selected
	1*	E1 is selected
Bit 2	0*	Q0 is selected
	1	Q1 is selected
Bit 3	0	V0 is selected
	1*	V1 is selected
Bit 4	0	Reserved
Bit 5	0*	T (tone) dial is selected
	1	P (pulse) dial is selected
Bit 6	0	Reserved
Bit 7	0	Answer
	1*	Originate

S21 – Bit-Mapped Options

S21 is a read-only register that indicates AT command settings.

Bit 0	0	Reserved
Bit 1	0	Reserved
Bit 2	0	Reserved
Bit 3	0	Reserved
Bit 4	0	Reserved
Bit 5	0	&C0 is selected
	1*	&C1 is selected
Bit 6	0*	&S0 is selected
	1	&S1 is selected
Bit 7	0*	Y0 is selected
	1	Y1 is selected

S22 – Bit-Mapped Options

S22 is a read-only register that indicates AT command settings.

Bits 1-0	00	L0 is selected
	01	L1 is selected
	10*	L2 is selected
	11	L3 is selected
Bits 3-2	00	M0 is selected
	01*	M1 is selected
	10	M2 is selected
	11	M3 is selected
Bits 6-4	000	X0 is selected
	001	Reserved
	010	Reserved
	011	Reserved
	100	X1 is selected
	101	X2 is selected
	110	X3 is selected
	111*	X4 is selected

| Bit 7 | 0* | Reserved |
| | 1 | Reserved |

S23 – Bit-Mapped Options

S23 is a read-only register that indicates AT command settings.

Bit 0		Reserved

Bits 3-1	000	0-300 bps communications rate
	001	1200 bps
	010	2400 bps
	011	4800 bps
	100	Reserved
	101	9600 bps
	110	19,200 bps
	111	>=38.4 bps

Bit 5,4	00	Even parity/space parity
	01	No parity
	10	Odd parity/mark
	11	Reserved

Bit 7,6	00	&G0 is selected
	01	&G1 is selected
	10	&G2 is selected
	11	Reserved

S25 – Detect DTR Change

S25 defines the minimum amount of time that DTR has to remain off (that is, on-to-off-to-on transitions) before the modem performs the function specified by &D command. A change in DTR that persists for a shorter time than the value specified in S25 is ignored by the modem.

Range: 0–255 (1/100 of a second)

Default: 5

S30 – Disconnect Inactivity Timer

This S-register sets the length of time (in minutes) that the modem stays online/off-hook before disconnecting when no data is being transmitted or received. In data and fax modes, any data transmitted or received between the DTE-DCE interface resets the timer. In all other modes (except Telephone-Emulation mode), any data transmitted resets the timer. In Telephone-Emulation mode, S30 is ignored (that is, the modem does not automatically hang up the line after a given time delay).

Range: n = 0–255 minutes

n = 0   Disabled

S33 – Sleep Mode Timer

S33 determines when the modem enters sleep or power-down mode. When enabled (S33 not equal to 0), the controller enters sleep mode whenever the modem has been inactive for a user-programmable time delay (S33). The modem is considered to be in an inactive state when:

1) No internal processing is being performed;
2) No activity occurs between the host and the modem within a specified time period;
3) The modem is off-line.

The modem exits sleep mode whenever the host reads or writes to the modem or when a ring signal is detected. Sleep mode is disabled by setting S33 to '0'.

Range: 0–90 seconds

Default: 10 seconds

S37 - Maximum line speed attempted

This S-register selects the maximum line speed allowable. Settings fpr Bn, +MS=n, Nn and S37 determine the allowable modem connections. S37 provides the same information as the +MS=m *<max rate>* parameter and changing this parameter automatically changes the value of S37. Note that S37 has no effect during V.32bis retraining/rate negotiation.

n = 0	DTE rate		n = 18	31200
n = 1	Reserved		n = 19	33600
n = 2	Reserved		n = 20	36000
n = 3	300		n = 21	33333
n = 4	Reserved		n = 22	37333
n = 5	1200		n = 23	41333
n = 6	2400		n = 24	42666
n = 7	4800		n = 25	44000
n = 8	7200		n = 26	45333
n = 9	9600		n = 27	46666
n = 10	12200		n = 28	48000
n = 11	14400		n = 29	49333
n = 12	16800		n = 30	50666
n = 13	19200		n = 31	52000
n = 14	21600		n = 32	53333
n = 15	24000		n = 33	54666
n = 16	26400		n = 34	56000
n = 17	28800		n = 35	57333

9   GLOSSARY

AAE	Automatic answering equipment
AM	Amplitude modulation
BPS	Bits per second
DCE	Data communication equipment (for example: modem)
DTE	Data terminal equipment (for example: personal computer)
DTMF	Dual-tone multifrequency (touchtone) dialing
DPSK	Differential phase-shift keying
ETX	End of text
FCS	Frame checking sequence
FM	Frequency modulation
FSK	Frequency shift keying
LRC	Longitudinal redundancy check
MFV	Multi-frequency (touchtone) dialing
MNP®	Microcom® Networking Protocol (proprietary process for error checking and data compression)
PM	Phase modulation
PSK	Phase shift keying
QAM	Quadratic amplitude modulation
Retrain	Modem resynchronizes when line conditions change
STX	Start of text
IWV	Pulse dialling method ("Impulswahlverfahren")

10 ITU-T RECOMMENDATIONS

The following standards have been established by the International Telecommunications Union-Telecommunications.

V.21	300 bps, full-duplex, synchronous and asynchronous, 2-point FSK
V.22	1200 bps with fallback to 600 bps, full-duplex, synchronous and asynchronous 4-point FSK
V.22 bis	2400 bps with fallback to 1200 bps, full-duplex, synchronous and asynchronous 16-point QAM
V.23	1200/1200 bps in four-wire operation, 1200/75 bps in two-wire operation, 600/600 bps in four-wire operation, 75/1200 bps in two-wire operation, 75/600 bps in two-wire operation, 75/75 bps in two-wire operation, synchronous and asynchronous, FSK
V.24	List of definitions for interface cabling between DTE and DCE
V.25	Automatic call-answering equipment and/or parallel dialing equipment in the public telephone dialing system
V.25 bis	Automatic dialing and/or call-answering equipment in the public telephone dialing system
V.26	2400 bps with fallback to 1200 bps, four-wire dedicated line, four-phase differential modulation
V.26 bis	2400 bps with fallback to 1200 bps, dialing line operation, half-duplex, synchronous, four-phase differential modulation
V.26 ter	2400 bps with fallback to 1200 bps, dialing and two-wire dedicated line operation with echo elimination, full-duplex, synchronous, differential phase modulation
V.27	4800 bps with fallback to 2400 bps, four-wire dedicated line operation, 8-phase differential modulation, synchronous, half/full-duplex
V.27 bis	4800 bps with fallback to 2400 bps, full or half-duplex in four-wire, dedicated line operation, 8-phase differential modulation at 4800 bps; 4-phase differential modulation at 2400 bps
V.27 ter	4800 bps with fallback to 2400 bps, dialing line operation, half-duplex; with 8-phase differential modulation at 4800 bps and 4-phase differential modulation at 2400 bps
V.28	Definition of the electrical characteristics of non-symmetrical polar lines
V.29	9600 bps, dedicated line; fallback to 7200 or 4800 bps; 16-point QAM
V.32	9600, 4800 and 2400 bps with fallback to 4800 bps dialing line or dedicated line operation; synchronous and asynchronous, echo suppression; 16/32-point QAM; differential trellis coding and/or non-redundant coding, full-duplex
V.32 bis	14,400 bps data transmission speeds. Use trellis-coded modulation and echo cancellation to send 6 data bits per baud period at 2400 baud.
V.34	Data rates of 28,800 bps. Increases speed by using a larger bandwidth than V.32 bis. After a connection, the modems negotiate optimize the carrier frequency, data encoding scheme, and transmission power to the line conditions.
V.42 bis	Transparent error correction and data compression procedure, data compression using the Lempel-Ziv algorithm. Compression ratios of 3:1.
V.34 bis	Data rates to 33,600 bps.
V.90	Receive data rates to 56,000 bps and transmit data rates to 33,600 bps.
V.92	Receive data rates to 56,000 bps and transmit data rates to 48,000 bps