

V.3229/V.3229L
Manual

Compliments of
ARC ELECTRONICS
800-926-0226 / 281-392-6333

<http://www.arcelect.com/>
arc@arcelect.com

Chapter 5 Asynchronous Operating Commands

GENERAL

This chapter describes the AT commands used to select options and to operate and test the modem.

COMMAND CATEGORIES

The modem offers eight major categories of command statements:

- Response
- Dial
- Terminal Interface
- Test
- General
- Configuration
- Security
- Protocol

OPERATION MODES

During asynchronous operation the modem functions in one of three modes:

- Offline Command Mode
- Online Command Mode
- Data Mode

Offline Command Mode

In offline command mode (generally referred to as command mode), the modem communicates with the computer or terminal. Commands can be entered separately or in strings. There is no data communication link established in this mode.

Online Command Mode

This mode is entered from the data mode after the escape command has been entered. The data communication link remains established but data transmission is suspended. The modem will now accept commands like it does in the offline command mode.

Data Mode

The modem goes to data mode (online) after it acknowledges the proper signal and successfully connects with a compatible modem. In data mode, the modem sends and receives data, but will not accept or execute command instructions.

SENDING COMMANDS TO THE MODEM

When the computer, modem, and monitor are on, an instruction can be sent to the modem telling it what function or activity to perform. The instruction, called a command statement, command string, or just command, is typed using the computer keyboard. The command statement temporarily resides in a section of memory called the command buffer.

Each command statement is made up of characters, numbers, and such keyboard symbols as the & and % signs. Commands must be written in a specific form so the modem recognizes and follows the instruction.

To create a command statement use the following steps:

- Type AT. This is the Attention Code telling the unit a command statement follows.
- Type the command.
- Press the return key to "Enter" or send the command statement to the modem.

An example of a command statement using the dial command (D) follows.

ATD555-1212

This statement can be read as:
Attention: Dial 555-1212.

Another example is:
Enter ATZ.

This means Attention: execute the Z command.

After entering a command line the modem returns a response message. If the command is accepted "OK" is returned. If the command is not accepted "ERROR" is returned

To clear command statements from the buffer perform one of the following:

- Turn the modem off
- Enter AT
- Use the DTR reset feature.

The attention code (AT) is analyzed by the modem to determine the transmission speed, parity, and bits per character used by the DTE. This autobaud process is repeated each time the AT command prefix is sent.

Autobaud

Guidelines for Creating Command Statements

When typing command statements, note the following:

- The attention code (AT) may be upper or lower case but not a combination like at.
- Return must be pressed to execute (Enter) a command.
- The command buffer can hold 40 characters.
- Use the backspace or delete key to erase the last character.

Even though the initial AT code must be all upper or lower case, characters that follow can be any mix of upper and lower case.

Monitor Display

As commands are typed they appear on the monitor so the operator can verify the input. This is called local character echo. The echo may be turned on or off using AT commands. Refer to Local Character Echo in the General Commands section of this chapter for details.

Command Buffer

The modem temporarily stores up to 40 characters in the command buffer. If this limit is exceeded, the modem does not accept the command and sends an ERROR message. To correct this condition, retype the command using 40 characters or less.

The AT characters and punctuation used in telephone numbers do not take up space in the buffer. Also, blank characters used as spaces to help increase readability are not counted. For example, the modem reads the commands

```
ATD (212) 555-1212
ATD2125551212.
ATD 212 555 1212
```

as having 11 characters each. Commands can be typed in any of these forms.

Backspace Key

Use the backspace key to change the command statement or correct errors. The backspace key allows the cursor to be moved back to the character(s) in error. The command can then be retyped from that point.

Example: ATD5551211 has been typed. To change the last 1 to 2, press the backspace key once, type 2, and press return to execute the command.

Repeating a Command A/

This command tells the modem to repeat the last command stored in its buffer. It automatically reexecutes the command without retyping. The return key does not need to be pressed.

Example: The ATD5551212 command has been executed, and the phone is busy. To repeat the instruction type A/, but do not use AT before this command as AT would empty the buffer and there would be no command to repeat.

Numbered Commands

Series of commands that start with the same letter are distinguished by a number following the letter.

For example, the M0 command selects speaker always off, M1 speaker on until carrier detected, and M2 selects speaker always on.

In all cases, the zero (0) may be omitted so the commands M and M0 are identical.

For clarity, this manual uses the nonzero form of commands. The modem treats both the same but zeros count against the buffer total.

Group Commands

A group of commands can be typed in a single command statement. Pressing the return key sends the entire command string to the modem, which executes each command individually in the order it appears in the command statement reading from left to right.

For example, the command statement ATQ0V0L3DT5551212 means

- AT Attention.
- Q Allow response messages to be sent.
- V Select digit code responses.
- L3 Select high volume.
- DT Tone dial 555-1212.

The modem executes the AT command followed by the Q,V,L,D, and T commands. ATQ0V0L3DT5551212 can be read as ATQVL3DT5551212. Eliminating zeros reduces the number of characters, allowing more room in the buffer.

The dial D command initiates the dial process so no other commands, only dial modifiers, can follow it.

RESPONSE COMMANDS

The modem communicates with the operator through response messages. These appear on the monitor or a computer printout to show the result of the command or action executed. Response messages can appear as words or numbers.

Digit / Word Selection

V tells the modem which type of response message to show on the monitor. Some software requires digit response messages but words are easier to remember.

Command	Operation
V	Enables digit response messages
V1	Enables word response messages*

*default

Response Displays

The Q command enables or disables response messages. The modem still responds to commands when the response display is inhibited.

Command	Operation
Q	Response display on *
Q1	Response display off
Q2	Response display on in originate mode only

*default

Response messages may be sent to the DTE at the DTE rate or the current DCE rate. Refer to S39 in Chapter 6 for further information.

Response Commands, Cont.

Call Progress and Connect Speed Displays

The X command selects connect / message displays and dialing options such as call progress monitoring, busy signal or dial tone detection and blind dialing.

Command	Operation
X	Dial tone and busy signal detection not selected; CONNECT (code 1) response messages displayed for all speeds
X1	Dial tone and busy signal detection not selected; appropriate CONNECT response messages or codes displayed for data rate
X2	Dial tone detection only; NO DIAL TONE message or code appears if dial tone not detected within 5 sec
X3	Busy signal detection only; BUSY message or code appears if dialed number is busy
X4	Dial tone and busy signal detection; appropriate CONNECT message or code displayed *

*default

X followed by a dial command causes the modem to go off hook, wait the amount of time set in register S6, and dial the number. If connection is made the modem returns a CONNECT (code 1) message to the screen regardless of the speed of connection. With a basic response, the modem will not detect a busy or no dial tone condition.

X1 followed by a dial command causes the modem to go off hook, wait the amount of time set in register S6, and dial the number. If connection is made the modem returns an appropriate CONNECT message or code to the screen. The modem will not detect a busy or dial tone signal.

Response Commands, Cont

X2 followed by a dial command causes the modem to go off hook and wait for a dial tone before dialing. If a dial tone is not detected within 5 seconds, the modem sends a NO DIALTONE message and hangs up. The modem will not detect a busy signal in this mode.

X3 followed by a dial command causes the modem to go off hook, wait the amount of time set in register S6 and dial the number. If a busy signal is detected, the modem sends a BUSY message and hangs up. If the call is completed, the appropriate CONNECT message similar to X1 will be displayed. The modem will not detect a dial tone signal.

X4 followed by a dial command causes the modem to go off hook and wait for a dial tone before dialing. If a dial tone is not detected within 5 seconds, the modem returns a NO DIALTONE message and hangs up. If a busy signal is detected, the modem returns a BUSY message and hangs up. If the call is completed, the appropriate CONNECT message similar to X1 will be displayed.

The X4 command combines all the features of X1, X2, and X3. The factory setting is X4.

Note: When an X2, X3, or X4 command is in effect, an appropriate CONNECT data rate message or code is displayed as for X1. When a blind dial command (X, X1, X3) is in effect, the modem waits 2 seconds or the time set by S6 and then dials.

Response Commands, Cont

Number Code Application *RC

Some communications software packages use different number codes to indicate the data rate of the serial port. This option selects either of two commonly used number code sets.

Command	Code Set	Number	Operation
*RC	Standard	15	4800 bps
		18	9600 bps
*RC1	Alternate	11	4800 bps
		12	9600 bps

default is *RC

Note: Asterisks in AT commands are part of the command and do not indicate footnotes.

Response Number Codes / Messages

Response number codes, messages, and their corresponding meanings are listed in Table 5-1. CONNECT messages may be selected for output to the DTE at the DTE or DCE rate. If register S39 bit 5 is set to 0, the CONNECT message is sent at the DTE rate; if 1, the message is sent at the DCE rate.

Response Commands, Cont.

Table 5-1
Response Messages

Code	Message	Meaning
0	OK	Command received
1	CONNECT	Connect at 300 bps while X1, X2, X3, or X4 command in effect; all rates while X command in effect
2	RING	Ring detected
3	NO CARRIER	Valid carrier is not detected after call attempt within period specified by register S7, or carrier lost for value of S10 or more
4	ERROR	Command not recognized or too long
5	CONNECT 1200	Connection made at 1200 bps
6	NO DIAL TONE	No dial tone detected for 5 seconds (X2 or X4 command in effect)
7	BUSY	Dialled number busy (X3 or X4 command in effect)
9	CONNECT 7200	DTE rate 7200 bps
10	CONNECT 2400	DTE rate 2400 bps
11, 15	CONNECT 4800	DTE rate 4800 bps
12, 18	CONNECT 9600	DTE rate 9600 bps
13	CONNECT 12000	DTE rate 12000 bps
14	CONNECT 19200	DTE rate 19200 bps
16	CONNECT 38400	DTE rate 38400 bps
17	CONNECT 14400	DTE rate 14400 bps
19	CONNECT 57600	DTE rate 57600 bps
20	CONNECT 0300/REL	MNP 300 bps connection
22	CONNECT 1200/REL	MNP 1200 bps connection
23	CONNECT 2400/REL	MNP 2400 bps connection
24	CONNECT 4800/REL	MNP 4800 bps connection
25	CONNECT 9600/REL	MNP 9600 bps connection
26	CONNECT 19200/REL	MNP 19200 bps connection

Response Commands, Cont.

Table 5-1, Cont.
Response Messages

Code	Message	When Displayed
27	CONNECT 38400/REL	MNP 38400 bps connection
28	CONNECT 7200/REL	MNP 7200 bps connection
29	CONNECT 12000/REL	MNP 12000 bps connection
30	CONNECT 14400/REL	MNP 14400 bps connection
31	CONNECT 57600/REL	MNP 57600 bps connection
36	CONNECT 1200/LAPM	LAPM 1200 bps connection
37	CONNECT 2400/LAPM	LAPM 2400 bps connection
38	CONNECT 4800/LAPM	LAPM 4800 bps connection
39	CONNECT 9600/LAPM	LAPM 9600 bps connection
40	CONNECT 14400/LAPM	LAPM 14400 bps connection
41	CONNECT 19200/LAPM	LAPM 19200 bps connection
42	CONNECT 38400/LAPM	LAPM 38400 bps connection
43	CONNECT 12000/LAPM	LAPM 12000 bps connection
44	CONNECT 7200/LAPM	LAPM 7200 bps connection
45	CONNECT 57600/LAPM	LAPM 57600 bps connection

Note: Connect rates indicate DTE speed.

DIAL COMMANDS

Dial commands let the modem originate a call to another modem. These commands can be used with either tone or pulse dial telephone systems. Commands for call answering are included at the end of this section.

Dialing

To Dial a number, for example 555-1212

Enter AT D 555-1212

The modem dials the number, either pulse or tone, whichever is currently in effect, and takes the role of the originate modem.

Use spaces, hyphens, parentheses, or other punctuation except dial modifiers to make the command line easier to read and enter. For example, these are all treated the same:

AT D 1-800-555-1212
 AT D 1 (800) 555-1212
 ATD18005551212

The dial modifiers are shown in Table 5-2.

Table 5-2
Dial Modifiers

Command	Operation
T	Tone dialing*
P	Pulse dialing
.	Insert a long pause (2 sec or value in S8)
W	Wait for 2nd dial tone
I	Flash (1/2 sec)
R	Switch to answer mode after dialing
@	Wait for silence
:	Return to command mode after dialing
S	Dial stored command line or number

*Default

Dial Commands, Cont.

Tone Dialing

To tone-dial a number sequence, insert a T in the dial command.

AT D T 323-1111

The dialing method selected remains in effect until changed.

Pulse Dialing

To pulse dial a number sequence, insert a P in the dial command

AT D P 555-9902

Insert Long Pause

To insert a long pause in the dialing sequence, use a comma. This inserts a 2 second delay (or the value in register S8).

AT D P 9, 1-800-555-1000

Here the modem pulse dials a 9, pauses for the telephone system to switch to an outside line, then dials the phone number. Comma pauses may be inserted consecutively if desired.

Wait for Second Dial Tone

To wait for a second dial tone insert a W in the dialing sequence.

AT D 9 W 323-8000

Instead of using a comma pause for an outside line, wait up to 30 seconds (time specified by S7) for a second dial tone.

Hook Flash

To flash the switchboard, enter an exclamation mark.

AT D T 9W 323-8000 ,!,, #7 377

This inserts a .5 second on hook condition, usually for transferring a call or similar use.

Dial Commands, Cont.

In this example, the modem tone dials a 9, waits for the second dial tone, dials the phone number, pauses, flashes to start the transfer, pauses twice, then uses #7 to transfer the call to extension 377.

To switch to answer mode after dialing, use an R at the end of the dial sequence.

Switching to Answer Mode after Dialing
R

AT D 555-2345 R

Use this command suffix to call an originate-only modem.

Remaining in Command Mode
;

To remain in command mode after dialing, place a semicolon at the end of the dial string.

AT D 234-5678 ;

The modem will dial the telephone number entered but will not attempt to train when the remote service answers the call.

This is used to retain control so that further dialing tones may be entered with the following:

AT DTn; (n=additional tones to be sent)

Wait for 5 Seconds of Silence
@

To wait for 5 seconds of silence (no answer back tone) after accessing an electronic service, use the @ command.

AT D 399-4700 @ 2251 ;

In this example the modem dials the number and, after the connection waits for 5 seconds. The modem then sends service code 2251 and returns to command mode for further input.

Dial Commands, Cont.

For example, you might enter a dollar amount for a banking transaction by entering

AT D 1400 ;

This sends the sequence 1400 and then returns to the command mode for further entries, according to the requirements of the banking service.

Dialing a Stored Command Line Telephone
S

To dial one of the previously stored numbers, enter ATDSn where n represents a stored telephone number location between 1 and 9.

AT D S9

In this example the number stored in location 9 is dialed.

Note: ATDS and ATDSI are the same.

Autodial Number Location
*AUn

AT*AUn - Selects stored number n (n=1 to 9) to be autodialed. This is the autodial number, which is used for any autodial application.

Voice Calls

To make a voice call, dial the number with the telephone. To use the dial command for the call

AT D (number) ;

The ; recalls the command mode and prevents the modems from training. The remote site must be answered by the telset for the voice call to be successful.

Switching from Voice to Data

After voice communication is complete, place the modems at both ends in DATA mode by pressing the TALK / DATA button.

ANSWERING A CALL

There are three ways to answer a call for data connection.

- Manual
- AT command
- Autoanswer

The most common is autoanswer.

Manual Answer

When the phone rings, answer by pressing the TALK/DATA button.

AT Command Answer

The modem can be made to go off hook in the answer mode by entering ATa when the phone rings. This commands the modem to go to the answer mode and connect.

Autoanswer S0

Autoanswer is controlled by register S0. S0 determines how many rings the modem must receive before autoanswering. S0 can be loaded with a value between 1 and 255 for autoanswer.

Entering ATSO=0 disables the autoanswer feature. Decide which ring the modem is to answer on and set S0 to that decimal value.

When S0 is one or greater, the modem automatically answers on the selected ring and connects with the calling modem.

Note: If the modem is set to respond to DTR, the DTR signal must be on for autoanswer to work.

TERMINAL INTERFACE COMMANDS

The EIA-232 interface connects the modem and DTE. Terminal interface commands control the action of the modem and the terminal in response to the signals being exchanged on the interface connections. Refer to Table 2-1.

Data Carrier Detect &C

When using DCD to indicate a valid carrier, enter AT&C1. Some terminals and other devices require DCD on in order to communicate with the modem; if so, select &C.

Command	Operation
&C	DCD always on*
&C1	DCD is on when the modem recognizes remote modem carrier or, if enabled, when protocol negotiation is complete
&C2	DCD on except for 5 seconds after disconnect
&C3	DCD follows RTS on remote modem. (Simulated switched carrier)

*default

AT&C3 must be enabled on both modems and synchronous or direct mode must be in effect for simulated switched carrier operation.

Data Set Ready &S

These commands control the DSR signal generated by the modem to indicate that the modem is ready for operation. DSR must be on for some terminals and devices to communicate with the modem.

Command	Operation
&S	DSR always on*
&S1	DSR on when off hook in data mode
&S2	DSR off for 5 seconds after disconnect then returns to on
&S3	DSR follows off hook (CH) signal

*default

Terminal Interface Commands, Cont.

Data Terminal Ready &D

In data mode DTR may be used for modem control.

Command	Operation
&D	The modem ignores DTR.*
&D1	The modem goes to command mode from data mode when DTR goes from on to off.
&D2	Disconnects when DTR goes from on to off; disables autoanswer while DTR is off.
&D3	Disconnects, recalls command mode, and resets the modem to a stored configuration when DTR goes from on to off. In dial line mode the modem disconnects; in leased line, the modem retrains.

*default

Note: If DTR controls dialer is selected, then selecting DTR active will cause an autodial after an off-to-on transition of DTR.

VR determines how the ring indicate signal operates on pin 22 of the EIA-232 DTE connector.

Serial Port Ring Indicator (Pin 22) VR

Command	Operation
VR	Causes ring indicate signal on pin 22 to turn on (high) during each ring and remain on during the call
VR1	Causes ring indicate signal on pin 22 to turn on (high) during each ring and turn off (low) when the call is answered*

*default

Terminal Interface Commands, Cont.

Request to Send / Clear to Send &R

When the modem is operating in nonbuffered mode (direct mode) or in synchronous mode, AT&R enables the RTS to CTS delay determined by the value in S26. AT&R1 forces CTS high and the modem ignores RTS (default). With AT&R2 selected CTS goes high when carrier is detected. AT&R9 forces CTS to follow the state of RTS without delay.

Command	Operation
&R	Enables RTS to CTS delay
&R1	CTS forced on*
&R2	CTS follows DCD
&R9	CTS equals RTS

*default

Note: RTS/CTS delay is not valid in buffered mode or with error control enabled.

Note: With AT&R2 selected, XON/XOFF is the only valid method of flow control and &C and &C1 are the only valid carrier detect options.

Terminal Interface Commands, Cont.

**DTE Controlled
Fallback Rate
(Pin 23)
*FB**

Pin 23 of the EIA-232 DTE connector provides a signal input to the modem for DTE fallback. If the modem is not using DTE fallback, set this option to ignore pin 23. To cause the modem to act on high / low levels of pin 23, enable this option. Negative level forces a higher rate for primary data rate; positive forces a lower rate providing a fallback rate.

Command	Operation
FB	Ignore pin 23
*FB1	Transition on pin 23 changes speed

*default

**TEST
COMMANDS
&T**

Diagnostic tests are used to isolate faults in the communications path. Diagnostic tests will terminate after the period of time specified by S18. If S18 is set to 0, the timer is disabled and tests will run continuously. Tests may also be terminated by the AT&T command. When in test modes without test pattern, issue the escape sequence +++ to return to command mode before terminating the test with the AT&T command. Refer to Appendix C for test procedures.

Command	Operation
&T	Terminate any test
&T1	Initiate local analog loopback test
&T2	Initiate remote analog loopback test
&T3	Initiate local digital loopback test
&T4	Grant remote requested digital loopback*
&T5	Deny remote requested digital loopback
&T6	Initiate remote digital loopback test
&T7	Initiate remote digital loopback with test pattern
&T8	Initiate local analog loopback test with test pattern
&T9	Initiate remote analog loopback with test pattern
%T	Transmit test pattern

*default

Note: Local analog loopback with or without test pattern is the only test available in error control mode.

Test Commands, Cont.

Bilateral Test Enable / Disable
*AN
*DG

Enable or disable bilateral test functions.

Command	Operation
AN	Bilateral analog loop disabled
*AN1	Bilateral analog loop enabled
DG	Bilateral digital loop disabled
*DG1	Bilateral digital loop enabled

*default

DTE Controlled Remote Digital Loopback
(Pin 21)
*RD

To enable DTE controlled remote digital loopback, enter AT*RD1. Enabled, the modem goes into remote digital loopback when it detects an off-to-on transition of pin 21 while in the online data mode. Test ends when it detects an on-to-off transition of pin 21 and the modem returns to online data mode. To disable this function enter AT*RD.

Command	Operation
RD	ignore pin 21
*RD1	RDL enabled (pin 21)

*default

DTE Controlled Local Analog Loopback
(Pin 18)
*LA

To enable DTE controlled local analog loopback test, enter AT*LA1. Enabled, the modem goes into local analog loopback when it detects an off-to-on transition of pin 18. Test ends when it detects an on-to-off transition of pin 18. To disable, enter AT*LA.

Command	Operation
LA	ignore pin 18
*LA1	LAL enabled (pin 18)

*default

GENERAL COMMANDS

Changing from Data Mode to Command Mode
+++

These commands control various standard options that in most cases apply to any mode of operation. To exit data mode and go to online command mode, press the escape character three times (+ is the default). Pause for the length of time set by register S12 (1 second is the default) before and after the +++ to ensure the modem recognizes the escape command.

This sequence temporarily suspends data transmissions and allows command mode operations without disturbing the telephone line connection. The modem responds with OK when it detects the escape code. Return to data mode by entering ATO.

Note: The AT command set must be enabled.

Local Character Echo
E

Type AT without a carriage return. If the screen shows AT character echo is correct. Proceed with other commands as desired.

If the screen shows AATT enter the ATE command to correct the double characters or disable the local echo on the terminal.

If the screen shows no characters, type ATE1 to turn the echo on or enable local echo on the terminal.

Command	Operation
E	Echo off
E1	Echo on*

*default

General Commands, Cont.

Online State Character Echo
F

In some lower speed modems the ATF command determines if characters are echoed to the DTE from the modem when online. This function is generally controlled by the communications software. The modem does not support online character echo.

Hanging Up
H

To end a call, enter ATH. This tells the modem to disconnect and go on hook. The modem must be in online command mode to use this command.

EPROM Check
ATI I

PC software packages may issue the ATI command to verify the modem will support all commands needed by the software package. The modem returns ASCII characters representing the model and revision level. To request the CRC to be calculated on the EPROM, enter ATII. The modem returns four ASCII characters representing the CRC in hexadecimal form. Enter ATI3 to request the product version.

Command	Operation
I	Request product code
I1	Request EPROM CRC value
I3	Request product version

Speaker Volume
L

ATL commands offer three volume levels.

Command	Operation
L, L1	Speaker volume low
L2	Speaker volume medium*
L3	Speaker volume high

*default

General Commands, Cont.

Speaker Control
M

ATM commands enable or disable the speaker for monitoring purposes.

Command	Operation
M	Disables the speaker
M1	Disables the speaker while receiving a carrier signal*
M2	Speaker always on
M3	Disables the speaker while dialing and after a carrier is detected

*default

Return Online
O

Use the O command when operating in the online command mode and need to return to data mode. It returns the modem to the same mode (originate or answer) that it was in before escaping to the (online) command mode.

Long Space Disconnect
Y

One method of disconnecting two modems is called long space disconnect. When any disconnect condition is detected by the local modem, it will send 4 seconds of data space condition to the remote modem before disconnecting. This signals the remote modem to disconnect. The local modem will disconnect if it receives 1.6 or more seconds of data space condition from a remote modem. If break sequences of 1.6 or more seconds are to be sent, enter ATY to disable this feature and prevent unintentional disconnects.

Note: This option must be disabled if SDLC NRZI data is used.

General Commands, Cont.

Command	Operation
Y	Long space disconnect off
Y1	Long space disconnect on*

*default

Guard Tones &G
Guard tones are not used in the United States. If required where operating the unit, select the appropriate guard tone.

Command	Operation
&G	No guard tone*
&G1	550 Hz guard tone
&G2	1800 Hz guard tone

*default

Dial / Leased Line &L
&L selects line operation as required.

Command	Operation
&L	Dial (switched)*
&L1	Leased (private) 2-wire
&L2	Leased (private) 4-wire

*default

Asynchronous / Synchronous Mode Selection &M
The AT&M commands select synchronous or asynchronous operation and synchronous dial method.
AT&M selects asynchronous data and dial mode.

AT&M1 selects synchronous data mode 1. Calls are placed asynchronously. Operation switches to synchronous after connecting with the remote modem.

General Commands, Cont.

AT&M2 selects synchronous data mode 2. The modem automatically dials a stored number when it detects a DTR off-to-on transition. The appropriate DTR option must be selected.

AT&M3 selects synchronous data mode 3. Calls are placed manually.

AT&M4 selects synchronous data mode 4 with V.25 bis autodialer set for Bisync protocol.

AT&M5 selects synchronous data mode 5 with V.25 bis autodialer set for SDLC protocol.

Use register S30 to select NRZ/NRZI for protocol data format if using SDLC.

Command	Operation
&M	Asynchronous mode*
&M1	Sync mode 1
&M2	Sync mode 2
&M3	Sync mode 3
&M4	Sync mode 4 with V.25 bis Bisync
&M5	Sync mode 5 with V.25 bis SDLC

*default

Caution: Synchronous terminal equipment must be available to communicate with the modem if the V.25 bis dialer is enabled.

General Commands, Cont.

Make / Break Dial Pulse Ratio &P
Using AT&P, the dial pulse is on for 39% and off for 61% of one cycle. Using AT&P1, the dial pulse is on for 33% and off for 67% of one cycle.

Command	Operation
&P	39% : 61% US and Canada*
&P1	33% : 67%

*default

Synchronous Transmit Clock Source &X
The AT&X commands select internal, external, or receive clock as the transmit clock source.

Command	Operation
&X	Internal clock*
&X1	External clock
&X2	Receive clock

*default

DCE Speed %B
AT%B sets the originating DCE speed to follow the DTE speed. When originating a call the two modems will not connect at a speed faster than the lower DCE speed setting of the two modems. To allow the modem to transmit data at a speed different from DTE speed, enter AT%Bn (n=1 to 9).

General Commands, Cont.

Command	Operation
&B	Use DTE speed
&B1	300 bps
&B2	1200 bps
&B3	2400 bps
&B4	4800 bps
&B5	9600 bps
&B6	9600 trellis
&B7	7200 trellis
&B8	12000 trellis
&B9	14400 trellis*

*default

Disconnect Buffer Delay %D
Sets a delay during which the modem processes data in its transmit and receive buffers before disconnecting. When a condition exists which causes a disconnect, the modem tries for n seconds to empty its buffers. When the buffers are empty or if n=0, the modem disconnects immediately.

Command	Operation
%D	Disconnect buffer delay disabled*
%Dn	Disconnect buffer delay value (seconds)

*default

Auto Retrain %E
This option allows the modem to automatically retrain in response to poor received signal quality without retuning. The modem always responds to a retrain request from the remote modem.

Command	Operation
%E	Disable auto retrain
%E1	Enable auto retrain*

*default

General Commands, Cont.

Auto Rate Renegotiation
%R

If auto rate renegotiation is enabled, the modem automatically decreases DCE rate if signal quality deteriorates beyond the allowable bit error rate. If signal quality improves, the modem increases DCE speed.

Command	Operation
%R	Disable auto rate renegotiation*
%R1	Enable auto rate renegotiation using low BER: 1 in 10 ⁵
%R2	Enable auto rate renegotiation using medium BER: 1 in 10 ⁶
%R3	Enable auto rate renegotiation using high BER: 1 in 10 ⁷

*default

Product Revision Level
%V

%V displays the product revision level.

Product Serial Number
\$V

\$V displays the product serial number.

Permissive / Programmable
%Z

For dial-up operation the modem transmitter output can be set in two different modes of operation. In permissive (RJ11 jack), transmit output level is set to -10 dBm. In programmable (RJ45 jack) operation, the transmit level is set by an external program resistor.

Command	Operation
%Z	RJ11 (permissive)*
%Z1	RJ45 (programmable)

*default

General Commands, Cont.

Dial Backup
*DB

Note: Asterisks in AT commands are part of the command and do not indicate footnotes.

*DB determines whether the dial backup mode is manual or automatic.

Command	Operation
DB	Manual dial backup operation
*DB1	Automatic dial backup operation

*default

V.32 Fast Train
*FT

The V.32 fast train option is used to reduce training time when operating over high quality, limited distance dial or 2-wire leased lines.

Command	Operation
FT	Disable fast train
*FT1	Enable fast train

*default

Return to Leased Line from Dial Backup
*LB

During dial backup operation, *LB causes the modem to return to leased line operation. If dial backup operation is set for manual the dial line connection is dropped immediately when returning to leased line from dial backup.

General Commands, Cont.

Line Current Disconnect
*LC

Dial line operation only. The modem can be configured to disconnect upon loss or interruption of telephone line current.

Command	Operation
*LC	Line current disconnect off
*LC1	Line current disconnect short (8 ms)
LC2	Line current disconnect long (90 ms)

*default

Manual Dial Backup
*LD

Leased line operation only. *LD dials the autodial number if the modem is in originate mode with manual dial backup selected.

Disable AT Command Set
*NT

AT*NT disables the AT command set.

AT*NT1 allows a modem to enable AT command operation of another modem via remote configuration.

Command	Operation
*NT	Disable AT command set
NT1	Enable AT command set at remote site

*default

To enable AT commands locally, scroll through the LCD menu to the CHANGE DTE OPTIONS? sub-menu. Scroll to AT COMMAND SET ENABLE / DISABLE.

On L models, press the TALK/DATA button for 5 seconds. The TD LED flashes indicating that the AT command set has been enabled.

General Commands, Cont.

Answer / Originate
*OR

*OR forces the modem to answer or originate mode. This option is used during 2- and 4-wire leased line operation with error correction and / or dial backup.

Command	Operation
OR	Force originate
*OR1	Force answer

*default

Leased Line Transmit Level
*TLn

Command	Operation
*TLn	Sets leased line TX level to n where n is a number 0 to 21 corresponding to a TX level of 0 to -21 dbm

default is 0 dbm

Dial Line Transmit Level
*TDn

Command	Operation
*TDn	Sets dial line TX level to n where n is a number 9 to 21 corresponding to a TX level of -9 to -21 dbm

default is -10 dbm

CONFIGURATION COMMANDS

These commands recall various profiles for insertion into the active profile, store the active profile and telephone numbers in nonvolatile memory, and designate the powerup profile. Remote configuration is discussed at the end of this section.

Storing a Configuration &W

The &W commands store the current configuration options in one of two nonvolatile memory locations (Figure 5-1). The stored configurations are retained in memory even when power is off, or until &W is issued with a new configuration.

Command	Operation
&W	Store options to user option set 1
&W1	Store options to user option set 2

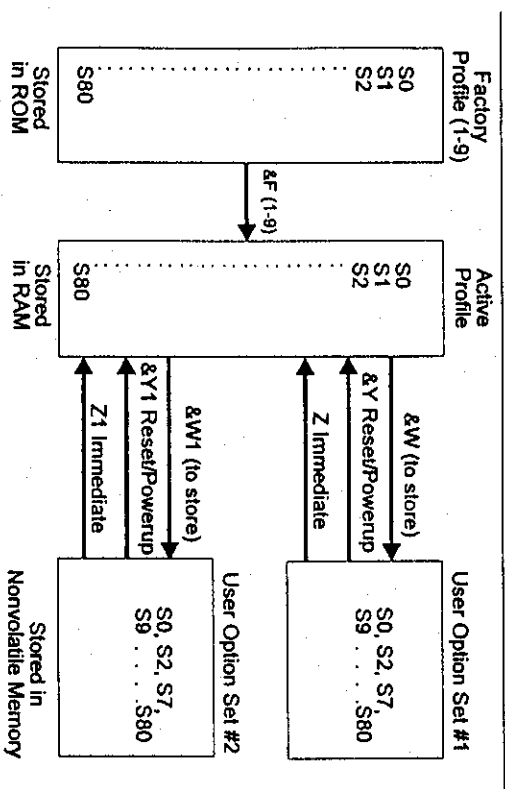


Figure 5-1
Configuration Storage and Recall

AutoConfigure Commands

The AutoConfigure feature is controlled by either the &F, &Y, or Z command. AutoConfigure loads an entire preselected group of options with a single command.

Powerup Option Set &Y

The &Y command determines which user option set is loaded during powerup and reset.

Command	Operation
&Y	Powerup with user option set 1
&Y1	Powerup with user option set 2
&Y7	Displays currently selected powerup option set

Load Factory Options &F

The AT&Fn command loads one the existing factory option sets. Refer to Appendix D for a complete list of the options in each set.

Command	Operation
&F, &F1	Load factory option 1 (async dial-up with V.42 bis)*
&F2	Load factory option 2 (async dial-up without V.42 bis)
&F3	Load factory option 3 (sync dial-up without V.42 bis)
&F4	Load factory option 4 (sync 4-wire leased line without V.42 bis)
&F5	Load factory option 5 (async 4-wire leased line with V.42 bis)
&F6	Load factory option 6 (async 4-wire leased line without V.42 bis)
&F7	Load factory option 7 (sync 2-wire leased line normal originate)
&F8	Load factory option 8 (sync 2-wire leased line forced answer)
&F9	Load factory option 9 (sync V.25 bis dialer)

*default

Configuration Commands, Cont.

Reset to Stored Configuration
Z

The Z commands reset the modem and immediately load either user option set 1 or 2 as the current configuration. This command saves time once a proven configuration is established.

Command	Operation
Z	Resets the modem and immediately loads user option set 1
Z1	Resets the modem and immediately loads user option set 2

View Configuration Profiles / Received Signal Options
&V

&V allows the user to view the current configuration profile in the form of S-register values. &V1 displays the received signal parameters or characteristics.

Command	Operation
&V	Displays configuration profiles
&V1	Display received signal characteristics

Storing a Telephone Command Line
&Z
*CN, x
*ND

Nine stored phone number locations of up to 31 characters each are available in nonvolatile memory. Normally, one phone number per location is accommodated. However, a phone number longer than 31 characters can overflow into the next location. Any spaces remaining in the overflowed location cannot be used for another number. The stored phone number is retained until replaced by another number. Modem power can be turned off without affecting stored information.

Two commands can store phone numbers:

- AT&Z inserts a phone number in location one only.
- AT*CN inserts a phone number in locations one through nine.

Configuration Commands, Cont.

To store a telephone command line in location one enter

AT&Z

followed by the desired command sequence of digits and modifiers.

AT&Z 555-1212

In this example the command sequence to dial the indicated number is stored at location 1 for later dialing.

Note: Neither the AT prefix nor the D command should follow the &Z.

AT&Zn - Stores telephone number n, including dial modifiers, at location 1 (up to 31 digits).

AT*CNx,n - Stores telephone number n, including dial modifiers, at location x (x=1 to 9).

AT*CNx, - Clears telephone number location x

AT*ND - Displays the stored numbers (1-9).

Configuration Commands, Cont.

Retaining / Restoring Options *RO

This option is used when the modem is shared by two or more DTEs.

When options are retained, the current configuration is not altered at disconnect. With options restored, the modem returns to the previously stored configuration on disconnect.

When options are restored at disconnect, the following commands return OK but are not executed:

- AT*CN Store telephone number
- AT&Z Store telephone number
- AT&F Recall factory configuration
- AT&W Store current configuration

Command	Operation
RO	Retain options at disconnect
*RO1	Restore options at disconnect

*default

REMOTE CONFIGURATION

Remote Security Code %P=D

A security code prevents unauthorized access to remote configuration mode. This code is separate from DTE security passwords, which are discussed under Security in the next section. The security code is user programmable and can be set to any value from a single 0 to any combination up to 999999999 using the AT%P=<desired code> command.

Example: If the remote modem security code is 12345, then the local modem must include this code in the initialization string before the remote modem responds.

Configuration Commands, Cont.

Command	Operation
%P=	Sets security code to a value 0 to 999999999 entered after the equal sign
%P?	Request local security code to be displayed
%P=D	Access for remote configuration is not possible when security code is disabled
%P=<blank>	Clears security code*

*default

The %P=D command disables remote configuration. To enable remote configuration, insert another security code.

Entering Remote Configuration %T=

This mode of operation allows the modem user to view or modify the option set of a compatible remote modem. Entering AT%T= (security code of remote) initiates remote configuration.

The modem is shipped from the factory with security code <blank>. This allows initiate remote configuration by using <blank> as the security code.

Command	Operation
%T=	This command followed by the correct security code establishes remote configuration
&T	Exits remote configuration

SECURITY COMMANDS

The following AT commands operate security. Refer to Chapter 4 for information on operating with security.

**Set Password
\$S=x**

Entering AT\$S=x sets an empty password location to x. This command only applies when no password or only one is stored in memory. It can not be used to change a password.

**Changing a Password
\$C=x, y**

AT\$C=x, y changes either password where x represents the old password and y is the new one.

**Deleting a Password
\$C=x-**

AT\$C=x- deletes password x from memory. Security is automatically disabled if the last password is deleted.

**Security Reset
\$DR**

This command resets security to its initial state (Off with no passwords stored). The option is not available in remote configuration.

**Disabling Security
\$D=x**

AT\$D=x disables security where x is either password.

**Security Status
\$D?
\$E?
\$E7**

AT\$D? or AT\$E? displays the current status of security (on or off).

**Enabling Security
\$E=x**

AT\$E=x enables security where x is either password.

x and y indicate passwords

PROTOCOL COMMANDS

These commands enable or control the various data compression, flow control, and error correction options of the modem. Table 5-3 illustrates mode and condition availabilities.

Table 5-3

Operating Modes and Features Available

Operating Mode	Error Correction	Data Compression	Flow Control	Data	Constant Speed Interface
Normal	Disabled	Not applicable	Allowed	Buffered	On or off
Direct	Disabled	Not applicable	Not applicable	Not buffered	DTE=DCE (slaved)
Reliable (MNP and LAPM)	Enabled	On or off	Allowed	Buffered	On or off
Auto-reliable (MNP and LAPM)	Enabled	On or off	Allowed	Buffered	On or off

Serial Port (DTE) bps Adjust

The ATU command allows DCE and DTE to operate at different speeds. The ATU1 command forces serial port (DTE) speed to follow data link speed in any mode.

If the modem is in direct mode (U1) and a DCE link is established at a speed other than that of the original DTE autobaud speed, the modem will issue the CONNECT message for the new DTE speed at the original rate. All subsequent data will be sent to the DTE at the new DCE speed.

Command	Operation
U	Disable slaved DTE/DCE (constant speed DTE on)*
U1	Enable slaved DTE/DCE (constant speed DTE off)

*default

Protocol Commands, Cont.

V.42 Optional
Detection Phase
M

This is a data sequence that speeds up the LAPM link negotiation time if V.42 LAPM is supported by the remote modem.

Command	Operation
M	Disable V.42 fast detect phase
M1	Enable V.42 fast detect phase*

*default

Operating Mode
M

Sets the error control mode that the modem uses while in data mode. An ATNn command issued during online command mode will not affect the current connection but will be acted on for subsequent connections. LAPM or MNP protocol operation is referred to as reliable mode, and the auto-reliable modes allow protocol fallback. Refer to Chapter 8 for descriptions.

Command	Operation
N	Normal mode - no error control; data buffered
N1	Direct mode - no error control; data not buffered
N2	MNP only - try MNP, disconnect if not successful
N3	MNP or normal - try MNP; fallback to normal async
N4	LAPM only - try LAPM; disconnect if not successful
N5	LAPM or normal - try LAPM; fallback to normal
N6	LAPM or MNP - try both protocols; disconnects if not successful
N7	LAPM, MNP, or normal - try both protocols; fallback to normal if not successful*

*default

Protocol Commands, Cont.

Auto-Reliable
Fallback Character
%An

Selects the ASCII character to be recognized as the auto-reliable fallback character by the answering modem. During negotiation of protocol in auto-reliable mode, the answering modem switches from reliable to normal mode when receiving the auto-reliable fallback character from the calling modem and passes the character to the serial port.

Enter AT%An to set the auto-reliable fallback character (n=1 - 127 decimal representing an ASCII character).

The default of 0 disables auto-reliable fallback character.

Command	Operation
%A	Sets ASCII character to be recognized as the auto-reliable fallback character

Note: The modem must be set for auto-reliable mode (ATN3, N5, N7).

Protocol Result
Codes
IV

Enable or disable protocol result codes. Table 5-1 lists these.

Command	Operation
IV	Disable protocol result codes*
IV1	Enable protocol result codes

*default

Protocol Commands, Cont.

Serial Port Flow Control

IQ Sets the type of flow control used by the serial port. If the serial port speed exceeds that of the modem connection, characters may be sent by the DTE to the modem faster than it can send them to the remote modem. The modem holds characters in an internal buffer until they can be transmitted. When this buffer is full the modem uses flow control to stop data from DTE. As the modem continues to transmit data and the buffer empties, flow control is again used to cause the DTE to resume sending data.

ATIQ--IQ3 affect both DTE and DCE flow control.

ATIQ4--IQ7 affect only flow control by the DCE.

ATIQ disables flow control.

When ATIQ1 is set, the modem generates and accepts XON/XOFF characters to start and stop the data flow. These characters have the same parity as the DTE setup taken from the last AT command.

ATIQ2 allows use of CTS off to stop the data from the DTE and CTS on to restart it.

ATIQ3 forces the modem to act on CTS like IQ2. In addition RTS on / off is used to facilitate starting and stopping data from the modem to the DTE.

ATIQ4 disables flow control from the DCE.

ATIQ5 enables XON/XOFF flow control from the DCE only.

ATIQ6 and IQ7 force the modem to use CTS like IQ2 does but do not affect flow control by the DTE.

Protocol Commands, Cont.

Command	Operation
IQ	Disable DTE flow control
IQ1	Enable DTE XON/XOFF flow control*
IQ2	Enable CTS flow control to the DTE
IQ3	Enable bilateral CTS/RTS flow control
IQ4	Disable DCE flow control
IQ5	Enable DCE XON/XOFF flow control*
IQ6	Enable CTS flow control to the DTE
IQ7	Enable CTS flow control to the DTE

*default

XON/XOFF Pass Through

This option is active when flow control of the modem by the DTE has been selected for XON/XOFF and the connect mode is reliable or normal. It enables or disables the sending of local flow control characters (XON/XOFF) to the remote modem as well as being acted on in the local modem. In reliable mode the modem treats incoming XON/XOFF characters from the remote modem as data characters. In normal mode the modem will look at the IQ command and act accordingly.

Caution: With VI in effect local flow control characters will be sent to the remote system. These characters may turn on the data flow from the remote system before the modem is ready to receive more data, possibly resulting in data loss.

Protocol Commands, Cont.

Command	Operation
X	Process but do not pass XON/XOFF characters to remote DCE*
X1	Process and pass XON/XOFF characters to remote DCE

*default

Data Link Flow Control

Enables or disables flow control used to pace data sent from the remote modem to the local modem during a normal connection. When ATG1 is set, the modem uses XON/XOFF to start / stop data transmission from the remote modem. This command is ignored during a reliable connection.

Command	Operation
VG	Disable data link flow control*
VG1	Enable data link flow control

*default

Break Control

Use ATKn (n=0-5) to indicate the action taken by the modem when a break is encountered.

Command	Operation
KB	Break option 0
KB1	Break option 1
KB2	Break option 2
KB3	Break option 3
KB4	Break option 4
KB5	Break option 5*

*default

Protocol Commands, Cont.

Conditions under which breaks may occur are explained below with descriptions of the modem's response under the different KB command break options:

A break is sent to the serial port while the modem is in *connect state* during a *reliable* or *normal connection*.

Command	Operation
KB, KB2, KB4	Enter command mode but do not send break to the remote modem
KB1	Empty the data buffers and send break to the remote modem
KB3	Immediately send break to the remote modem
KB5	Send break to the remote modem in sequence with any data received from the serial port

A break is sent to the serial port while the modem is in *connect state* during a *direct connection*.

Command	Operation
KB, KB2, KB4	Immediately send a break to the remote mode and enter command state when break is through
KB1, KB3, KB5	Immediately send a break to the remote modem

Protocol Commands, Cont.

A break is received from the remote modem while the modem is in *connect state* during a *normal connection*.

Command	Operation
WK, WK1	Empty the data buffers and send break to the serial port
WK2, WK3	Immediately send break to the serial port
WK4, WK5	Send a break to the serial port in sequence with any data received from remote modem

A transmit break command is issued while the modem is in *command state* during a *reliable* or *normal connection*.

Command	Operation
WK, WK1	Empty the data buffers and send break to the remote modem
WK2, WK3	Immediately send break to the remote modem
WK4, WK5	Send a break to the remote modem in sequence with any data received from the serial port

Inactivity Timer
VT

VT specifies the number of minutes the modem will stay online in a reliable mode without transmitting or receiving data before hanging up. When the value is set to 0, the timer is disabled. The timer is active only during a reliable connection.

Command	Operation
VT	Disable inactivity timer*
VTn	Set inactivity to n (n-1-90) minutes

*Default

Protocol Commands, Cont.

Maximum Reliable Block Size
VA

VA sets the maximum transmit block size for reliable connections. Use this command to force the modem to transmit smaller blocks when in a reliable link connection. A smaller block size will maximize throughput when marginal line conditions are causing errors. The modem sends a block up to the size specified by the ATVA command.

Command	Operation
VA	Maximum transmit block size =64 characters
VA1	Maximum transmit block size =128 characters
VA2	Maximum transmit block size =192 characters
VA3	Maximum transmit block size =256 characters*

*Default

Transmit Break / Set Break Length
VB

ATVB commands the local modem to send a break signal to the remote modem. In all modes except direct, S-register 79 determines the length of the break sent to the DTE by the modem receiving a break signal over the link. S79 may be set directly or via ATVBn where n=1-255 in 20 ms increments.

Command	Operation
VB	Sends a break signal to the remote modem. (Does not modify S79)
VBn	Sets S79 to length of break desired. n=1-255 in 20 ms increments

default is 35 (700 ms)

Protocol Commands, Cont.

Set Auto-Reliable Buffer
VC

This determines whether or not a modem in reliable mode will buffer data received from a modem that is not in reliable mode during the time in which the modems try to establish a reliable link. Use these commands when the modem is in the auto-reliable mode and is expected to process a call from a modem not in reliable mode. Refer to Chapter 8 for information on reliable mode.

Command	Operation
VC	Disables auto reliable data buffer*
VC1	Buffer data for 4 seconds or 200 characters

*default

V.42b Data Compression
%C

Determines application of data compression while running LAPM protocol. Refer to 8 for explanation.

Command	Operation
%C	Data compression disabled
%C1	Enabled on transmit and receive data*
%C2	Enabled on transmit data only (enhanced compression)
%C3	Enabled on receive data only (enhanced compression)

*default

Originate MNP Link
VO

The ATVO command forces the local modem to return online and initiate an MNP link regardless of whether it originated or answered the call. For this command to succeed, the remote modem must have received the ATVU command. The modem sends two link requests (18 seconds) and if the remote modem does not respond the modem returns to normal mode.

Protocol Commands, Cont.

Accept an MNP Link
VU

Forces the modem to return online and accept an MNP link independent whether the modem originated or answered the call. For this command to succeed, the remote modem must have received the ATVO command.

This command causes the modem to wait indefinitely for the remote modem to issue the "originate MNP link" command.

Switch from Normal to MNP
VY

Entering VY causes the modem to return online and attempt an MNP link while connected in normal or direct mode. The modem will initiate / accept a link based on which mode, originate / answer, it was in for the call. The remote modem must switch to MNP mode for this command to succeed. The modem will return to a normal connection if an MNP link is not established in 18 seconds.

Switch from MNP to Normal
VZ

This command causes the modem to return online and switch from an MNP connection to a normal connection.

Note: If VU and VC are set, the VZ command forces the modem to the direct mode.

Note: The VZ and VY commands must be issued at the same time to both modems for the switch to occur.