V.3229 / V.3229L

Installation and Operation

Motorola

20 Cabot Boulevard

Mansfield, MA 02048

(508) 261-4000

Doc. 6 209 5262 07 014

May 1995

Introduction

Chapter 1
Introduction

GENERAL

The UDS V.3229 and the V.3229L are versatile high speed asynchronous or synchronous modems that allow data transfer between two host computers via the telephone communication system.

The modems can operate full-duplex on both dial-up and leased lines. The modems are compatible with all required standards and recommendations, and feature a wide variety of automatic, remote, and backup capabilities.

Major characteristics include:

¥14.4 kbps data rate
¥V.42 bis and MNP 5 error control protocols with data compression
¥a V.25 bis autodialer
¥secure operation
¥trellis coding for superior signal-to-noise performance.

Data Rates

The V.3229 operates at data rates of

¥7.2, 12.0, and 14.4 kbps trellis-coded per CCITT V.32 bis
¥9.6 kbps trellis-coded and 4.8 and 9.6 kbps uncoded per CCITT V.32 bis
¥2400 and 1200 bps per CCITT V.22 bis
¥300 bps per Bell specification 103

DESCRIPTION

Introduction

Functional

The V.3229 processes serial asynchronous data from a DTE at all standard rates from 300 bps to 57.6 kbps, and serial synchronous data at rates from 1.2 to 14.4 kbps. Transmission can be over the dial-up telephone network or 2- or 4-wire, point-to-point, dedicated leased lines. The maximum telephone line speed is 14.4 kbps.

Built-in test features can determine system performance and isolate faults in the data link.

Operation and configuration are controlled by either the front panel LCD, the AT command set or V.25 command set. Changes can be made easily.

AutoConfiguration

AutoConfigure allows any of eleven option sets to be quickly enabled or selected as the powerup configuration. There are two ways to enable option sets: the LCD and the AT command set. Refer to Chapter 3 and 5 respectively.

Appendix D lists the nine factory option sets. For maximum versatility two additional options sets designed by the user can also be stored for instant recall or as the powerup configuration.

Remote configuration allows option changes to be made to a remote unit.

Standard and L Models

The modem is available in two models: standard and the L model. The standard model has a 32 character (liquid crystal display) LCD front panel with three pushbuttons for option selection (Figure 1-1).

The L model has a TALK LED and TALK/DATA

button. The LED is on in talk mode and off in data mode; the pushbutton selects between the two modes (Figure 1-2).

Introduction

Both models have six light emitting diodes (LEDS) to show communication status between the modem and data terminating equipment (DTE).

Standalone and Shelf Units

The standard and L models are available in both standalone or shelf mount configurations. The pc (printed circuit) boards are identical for either so that the standalone board can be field changed for use in the shelf or vice versa. Hardware straps on the pc board offer additional customer options.

The shelf mount unit has edge connectors that insert into the shelf backplane. The shelf backplane performs the same functions as the standalone rear panel.

The standalone rear panel has an EIA-232 DTE connector, an 8-pin (TELSET / LEASED LINE) jack, and an 8-pin (DIAL) jack, the power switch, fuse and power cord (Figure 1-3). Some versions have a 110/220V selection switch.

HOW TO USE THIS MANUAL

Most of the manual applies to both the standard and the L model. Users of the L model can ignore Chapter 3 and other explanations of LCD and push-button operation throughout the manual. However, these discussions include valid operating information and can be consulted as desired.

Option Selection

There are six ways to change or select options:

¥LCD - Using the front panel LCD and pushbuttons is simple, straightforward, and requires the least amount of technical background. Refer to Chapter 3.

¥ Software program - A variety of software programs is available, or advanced computer users can write their own software programs to interact with the modem. This manual does not discussed software programs.

¥AT Commands - The AT compatible command set can be used to select modem options. Refer to Chapter 5.

¥Status Registers - A series of special ATS commands allows the user to change the decimal or hexadecimal value of a memory byte to change one or more options in that byte. Refer to Chapter 6.

¥Single Bit Commands - A second series of special ATS commands allows the user to change single bits

Introduction

within a byte to change an option. Refer to Chapter 6.

¥V.25 bis Commands - An extended set of V.25 commands allows selection of modem options during synchronous operation. Refer to Chapter 7.

Quick Startup

A quick startup procedure at the beginning of Chapter 4 provides information for quickly getting online.

Specifications

Appendix A contains modem specifications.

SECURITY

Three separate security schemes prevent unauthorized access to local and remote modems and DTEs:

¥An AT command password prevents remote configuration of the modem.

¥An AT command password prevents remote access to the DTE while operating in dial-up mode.

¥An autocallback option requires the remote modem to callback the originating modem using the remote unit's autodial capability.

Chapter 2
Installation

GENERAL

This chapter provides information for the mechanical and electrical installation of the modem.

SITE SELECTION

Install the modem within 6 feet of a standard 115 or 230 Vac grounded wall outlet as required for the specific model and no further than 50 feet from the terminal equipment.

The installation area should be clean and free from extremes of temperature, humidity, appreciable shock, and vibration. See equipment specifications in Appendix A for details. Allow clearance for operation and maintenance and at least 4 inches at the rear for cables and air flow.

Receipt Inspection

After unpacking the equipment, check the contents against the packing list. Inspect the equipment for any damage that may have occurred in shipment. If any damage or equipment shortage is noted, refer to the warranty literature. Keep the shipping container and material.

Tools Required

Normal installation requires a screwdriver to secure the data terminal equipment (DTE) cable to the modem and to attach the telephone cable to the 42A terminal block for leased line operation.

Installation

Strap Inspection

Several hardware straps on the printed circuit board may require changing prior to installation. Refer to Strap Option Selection at the front of Chapter 3 for information.

ELECTRICAL INSTALLATION

The rear panel (Figure 2-1) houses connectors for the DTE cable and telephone lines.

AC Power Connection

Power is supplied through a 6-foot line cord with a grounded 3-wire plug. If common ground is available through the third prong of the plug, a separate ground wire is not required. If the modem has a 110/220V switch, select the appropriate voltage. If 220 Volt operation is selected, install the supplied 1/8 Amp fuse before connecting power to the modem.

DC Power Input Option

Caution: *To protect the dc to dc converter from damage, ensure the positive and negative leads are properly connected.*

If the modem is equipped for dc power input, connect 12 to 60 Vdc power to the terminal block attached to the modem back panel. A chassis ground connection is also supplied on the terminal block.

DTE CONNECTION

The DTE connector is a 25-pin D-series type conforming to EIA-232 specifications. Pin signals are shown in Figure 2-2 and described in Table 2-1.

TELEPHONE LINE CONNECTION

The modem operates in one of three line-related modes:

¥Permissive (PSTN)
¥Programmable (PSTN)
¥Private line

Permissive and programmable modes are used on the Public Switched Telephone Network (PSTN). Private line mode is used on 4-wire or 2-wire dedicated leased lines. The user must decide which mode to use and then select the telephone jack arrangement accordingly.

PSTN Connection

Modems are registered with the Federal Communications Commission (FCC) for direct connection to the PSTN (dial-up network). The label on the chassis bottom gives the FCC registration number and other information.

Direct connection to the PSTN provides two modes of operation (Figure 2-3):

¥Permissive (standard)
¥Programmable

Permissive

In permissive mode, the modem transmits a maximum signal level of -10 dBm. For standard tele-

phones the jack arrangement is RJ11C . Cable PN 61020202-0301 connects the DIAL jack on the back of the modem to the RJ11C wall jack.

Programmable

Programmable mode corrects for the signal level loss between the modem and the telephone company central office. This is done by setting the modem transmit output signal level with a resistor selected and installed in the jack by the telephone company. This allows the output signal to reach the central office at the optimum level of -12 dBm. Jack arrangements for this mode are the RJ45S (Programmable) and RJ41S (Universal). The RJ41S has a switch option that must be selected to Programmed (P). Cable PN 61020192-0301 (not supplied with modem) is used to connect the DIAL jack to the RJ41S or RJ45S wall jack.

Table 1:

Pin No.	EIA-232D	CCITT V.24	Signal Name	Description
1		101	Shield	Protective Ground
2	BA	103	Transmitted Data	Serial digital data (to be modulated) from a data terminal or other digital data source: Synchronous data must be accompanied by the modem transmit clock (pin 15) or by an external data rate clock (pin 24). Data transitions should occur on negative-going clock transitions; asynchronous data does not require a transmit clock.
3	BB	104	Received Data	Serial digital data output to the DTE interface: Sync data is accompanied by an internal data rate (receive) clock (pin 17) with negative-going transitions on the data transition. Async data does not require a receive clock.
4	CA	105	Request to Send	A positive level to the modem when data transmission is desired
5	CB	106	Clear to Send	A positive level from the modem in response to request to send and when the modem is ready to transmit*
6	CC	107	Data Set Ready	A positive level from the modem when power is on and ready to operate. In dial-up operation, the modem must be off hook to give a high DSR signal.*
7	AB	102	Signal Ground or Common Return	Common signal and DC power ground
8	CF	109	Received Line Signal Detector	A positive level from the modem indicating the presence of a received signal (carrier detect)*
9			+12 Volts	+12 voltage reference
10			-12 Volts	-12 voltage reference

**** Modem options may force these signals on or cause them to be ignored.***

Table 2:

Pin No.	EIA-232D	CCITT V.24	Signal Name	Description
11			Signal Quality Indicator	This circuit indicates probability of errors in the received data: a positive level indicates poor signal quality while a negative level indicates good signal quality.
15	DB	114	Transmit Clock (DCE)	A transmit data rate clock output for use by the DTE equipment. Negative clock transitions correspond to data transitions.
17	DD	115	Receive Clock	A receive data rate clock output for use by the DTE equipment. Negative clock transitions correspond to data transitions.
18		141	Local Loopback (Loop 3) Control	A positive level causes the modem to enter the local analog loopback test mode.*
20	CD	108.2	Data Terminal Ready	This circuit is positive when the DTE is ready to originate or answer a call in dial-up operation. DTR must always be active (high) in 2-wire private line operation. Cycling DTR causes retraining.*
21		140	Remote Digital Loopback	A positive level causes a digital loopback test mode at the remote modem.
22	CE	125	Ring Indicator	In dial line operation this circuit is positive in response to an incoming ring signal.*
23	CH	111	Data Rate Select	Supplies a data rate control input to select primary or fallback data rate: Negative voltage selects primary data rate and positive voltage selects fallback data rate.*
24	DA	113	External Transmit Clock	A serial data rate clock input from the data source. Negative clock transitions correspond to data transitions.
25		142	Test Mode	Indicates the modem is in a test mode

** Modem options may force these signals on or cause them to be ignored. This function can be disabled or its logic sense reversed by hardware straps.*

Refer to Strap Options.

Note: The modem is compatible with exclusion key phone arrangements.

Leased Line Connection

The modem operates on either 2-wire or 4-wire leased lines. The telephone company will install the leased line and wall jack at your site. The line connects to the modem at the 8-position TELSET/ LEASED LINE jack.

The 42A block is the most common termination for leased line use. It requires the use of the 8-pin modular to spade lug cable (PN 61020569-0000). Figure 2-4 illustrates the typical hook-up of the modem for operation over private leased lines with dial backup.

Note: *Although the 42A block is the most common, some Bell operating companies have discontinued its use for leased lines. Instead, the modular jack JM8 is used. If this is the case in your area, you need a special cable (PN 61020575-0000). Contact your distributor for further information.*

Chapter 3
Option Selection

GENERAL

Note: *This chapter contains the options available by pushbutton in response to the LCD. Users of the L model are encouraged to consult the different sections of this chapter as appropriate for further information on modem operation and option selection.*

Nine factory option sets provide complete setups for most data communication arrangements. The modem is shipped configured to factory option set #1. Appendix D lists the options for each set. Because of the number of possible applications, most modems require some option changes to fit the application.

Two user programmed option sets are also available. These allow the user to configure customized option sets and store them in memory for immediate recall or as the powerup configuration.

The AutoConfigure feature, explained later in this chapter, allows immediate use of any stored option set.

STRAP OPTION SELECTION

Modem configuration is controlled by front panel pushbuttons and the LCD, AT or V.25 bis commands, and hardware option straps located on the pc board. Normally straps do not have to be changed. If a change is required, remove the modem cover to access the option straps.

The strap diagrams on the following pages indicate the factory settings.

Removing Cover

Warning: *Disconnect ac power before removing the cover. Although dangerous voltage levels are not exposed, disconnecting power ensures an electrical shock hazard is not present.*

Place the unit on its side on a flat surface. To disengage the lock prong insert a medium size flat screwdriver blade in one of the bottom rear latch slots. DO NOT PUSH the screwdriver but lightly pry the handle away from the unit as illustrated in Figure 3-1. Assist removal by pushing the cover from the chassis with your fingers on the unit rear edges. Repeat this procedure with the remaining three latch slots.

To replace the cover align the lock clips, rear guide grooves, and front lock tabs. Press the cover in place until the lock clips engage the lock prongs.

Board Identification

Two different printed circuit boards exist for the V.3229. After removing the cover use Figures 3-2a and 3-2b to identify which board is in your modem and to locate hardware straps. The board represented in Figure 3-2b has a piggyback board.

Setting Straps

Figure 3-3 shows a typical strap application.

HARDWARE STRAPS

Strap illustrations in this section match the board with the TR LED.

Tip and Ring Polarity

Some telephones are tip and ring polarity sensitive. If a dial tone is detected after dialing, reverse these two straps.

** factory setting*

Ground Strap

Signal ground is normally connected to chassis ground. If interference exists, isolate signal ground from chassis ground.

QM Disabled

When enabled, the Quality Monitor (QM) output is connected to the EIA-232 (pin 11) interface. Disabling it disconnects the QM output. Refer to Chapter 4 and Table 2-1 for more information.

QM Normal / Inverted

This strap only applies to the board shown in Figure 3-2b. Select normal or inverted QM output.

**factory setting*

LCD OPTION SELECTION

Modem options can be checked or changed with the front panel LCD and pushbuttons.

Note: *Options are also controlled by AT or V.25 bis operating commands discussed in Chapter 5 and 7.*

MAIN MENU

Six main menus support modem operations:

¥MODEM STATUS
¥DIAL STORED NUMBER
¥DISPLAY STATUS
¥SELECT TEST
¥MODIFY CONFIGURATION
¥CHANGE PHONE NUMBERS

Each main menu contains submenus, items, and options (Table 3-1). The two right columns in the table show associated AT commands and S-registers.

Menu Sequence

The user can step through the menu by pressing the YES, NO, and TALK/DATA pushbuttons. Main Menus allow access to Submenus. Each Submenu

has a Submenu Item column; if an option setting is selected or if all options have been scrolled through, the menu returns to the Submenu header.

If the NO pushbutton is pressed and held, the modem scrolls through the menu.

Note: *The displays in Main Menu 1 show the current operating mode or status. These displays are not option selections. In most cases, while operating in the option menu, pressing NO scrolls down the columns in Table 3-1 and pressing YES advances across the rows.*

Table 3-1
Menu Options

Table 1:

	MAIN MENU	**LCD MESSAGES**	+		+	+
MAIN 1		V.32b 14400 TALK V.32b 14400 TRAINING V.32b 14400 ON-LINE V.32b 14400 RINGING V.32b 14400 IN TEST	+	*(Press NO to advance to MAIN 2)*	+	+
MAIN MENU	+	**SUBMENU**	**SUBMENU ITEM**	**ITEM OPTION**	**AT COMMAND**	**S-REG**
MAIN 2	DIAL STORED NUMBER?		DIAL #1-9	YES, NO	DSn (n-1-9)	---
MAIN 3	DISPLAY STATUS? *(status only)*	DTE SIGNALS	QM ON/OFF DSR ON/OFF OH ON/OFF RI ON/OFF	DISPLAY STATUS	---	---

Option Selection

Table 1:

^	^	PROTOCOL	NONE NEGOTIATING V.42 LAPM OR V.42 MNP 2/3/4/5	DIS- PLAY STA- TUS	---	---
		COMPRESSOR *	NONE MNP 5 V.42 *bis*	DIS- PLAY STA- TUS	---	---
		CARRIER DESCRIPTIONS*	RECEIVE LEVEL NEAR END ECHO LEVEL FAR END ECHO LEV- EL FAR END ECHO DE- LAY ESTIMATED DELAY FREQUENCY TRANSLATION	DIS- PLAY STA- TUS	---	---
M A I N 4	SELECT TEST?	*(Offline test only)*	LONG ANALOG LOOP	INI- TIATE, EXIT	&T1	S16
^	^		LAL WITH TP	INI- TIATE, EXIT	&T8	S16
^	^	*(4-wire only)*	REMOTE ANALOG LOOP**	INI- TIATE, EXIT	&T2	S16
^	^	^	RAL WITH TP**	INI- TIATE, EXIT	&T9	S16
^	^	*(Online test)*	LOCAL DIGITAL LOOP**	INI- TIATE, EXIT	&T3	S16
^	^	^	REMOTE DIGITAL LOOP**	INI- TIATE, EXIT	&T6	S16
^	^	^	RDL WITH TP**	INI- TIATE, EXIT	&T7	S16
^	^	^	TEST PATTERN**	INI- TIATE, EXIT	%T	---

* *Modem must be online for results*
** *Modem must be online with protocols disabled*

Table 3-1 Cont.
Menu Options

Table 2:

MAIN MENU	+	SUBMENU	SUBMENU ITEM	ITEM OPTION	AT COMMAND	S-REG
MAIN5	MODIFY CONFIGU-RA-TION?	CHANGE MODEM OPTIONS?	CHANGE DCE RATE	DTE SPEED 14400 TREL-LIS 12000 TREL-LIS 7200 TRELLIS 9600 TRELLIS 9600 UNCOD-ED 4800 UNCOD-ED 2400 V.22 *bis* 1200 V.22 *bis* 300 BELL 103	%B %B9 %B8 %B7 %B6 %B5 %B4 %B3 %B2 %B1	S69
^	^	^	FORCED ANSWER OR NORMAL ORIGINATE	NORM ORIGIN FORCED ANSWER	*OR *OR1	S14
^	^	^	V.32 FAST TRAIN	ENABLE DISABLE	*FT1 *FT	S29
^	^	^	AUTO RETRAIN	ENABLE DISABLE	%E1 %E	S60
^	^	^	AUTO RATE RENEGOTIATION	DIS, low BER, med, high BER	%R, %R1, %R2, %R3	S53
^	^	^	TRANSMIT CLOCK	INT, EXT, RX	&X, &X1, &X2	S27
^	^	^	LINE TYPE	LEASE, DIAL	&L1, &L2, &L	S27
^			DIAL LINE TRANSMIT LEVEL	-9 to -21 dBm	*TDn (n=9-21)	S51
^			JACK TYPE	PER - RJ11 PROG - RJ45	%Z %Z1	---
^	^	^	LINE CURRENT DISCONNECT	OFF, 8 MS, 90 MS	*LC, *LC1, *LC2	S32
^	^	^	LONG SPACE DISCONNECT	ENABLE DISABLE	Y1 Y	S21
^	^	^	V.22 GUARD TONE	DIS, 550, 1800 Hz	&G, &G1, &G2	S23
^	^	(*leased only*)	2-WIRE/4-WIRE	2-WIRE/4-WIRE	&L1, &L2	S32

Option Selection

Table 2:

^	^	^	DIAL BACKUP	MANUAL, AUTO	*DB, *DB1	S32
^	^	^	LOOKBACK TIMER	OFF, 15, 30, 45, 60 MIN	---	S28
^	^	^	LL TRANSMIT LEV-EL	0 to -21 dBm	*TLn	S52
^		CHANGE PROTOCOL OPTIONS? *(async only)*	LAPM PROTOCOL	ENABLE DISABLE	\N4, \N5, \N6, \N7 \N, \N1, \N2, \N3	S70
^	^	^	MNP PROTOCOL	ENABLE DISABLE	\N2, \N3, \N6, \N7 \N, \N1, \N4, \N5	S70
^	^	^	PROTOCOL FALLBACK	ENABLE DISABLE	\N3, \N5, \N6, \N7 \N, \N1, \N2, \N4	S70
^	^	^	DATA COMPRES-SION	DISABLE NORM TX RX	%C %C1 %C2 %C3	S56

Table 3-1 Cont.

Menu Options

Table 3:

MAIN MENU	+	**SUBMENU**	**SUBMENU ITEM**	**ITEM OPTION**	**AT COM-MAND**	**S-REG**
MAIN5	MODIFY CONFIGU-RA-TION? (cont.)	CHANGE PROTOCOL OPTIONS? (cont.)	BUFFER MODE	NORMAL DIRECT	\J \J1	---
^	^	^	DTE SPEED	DTE=DCE CONSTANT DTE	\J1 \J	---
^	^	^	DTE FLOW CON-TROL	DISABLE XON/XOFF CTS RTS/CTS	\Q \Q1 \Q2 \Q3	S54
^	^	^	DCE FLOW CON-TROL	DISABLE XON/XOFF CTS	\Q4 \Q5 \Q6, \Q7	S54
^	^	^	XON/XOFF PASS THROUGH	ENABLE DISABLE	\X1 \X	---

Table 3:

^	^	^	INACTIVITY TIMER	OFF, 15, 30, 45, 60, 75, 90 MIN	---	S5 8
^	^	^	BREAK CONTROL	0, 1, 2, 3, 4, 5	\K, \K1, \K2, \K3, \K4, \K5	S5 9
^	^	^	V.42 FAST DETECT	ENABLE DISABLE	\M1 \M	S7 0
^	^	CHANGE DTE OPTIONS?	OPERATION	SYNC ASYNC	&M1, 2, 3, 4, 5 &M	S2 7 S3 0
^	^	^	DTE RATE (async)	57600, 38400, 19200,14400, 12000, 9600, 7200, 4800, 2400,1200, 300	---	S8 0
^	^	^	CHAR SIZE (async)	7 BIT 8 BIT	---	S6 1
^	^	^	PARITY (async)	NO, EVEN, ODD	---	S6 1
^	^	^	DIAL METHOD (sync)	ASYNC, DTR, MANUAL, V.25 BISYNC, V.25 SDLC	&M1,&M2 &M3 &M4 &M5	S2 7 S3 0
^	^	^	AT COMMAND SET	ENABLE DISABLE	*NT1 *NT	S2 9
^	^	^	CHARACTER TYPE (V.25 only)	ASCII, EBCDIC	---	---
^	^	^	SDLC DATA FOR-MAT	NRZ, NRZ1	---	---
^	^	^	DTR RESPONSE	IGNORE RECALL CMD DISCONNECT RESET	&D &D1 &D2 &D3	S2 1
^	^		DSR STATE	NORMAL FORCED HIGH Off 5 SEC ON DISCONNEC T FOLLOWS OH	&S1 &S &S2 &S3	S2 1

Table 3-1 Cont.
Menu Options

Table 4:

MAIN MENU	+	SUBMENU	SUBMENU ITEM	ITEM OPTION	AT COMMAND	S-REG
MAIN 5	MODIFY CONFIGU-RA-TION? (cont.)	CHANGE DTE OPTIONS? (cont.)	DCD STATE	NORMAL FORCED HIGH OFF 5 SEC ON DISCON-NECT FOLLOWS REMOTE RTS	&C1 &C &C2 &C3	S2 1
^	^	^	CTS STATE	NORMAL FORCED HIGH CTS FOL-LOWS DCD CTS=RTS	&R &R1 &R2 &R9	S2 1 S7 2
^	^	^	RTS/CTS DELAY	0 to 150 ms (10 ms incre-ments)	---	S2 6
^	^	^	DTE COMMANDED FALLBACK	ENABLE DISABLE	*FB1 *FB	S5 3
^	^	^	OPTIONS RES/RET-ND AT DISC	RESTORED RETAINED	*RO1 *RO	S2 9
^	^	CHANGE TEST OPTIONS?	BILATERAL ANA-LOG LOOP	ENABLE DISABLE	*AN1 *AN	S3 4
^	^	^	BILATERAL DIGITAL LOOP	ENABLE DISABLE	*DG1 DG	S3 4
^	^	^	DTE LOCAL TEST	ENABLE DISABLE	*LA1 *LA	S3 4
^	^	^	DTE REMOTE TEST	ENABLE DISABLE	*RD1 *RD	S3 4
^	^	^	REMOTE COM-MANDED	ENABLE DISABLE	&T4 &T5	S2 3
^	^	^	TEST TIMEOUT	OFF, 60, 120, 180. 240 SEC	---	S1 8
^	^	CHANGE DIAL OPTIONS?	DIAL TYPE	PULSE, TONE	P, T	S1 4
^	^	^	AUTODIAL #	OFF, 1 - 9	*AUn (n=1-9)	---

Table 4:

^	^	^	DIAL TONE	BLIND DIAL WAIT FOR DIAL TONE	X, X1, X3 X2, X4	S2 2
^	^	^	WAIT DELAY (Blind Dial)	1, 2, 4, 8, 16, 32 SEC	---	S6
^	^	^	PAUSE DELAY	1, 2, 4, 8, 16, 32 SEC	---	S8
^	^	^	CALL TIMEOUT	15, 30, 45, 60, 75, 90, 105, 120 SEC	---	---
^	^	^	ANSWER RING #X	1, 2, 4, 8, 16, manual	---	S0
^	^	^	801 V.32 TIMEOUT	LONG, SHORT	---	S5 3
^	^	^	AUTOCALLBACK	ENABLE, DIS	---	S7 2

Table 3-1 Cont.
Menu Options

Table 5:

MAIN MENU	+	SUBMENU	SUBMENU ITEM	ITEM OPTION	AT COM-MAND	S-REG
MAIN 5	MODIFY CONFIGU-RA-TION? (cont.)	CHANGE SPEAKER OPERATION?	VOLUME CONTROL	LOW MEDIUM HIGH	L1 L2 L3	S22
^	^	^	SPEAKER CON-TROL	ON UNTIL CARRIER DETECT ALWAYS ON OFF WHILE DIALING ALWAYS OFF	 M1 M2 M3 M	S22
^	^	LOAD/STORE OPTION SET?	LOAD FACTORY OPTION	NO, 1-9	&Fn (n=1-9)	---
^	^	^	LOAD USER OP-TION SET	1 2	Z Z1	---
^	^	^	STORE PRESENT OPTIONS	1 2	&W &W1	---
^	^	^	USER OPTION AT RESET	1 2	&Y &Y1	---
MAIN 6	CHANGE PHONE NUMBERS?		PHONE NUMBER	NINE 31-CHAR NUMBERS	&Zn (n=phone# and dial modifiers) *CNn,x (n=location x=phone #)	---

SELECTING OPTIONS

Select options by pressing the YES or NO pushbutton in response to the LCD prompt. When first turned on, a main menu 1 message is displayed. Table 3-1 lists these messages. Pressing NO scrolls through

main menus 2 through 6. To return to main menu 1 press the TALK/DATA pushbutton.

NO

DIAL STORED
PHONE #?

NO

DISPLAY
STATUS

NO . . .

CHANGE
PHONE #?

***Note**: While operating in the option menu, pressing NO scrolls down the columns in Table 3-1 and pressing YES advances across the columns.*

Main Menu

When any Main Menu is on display, pressing YES advances to the first Submenu in that Main Menu group.

MODIFY
CONFIGURATION?

YES

CHANGE MODEM
OPTIONS?

Submenu

When in a Submenu column, pressing NO scrolls down the Submenus; when the end is reached it returns to the Main Menu for that group of submenus.

CHANGE MODEM OPTIONS?

NO . . .

LOAD/STORE OPTION SET?

NO

MODIFY CONFIGURATION

In a Submenu column, pressing YES advances to the Submenu Item column.

CHANGE MODEM OPTIONS?

YES

DCE RATE

Submenu Item

To scroll through the Submenu Item column, press NO. At the end, pressing NO returns you to the Submenu header for that item group.

DCE

RATE
NO

ORIG/FORCE ANSWER
NO . . .

V.22 GUARD TONE DISABLED*
NO

CHANGE MODEM OPTIONS?

When in a Submenu Items column, pressing YES advances through the options for that Submenu Item. The first option that appears is the currently selected option.

NORMAL ORIG. FORCED ANSWER?
YES

FORCE ANSWER NORMAL ORIG.?

** This is the last submenu item for modem options.*

Item Option

When in the Item Option column, respond to the prompt question on the LCD to either keep or change the current option displayed.

USE RECEIVE TRANSMIT CLOCK?
NO
USE EXTERNAL TRANSMIT CLOCK?
NO
USE INTERNAL TRANSMIT CLOCK?
YES
INTERNAL CLOCK CHANGE?

Selecting the Option

Select the submenu containing the option (submenu item) to be changed and press YES. The LCD displays the first Submenu Item.

If the Submenu Item (option) setting displayed is the desired option, press NO to scroll through Submenu Items. If the option displayed is not the desired setting, respond to the prompts until the desired option is displayed, and then advance to the next Submenu Item. In any case, responding to the prompt will guide you to the desired option.

Note: *Because of menu structure and options available, not all Main Menus have Submenus and not all Submenus have Item Options. However, the option selection sequence is the same.*

Chapter 4
Operation

GENERAL

This chapter contains a functional description of the modem.

CONTROLS AND INDICATORS

The front panel houses the LCD panel and LED indicators. The power switch is located on the rear panel.

LED DESCRIPTIONS

The LEDs display modem status during various operations. Two versions of the V.3229 contain two different LEDs. One version has a TR LED in the location where the other version has a QM LED. Definitions are as follows:

Terminal Ready

TR - lights when the associated DTE is ready to exchange data with the modem. This signal is input on EIA-232 pin 20.

OR

Quality Monitor

QM - lights when poor signal quality produces a bit error rate of 1 x 10^4 or greater, or when error control causes retransmission of data. This signal is output

on EIA-232 pin 11.

Request to Send

RS - lights when the DTE is ready to send data to the modem. This signal is input on EIA-232 pin 4.

Clear to Send

CS - lights when the modem is ready to accept data from the DTE. This signal is output on EIA-232 pin 5.

Carrier Detect

CD - lights when the received audio carrier signal is detected or, if enabled, when error control negotiation is complete. This signal is output on EIA-232 pin 8.

Received Data

RD - lights for a space at the receive data output, indicating receive output data activity. This signal is output on EIA-232 pin 3.

Transmit Data

TD - lights for a space at the transmit data input, indicating transmit input data activity. This signal is input on EIA-232 pin 2.

TALK / DATA

Only on the L model, the TALK / DATA LED lights to indicate that the modem is in talk mode and goes off to indicate that the modem is in data mode.

POWERUP

A powerup procedure is not required. Turn the ON/OFF power switch on the rear panel to ON.

Quick Startup Procedure

This procedure can help with first time operation of the modem. The procedure assumes that phone numbers have been inserted in memory, that an asynchronous dial-up option set is in effect, that power, DTE, and telephone line connections are made, and that a similar, remote station is available for communication.

¥Make sure the modem is installed according to the instructions in Chapter 2.

Operation

¥Turn on the computer and the modem.

Manual Dialing

After turning the modem on the LCD shows the software version and advances to main menu 1.

¥Pick up the handset and dial the phone number of the remote modem. For the L model press the TALK / DATA button to enter talk mode.

¥When a remote modem answers a high pitched tone (2100 Hz answer back tone) is heard.

¥Press TALK/DATA. This puts the modem in data mode and data transfer can begin.

The display shows TRAINING as the modems negotiate a connection and then ONLINE when the connection is made. Data transfer is controlled by the user and begins when instructed.

Manual Answering

To manually answer the phone for conversation, set the autoanswer register (S0) to a ring count value high enough to allow answering by the connected phone before the modem autoanswers.

When the conversation is completed, both parties press TALK/DATA and a data connection is established.

Autodialing from the Front Panel

¥Starting at the V.32 bis 14400 TALK display, press NO. The display advances to DIAL STORED NUMBER?

¥Respond to the prompts until reaching the desired number to dial.

¥Press YES. The modem proceeds through the dial sequence.

To follow this sequence, observe the LCD and listen to the speaker.

AT Command Dialing

Enter ATD and the telephone number or memory location number to dial. When the enter key is pressed the dial sequence starts. Follow the status of the dial sequence by observing the monitor screen and listening to the speaker. .

Software Packages Communication

A large variety of software packages compatible with the modem is available. Most provide a way for the operator to select options, insert phone numbers, and establish communications with a remote modem. Software package instructions describe the actions required for these functions.

ERROR CONTROL

The modem incorporates error control capabilities including LAPM and MNP protocols. Chapter 8 provides detailed explanations for error control.

FLOW CONTROL

If the DTE speed exceeds the DCE (modem) speed, 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 cause the DTE to stop sending characters. As the modem continues to transmit data and the buffer empties, flow control is again used to cause the DTE to resume sending data.

AUTOBAUD

Sending AT to the modem accomplishes autobaud. The modem can automatically detect DTE speed and adjust to communicate with the DTE at that rate (autobaud). The default is 9600 bps. Autobaud also detects the character size and parity used by the DTE. The default is 8 data bits, no parity, and one stop bit.

2- / 4-WIRE OPERATION

Note: *For a 2- or 4-wire leased line connection to succeed one modem must be configured as forced answer and the other modem as normal originate. Both modems should have only one protocol, MNP or LAPM, enabled and PROTOCOL FALLBACK must be disabled. DCE line speed must be the same for both modems.*

4-Wire Operation

In 4-wire operation, the modem is a full-duplex, leased line modem requiring a dedicated 4-wire leased line. Only point-to-point dedicated leased lines are supported.

A V.32 or V.33 training sequence may be selected for use during 4-wire leased line operation using S31. Refer to S31 in Chapter 6 for options.

The 4-wire leased line connects to the TELSET/ LEASED LINE jack on the modem rear panel. Dialing is not necessary. When connected via leased line the modems will train and begin communicating with each other. The DIAL jack can be used to connect a 2-wire PSTN line for dial backup.

2-Wire Operation

In 2-wire operation, the modem is a full-duplex modem able to operate over 2-wire leased or PSTN lines.

2-WIRE LEASED LINE OPERATION

The 2-wire leased line is connected to the TELSET/ LEASED LINE jack; the DIAL jack connects to a 2-wire PSTN line for dial backup. The leased line connects the local and remote modems directly and dialing is not necessary. One of the modems must be configured for forced answer. When connected via

leased line the modems connect and begin communicating with each other.

Note: *DTR must be held high in 2-wire leased line operation. This is accomplished by DTE control, wiring pin 20 of the digital interface cable high, or by selecting the option IGNORES DTR. If DTR is terminal controlled, loss of synchronization can be corrected by cycling DTR. This causes the modem to initiate the 2-wire training sequence.*

2-WIRE DIAL-UP OPERATION

Connection to the telephone network is through the DIAL jack. A standard telephone can be connected to the TELSET/LEASED LINE jack for manual dialing.

CONFIGURATION PROFILES

Modem operations are controlled by option settings selected from factory defaults stored in ROM, active settings stored in RAM, and custom settings stored in nonvolatile memory. These three code storage locations are called profiles. Chapter 5 includes commands for profile storage and recall.

Active Profile

The active profile holds the current option settings and is used by the modem for all operations and functions. Any active profile option can be changed to meet an immediate requirement.

Stored Profile

When an active configuration is established that meets all operating requirements, it can be transferred to one of the stored profiles. Two stored profiles are available for greater versatility.

If the active profile has been temporarily changed it can be reset to either of the stored profiles with the ATZ command. Another AT command selects one of the stored profiles to be the powerup profile.

Factory Profile

The factory configurations are stored in ROM and cannot be changed by the user; they can be trans-

ferred to the active profile and then modified to fit a specific application if needed.

REMOTE CONFIGURATION

This mode of operation allows viewing or modifying the options of a remote modem that supports Motorola UDS remote configuration. Remote configuration is initiated by the local (master) modem through a routine incorporating remote digital loopback, a security code, and an acknowledgment from the remote (slave) unit to be modified. The security code is user programmable and provides protection from unauthorized entry. The modems are shipped from the factory without a security code. Refer to Remote Configuration in Chapter 5.

The ATD and AT&T commands are not accepted in remote configuration.

Note: *Remote configuration is supported at all rates except 300 bps.*

Remote Configuration Security

The correct code must be received by the remote modem before remote configuration can be established. Once established, the local DTE becomes a virtual terminal and can serve both local and remote modems. After starting remote configuration, the local DTE serves the remote modem.

To return DTE service to the local modem while in remote configuration, issue the +++ escape sequence.

DTE service can again be returned to the remote modem by issuing the ATO command. Switching DTE service between local and remote modems may be performed as needed.

To exit remote configuration, return DTE service to the local modem. The AT&T command will exit remote configuration mode.

Remote configuration may be entered after dialing by placing the remote configuration command (%T=), without the = sign and followed by the security code, at the end of the dial string.

SECURITY OPERATION

Security operation provides password protection against unauthorized dial-up access. The security feature can be enabled / disabled with AT commands when operating on a dial-up system.

Transmitted data and received data lines are suppressed to the host DTE during security validation; all other signals (CTS, DSR, RI, etc.) operate as selected. After the password has been validated, the modem operates normally.

Operating without Security

The modem is not factory set for security and operates like a standard V.32, except for additional AT command which allow access to security. With these commands a user can set passwords and turn security on. When security is enabled, a password must be used to change security options.

Operating with Security

A secure modem will not allow data transfer between its host and a remote host until a correct password is received from the calling party. If an incorrect password is received the secure modem disconnects. The front panel is not locked out because this type of security prevents unauthorized dial-up access.

Remote Operation

The originating modem must transmit the correct

security code before the secure modem will allow data transfer. If accessing a secure remote modem, the local modem prompts the user with

PLEASE ENTER YOU PASSWORD ⇒

To

Respond to the password prompt

Enter

$ followed by the password.

After receiving the $ the secure remote modem accepts the security code and waits for a carriage return. Entering more than ten characters is invalid and causes the secure modem to disconnect. Entering a valid password causes the calling party's DTE to display PASSWORD ACCEPTED.

Local Operation

When accessing the local modem, the password is not required except when the user wants to change a security option. To change a password or turn security on or off, the user must enter a password when entering the appropriate AT commands. EIA-232 signals to the DTE are not affected by security in command mode.

Passwords

Two passwords of up to ten characters each can be stored in the modem's nonvolatile memory. AT commands change the passwords. Backspace and escape keys are not supported for password entry. The passwords can consist of any printable characters except a dollar sign, a comma, or space. Passwords are case sensitive.

The passwords have the same priority level and are interchangeable with each other. This can be helpful in situations such as when the user forgets one of the passwords.

LCD Indication Security

The front panel LCD indicates whether security is on or off. If disabled, the LCD appears as if the security does not exist. If enabled, main #1 consists of the following display:

SECURE 14400
xxx

Restrictions in Security Operation

The following conditions will cause the modem to disconnect:

¥An error control protocol is not in effect
¥Illegal password attempt
¥Connection is 300 bps
¥Connection is synchronous

These restrictions apply only when security is enabled.

AUTOCALLBACK SECURITY

Another security feature, Autocallback, forces the answering modem to dial the selected autodial (AT*AUn) telephone number after answering a call, holding the line for one second, and then disconnecting. When autocallback is enabled the modem will not train on an incoming call. Access autocallback via Main Menu #5 on the LCD. Refer to Chapter 3 for further information. S-register 72 enables / disables autocallback. S-register 78 determines the delay in seconds before autocallback is initiated.

DIAL BACKUP

Dial backup allows the modem to switch to a dial backup mode if the data connection on the leased line becomes unacceptable for communications. This can be accomplished in two ways:

Operation

¥Automatic - backup due to extended loss of carrier or 4 unsuccessful retrains in 3 minutes

¥Manual - user determined using front panel controls or AT commands

Note: *In 4-wire leased line operation, if both units have autodial backup enabled, one must be configured for forced answer. This prevents both units from dialing if the leased line fails.*

Both methods use the prestored autodial number. If the dial attempt is unsuccessful after three tries, a retrain on the leased line will be initiated.

In automatic and manual mode the return to leased line is initiated after the lookback time in register S28 has elapsed. In automatic mode unnecessary termination of the dial line connection is prevented by a leased line lookback test. If the leased line is not acceptable, the dial connection is resumed with a retrain. If the leased line is acceptable, the dial connection is dropped and normal leased line mode is resumed. If return to lease line is manually invoked in manual dial backup mode the dial line is dropped immediately.

When the unit attempts to return to leased line, the LCD displays LEASE LOOKBACK. If the leased line has been restored to service, data can be passed approximately 10 seconds after LEASE LOOKBACK was initiated. The LCD will continue to display LEASE LOOKBACK for slightly more than a minute. When the LCD displays ON LINE again the dial line is disconnected.

Note: *A diagnostic test initiated during dial backup*

mode terminates when the modem performs leased line lookback.

AUTO RATE RENEGOTIATION

Auto rate renegotiation allows the modem to automatically decrease the DCE rate when the allowable bit error rate is exceeded. If line condition improves the modem automatically increases the rate.

Select this feature by front panel operation or AT command. Options include disabled (factory default), low (BER= 1 in 10^5), medium (BER= 1 in 10^4), high (BER= 1 in 10^3).

The following apply to auto rate renegotiation:

¥Auto retrain is disabled when auto rate renegotiation is enabled.

¥Auto rate renegotiation is disabled during direct mode.

¥Manual rate renegotiation is disabled from the front panel when auto rate renegotiation is enabled.

¥Only one increment or decrement in the DTE rate is allowed at a time during auto rate renegotiation.

¥When online, initiator rate renegotiation occurs a maximum of every 12 to 14 seconds from the last occurrence of a rate renegotiation.

¥After the modem drops data rate because of poor signal quality, the line must improve by approximately 2.5 dB before an increase in rate can occur.

PLACING A CALL

Using a Standard Telephone

¥Lift the telephone receiver. Wait for the dial tone. With the L model enable talk mode by pressing the TALK / DATA button.

¥Dial the number of the remote site.

¥When the answer back tone is heard, immediately press the TALK/DATA button and hang up the phone. The modems go through a connection sequence and establish a data link. If not, hang up and return to the first step.

Autodial from Front Panel

¥Advance the LCD to main #2, DIAL STORED NUMBER.

¥Select the stored number to dial and press YES to dial.

Autodial with the AT Command Set

¥To dial a number, for example 5551212 type AT D 555-1212 carriage return, or enter ATD Sn where n equals the stored telephone number location (1-9) to dial.

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

Refer to the DIAL COMMANDS section in Chapter 5 for additional information.

ANSWERING A CALL

Autoanswer

Normally the modem is configured to autoanswer. A telephone plugged into the telset jack will also ring.

Manual Answer

On ring detection the modem displays:

Press TALK/DATA to answer the call or enter the ATA command at the DTE.

ENDING A CALL

The following conditions cause call termination:

¥Abort Disconnect
(No answer, busy signal, no modem, etc.)

Default 30 sec. Select 1 to 30 sec.

¥ATH

Disconnect command.

¥Loss of Carrier Disconnect

Select 100 ms to 25.5 sec.

¥Receive Long Space Disconnect

Disable or enable.

¥DTR Disconnect

Disable or select 10 ms to 2.55 sec.

¥LCD Display

When TALK/DATA is pressed, the LCD displays DO YOU WANT

TO DISCONNECT? When YES is pressed the modem hangs up. Pressing NO displays SWITCH TO TELSET (TALK MODE)? Pressing YES turns the connection over to the connected telephone.

¥Protocol Link Establishment Failure

Reliable mode only. Failure to establish reliable link.

¥Protocol Inactivity Timeout

Default (0) disabled. Select disable or 1 to 255 minutes.

¥Protocol Retry Limit Exceeded

12 retransmissions of the frame.

¥Signal Quality

Leased line operation with dial backup enabled; extended loss of carrier or 4 unsuccessful retrains in 3 minutes.

¥Modem power is turned off.

V.32 Cleardown

Operation

V.32 cleardown is a method of call termination specified in the CCITT recommendation. Cleardown incorporates a training sequence which ends with a command to disconnect. If long space disconnect is disabled, the cleardown sequence is activated by the ATH command or by any method of disconnect request.

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.

Creating a Command Statement AT

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.

Autobaud

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.

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.

Response Commands, Cont.

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.

Response Commands, Cont.

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

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.

Table 1:

V	Enables digit response messages
V1	Enables word response messages*

**default*

Response Displays Q

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

Table 2:

Command	Operation

Asynchronous Operating Commands

Response Commands, Cont. **Table 2:**

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

**default*

Response Commands, Cont.

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.

Call Progress and Connect Speed Displays X

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

Table 3:

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.

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.*

Number Code Application, Cont.

*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.

Table 4:

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

Dial Commands, Cont. 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.

Table 5-1
Response Messages

Table 5:

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	Dialed 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

Dial Commands, Cont. **Table 5:**

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

Table 5-1, Cont.

Response Messages

Table 6:

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

Table 6:

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
D

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

Table 7:

Command	Operation

Terminal Interface Commands, Cont. **Table 7:**

T	Tone dialing*
P	Pulse dialing
,	Insert a long pause (2 sec or value in S8)
W	Wait for 2nd dial tone
!	Flash (1/2 sec)
R	Switch to answer mode after dialing
T	insert a T in the dial command.
AT D T 323-1111P	insert a P in the dial command
AT D P 555-9902,	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 consecu-tively if de-sired.W	wait up to 30 seconds (time specified by S7) for a second dial tone.
Hook Flash !	enter an exclamation mark.
AT D T 9W 323-8000 ,!, #7 377	usually for transferring a call or similar use.
In this ex-ample	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.

Terminal Interface Commands, Cont. **Table 7:**

Switching to Answer Mode after Dialing R	use an R at the end of the dial sequence.
AT D 555-2345 R;	place a semicolon at the end of the dial string.
AT D 234-5678 ;@	use the @ command.
AT D 399-4700 @ 2251 ;	after the connection waits for 5 seconds. The modem then sends service code 2251 and returns to command mode for further input.
For example	you might enter a dollar amount for a banking transaction by entering
AT D 1400 ;	according to the requirements of the banking service.
Dialing a Stored Command Line Telephone S	enter ATDSn where n represents a stored telephone number location between 1 and 9.
AT D S9*AUn	which is used for any autodial application.
Voice Calls	dial the number with the telephone. To use the dial command for the call
AT D (number) ;	place the modems at both ends in DATA mode by pressing the TALK / DATA button.
ANSWERING A CALL	answer by pressing the TALK/ DATA button.
AT Command Answer AS0	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.
Detect &C	enter AT&C1. Some terminals and other devices require DCD on in order to communicate with the modem; if so

Terminal Interface Commands, Cont. **Table 7:**

select &C.	DIMENSION(IN)
COL-WIDTHS(1.0000,2.7108)	WIDTH(5.4992)
BE-LOW(.0005)	HGUTTER(.0555)
VGUT-TER(.0555)	BOX(Z_DOUBLE)
HGRID(Z_SINGLE)	VGRID(Z_SINGLE)
KEEP(OFF)	ALIGN(RT)
L2(R1C0..R1C2)	TABLE HEADING
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.

Table 8:

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 (OH) signal

**default*

Data Terminal Ready &D

In data mode DTR may be used for modem control.

Table 9:

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.*

Serial Port Ring Indicator (Pin 22) \R

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

Table 10:

Command	Operation
\R	Causes ring indicate signal on pin 22 to turn on (high) during each ring and remain on during the call
\R1	Causes ring indicate signal on pin 22 to turn on (high) during each ring and turn off (low) when the call is answered*

**default*

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.

Table 11:

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.*

General Commands, Cont.

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.*

General 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.

Table 12:

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.

Table 13:

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.*

Bilateral Test Enable / Disable
***AN**
***DG**

Enable or disable bilateral test functions.

Table 14:

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

Table 15:

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.

Table 16:

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

**default*

GENERAL COMMANDS

These commands control various standard options that in most cases apply to any mode of operation.

Changing from Data Mode to Command Mode +++

General Commands, Cont.

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.

Table 17:

Command	Operation
E	Echo off
E1	Echo on*

**default*

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 ATI1. The modem returns four ASCII characters representing the CRC in hexadecimal form. Enter ATI3 to request the product version.

Table 18:

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

Speaker Volume

General Commands, Cont.

ATL commands offer three volume levels.

Table 19:

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

**default*

Speaker Control M

ATM commands enable or disable the speaker for monitoring purposes.

Table 20:

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.*

Table 21:

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.

Table 22:

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.

Table 23:

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.

Configuration 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.

Table 24:

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.*

Configuration 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.

Table 25:

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.

Table 26:

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

**default*

DCE Speed %B

Configuration Commands, T...

AT%B1 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).

Table 27:

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.

Table 28:

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 redialing. The modem always responds to a retrain request from the remote modem.

Table 29:

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

**default*

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.

Table 30:

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 10^4
%R3	Enable auto rate renegotiation using high BER: 1 in 10^3

**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.

Table 31:

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

**default*

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

Dial Backup *DB

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

Table 32:

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.

Table 33:

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.

Line Current Disconnect *LC

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

Table 34:

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.

Protocol Commands, Cont.

Table 35:

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.

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.

Table 36:

Command	Operation
*OR	Force originate*
*OR1	Force answer

**default*

Leased Line Transmit Level *TLn

Table 37:

*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

Protocol Commands, Cont.

Table 38:

*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.

Table 39:

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

Protocol Commands, Cont.

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.

Table 40:

Command	Operation
&Y	Powerup with user option set 1
&Y1	Powerup with user option set 2
&Y?	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.

Table 41:

Command	Operation
&F, &F1	Load factory option 1 (async dial-up with V.42 bis)*

Protocol Commands, Cont.

Table 41:

&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*

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.

Table 42:

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

Protocol Commands, Cont'd

&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.

Table 43:

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.

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

Protocol Commands, Cont'd

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

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

Table 44:

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 re-

mote 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 99999999 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.

Table 45:

Command	Operation
%P=	Sets security code to a value 0 to 99999999 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.*

Table 46:

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?

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

Table 47:

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 \J

The AT\J command allows DCE and DTE to operate at different speeds. The AT\J1 command forces serial port (DTE) speed to follow data link speed in any mode.

If the modem is in direct mode (\J1) 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.

Table 48:

Command	Operation
\J	Disable slaved DTE/DCE (constant speed DTE on)*
\J1	Enable slaved DTE/DCE (constant speed DTE off)

**default*

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.

Table 49:

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

**default*

Operating Mode \N

Sets the error control mode that the modem uses while in data mode. An AT\Nn 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.

Table 50:

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*

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.

Table 51:

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 (AT\N3, \N5, \N7).*

Protocol Result Codes \V

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

Table 52:

Command	Operation
\V	Disable protocol result codes*
\V1	Enable protocol result codes

**default*

Serial Port Flow Control \Q

\Q 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.

AT\Q --\Q3 affect both DTE and DCE flow control.

AT\Q4 --\Q7 affect only flow control by the DCE.

AT\Q disables flow control.

When AT\Q1 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.

AT\Q2 allows use of CTS off to stop the data from the DTE and CTS on to restart it.

AT\Q3 forces the modem to act on CTS like \Q2. In addition RTS on / off is used to facilitate starting and stopping data from the modem to the DTE.

AT\Q4 disables flow control from the DCE.

AT\Q5 enables XON/XOFF flow control from the DCE only.

AT\Q6 and \Q7 force the modem to use CTS like \Q2 does but do not affect flow control by the DTE.

Table 53:

\Q	Disable DTE flow control
\Q1	Enable DTE XON/XOFF flow control*
\Q2	Enable CTS flow control to the DTE
\Q3	Enable bilateral CTS/RTS flow control
\Q4	Disable DCE flow control
\Q5	Enable DCE XON/XOFF flow control*
\Q6	Enable CTS flow control to the DTE
\Q7	Enable CTS flow control to the DTE

**default*

XON/XOFF Pass Through \X

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 \G command and act accordingly.

Caution: *With \X1 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.*

Table 54:

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 \G

Enables or disables flow control used to pace data sent from the remote modem to the local modem during a normal connection. When AT\G1 is set, the modem uses XON/XOFF to start / stop data transmission from the remote modem. This command is ignored during a reliable connection.

Table 55:

Command	Operation
\G	Disable data link flow control*
\G1	Enable data link flow control

**default*

Break Control \Kn

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

Table 56:

Command	Operation
\K	Break option 0
\K1	Break option 1
\K2	Break option 2
\K3	Break option 3
\K4	Break option 4
\K5	Break option 5*

**default*

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

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

Table 57:

Command	Operation
\K, \K2, \K4	Enter command mode but do not send break to the remote modem
\K1	Empty the data buffers and send break to the remote modem
\K3	Immediately send break to the remote modem
\K5	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*.

Table 58:

\K, \K2, \K4	Immediately send a break to the remote mode and enter command state when break is through
\K1, \K3, \K5	Immediately send a break to the remote modem

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

Table 59:

Command	Operation
\K, \K1	Empty the data buffers and send break to the serial port
\K2, \K3	Immediately send break to the serial port
\K4, \K5	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.*

Table 60:

Command	Operation
\K, \K1	Empty the data buffers and send break to the remote modem
\K2, \K3	Immediately send break to the remote modem
\K4, \K5	Send a break to the remote modem in sequence with any data received from the serial port

Inactivity Timer \T

\T 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.

Table 61:

Command	Operation
\T	Disable inactivity timer*
\Tn	Set inactivity to n (n-1-90) minutes

**default*

Maximum Reliable Block Size \A

\A 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 AT\A command.

Table 62:

Command	Operation
\A	Maximum transmit block size =64 characters
\A1	Maximum transmit block size =128 characters
\A2	Maximum transmit block size =192 characters
\A3	Maximum transmit block size =256 characters*

**default*

Transmit Break / Set Break Length \B

AT\B 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 AT\Bn where n=1-255 in 20 ms increments.

Table 63:

Command	Operation
\B	Sends a break signal to the remote modem. (Does not modify S79)
\Bn	Sets S79 to length of break desired. n=1-255 in 20 ms increments
@Z_TBL_END = \C	DIMENSION(IN)
COL-WIDTHS(1.0000,2.7108)	WIDTH(5.4992)
BE-LOW(.0005)	HGUTTER(.0555)
VGUT-TER(.0555)	BOX(Z_DOUBLE)
HGRID(Z_SINGLE)	VGRID(Z_SINGLE)
KEEP(OFF)	ALIGN(RT)
L2(R1C0..R1C2)	TABLE HEADING
Command	Operation
\C	Disables auto reliable data buffer*
\C1	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.

Table 64:

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 (enchanced compression)

**default*

Originate MNP Link \O

The AT\O 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 AT\U command. The modem sends two link requests (18 seconds) and if the remote modem does not respond the modem returns to normal mode.

Accept an MNP Link \U

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 AT\O 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 \Y

Entering \Y 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 \Z

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

Note: *If \J1 and \C are set, the \Z command forces the modem to the direct mode.*

Note: *The \Z and \Y commands must be issued at the same time to both modems for the switch to occur.*

Chapter 6
Status Registers

S-REGISTERS

Most modem configuration information is stored in a part of memory called status (S) registers. During operation this information is used to determine modem functions.

The information stored in the S-registers is changed by the AT or V.25b command sets and by pushbuttons in response to the LCD prompt. These are the preferred methods. Some software programs also access the S-registers via the AT command set, but this action is transparent to the user. The ATS commands indicate which memory bit(s) to alter to select a particular option or to perform a certain function. The S-register values comprise the configuration profile.

Caution: *The purpose of this tutorial is to show the versatility of option selection and register function. It is strongly recommended that the preferred methods of option selection be used. This tutorial uses S22 as the example register. Certain modems may use S22 differently or may not have an S22.*

Generally the user should not directly alter S-register values. However, the user has the option of changing S-registers via ATS commands and directly altering the register value. This is called "writing" to the S-register. Writing to an S-register is not a preferred method and should only be used by programmers who need to manipulate S-registers so they can interact with a software program under development or some other similar action.

Certain S-registers cannot be altered by the ATS command series. These are called "read only" S-registers. Appendix D contains a listing of S-registers and indicates if they are read only or read and write.

Figure 6-1 illustrates how the different inputs to an S-register (S22 in this case) are used to select a particular option. Bits 3 and 2 of S22 control speaker options. Some communication software packages may use the AT command set. For example purposes bit values are arbitrary.

Bit values for S-registers must not be confused with the total register value. Bit values are counted separately for each option group, called bit mapping, while the register value is the cumulative decimal or hexadecimal total. The decimal value counts all eight bits as a single group. Hexadecimal values split the bits into two groups of four each. Writing to an S-register changes the total value. Figure 6-2 illustrates the difference between decimal calculation and hexadecimal calculation.

Note: *Refer to Appendix F for decimal/ hexadecimal values.*

S-REGISTER OPERATION

Enter ATSn? to read a register value, where n=register number for a decimal value; or ATSn?^ for a hexadecimal value.

For example, to determine the current backspace character enter

ATS5?

The screen will show the ASCII value of the backspace character stored in register S5.

Changing Register Values
Sn=v
Sn=^v

To change an option using ATS commands requires the operator to precalculate the revised decimal (or hexadecimal) total. Because of the chance of miscalculating the bit sum, causing unplanned option changes, writing to an S-register is discouraged. For operators who prefer this method of option selection a much simplified command that eliminates the decimal calculation is explained in the Individual Bit Command section.

Enter ATSn=v to change a register value, where n=register number and v=decimal value; or ATSn=^v,where ^v=hexadecimal value.

Note: *Not all registers can be set by the ATSn=v (or ^v) command. Some registers are for reference only.*

To change the escape character from + to the ESC key (ASCII value of 27)

Enter ATS2=27

To return the modem to the command mode press the ESC key three times:

(pause) ESC ESC ESC (pause)

Individual Bit Command Sn . #=v

Most operators use AT commands as the primary method of changing S-register options. However, some options stored in registers do not have an associated AT command. For these options, the individual bit AT command can be used to change the setting of the bit controlling the option.

To

Change a single bit value within a register

Enter

ATSn . # = v

where n= register number #= bit position 0 through 7 v= bit value 1 or 0

Example:

S-register 27, bit 2 selects between dial-up or leased line operation.

AT command method:

AT&L selects dial-up operation (sets S27 bit 2 to 0)

AT&L1 selects leased line operation (sets S27 bit 2 to 1)

Individual bit method:

ATS27.2=0 selects dial-up operation (sets S27 bit 2 to 0)

ATS27.2=1 selects leased line operation (sets S27 bit 2 to 1)

Note: *This way of selecting options can be used on all S-registers except read only registers.*

Autoanswer
S0=0-255

This register turns the option on or off. Set the register to 0 to turn autoanswer off.

Set the register to any value other than zero (1-255) to turn autoanswer on. The number selected is the ring count the modem answers on. For example, if S0 equals 4, the modem answers the call on the fourth ring. The default value is 1.

Ring Count
S1=0-255

This register contains the ring count for a current incoming call and should not be changed. The user can read the register to determine the ring total.

Escape Character
S2=0-255

The standard escape character is a + sign (ASCII value of 43). To change the character, set S2 to the desired ASCII value.

To disable the escape command, set S2 to any value greater than 127.

End-of-Line Character S3=0-127

The standard end of line character is the carriage return (ASCII value of 13). This character ends each command as it is sent to the modem. It is also sent by the modem after each status message or number code.

To change the character, set S3 to the desired ASCII value (0-127).

Line Feed Character S4=0-127

The standard character is the line feed (ASCII value of 10). This character is sent by the modem after each status message. To change it, set S4 as desired (0-127).

Backspace Character S5=0-127

The standard character is the backspace (ASCII value of 8). To change it, set S5 to the desired value (0-127).

Pause Before Dialing S6=0-255

When dial tone detection is disabled (command X, X1, or X3 in effect), the modem waits the number of seconds (0-255) stored in this register before dialing.

The default value is 2 (seconds).

Pause for Ringback and Carrier Detection / Wait for 2nd Dial Tone S7=1-255

If no ringback is detected in the number of seconds in S7 (1-255), the modem disconnects and sends the NO CARRIER message or code. If ringback is detected, the modem begins to look for a carrier.

If no carrier is detected within the number of seconds in S7, the modem hangs up and sends the NO CARRIER message or code.

Values between 1 and 255 may be used. The default value is 30 (seconds).

Pause Interval for Comma S8=0-255

When a dial command contains a comma, the modem pauses the number of seconds in S8.

Change S8 to change the basic pause interval (0-255), or use several commas in a row for greater delay during dialing.

The default value is 2 (seconds).

Carrier Detect Time S9=0-255

S9 contains the amount of time (0-255) in 0.1 second increments the carrier must be present to be recognized. The default value is 6 (0.6 second). This timer can be extended to lessen the likelihood of false detection of carrier.

Lost Carrier Detect Time S10=0-255

S10 contains the amount of time (0-255) in 0.1 second increments carrier must be absent to be recognized as a loss of carrier. The default value is 14 (1.4 seconds).

DTMF Tone Duration S11

S11 determines the length of DTMF tones. The period of silence is equal to the duration of the tone. The value of this register must be entered in multiples of 10. Default value is 80 (80 ms).

Escape Sequence Pause S12=0-255

Using the escape sequence to return to command mode from data mode requires two pauses, one before and one after the escape characters.

The pauses prevent the modem from responding to a character sequence which might contain the escape sequence as part of its normal data transmission.

S12 contains the pause interval in 0.02 second increments. The factory setting is 50, equivalent to 1 second (50 x 0.02 sec). When S12 is 0 then timing is not a factor.

The timing between the 3 escape characters must be less than the pause interval or the escape sequence will not be detected. The data rate also affects the timing and must be taken into account when changing the pause interval.

To disable the escape command, set S2 to a value

greater than 127 instead of changing S12. Values between 0 and 255 may be used for S12.

Note: *When S-registers have parallel AT commands, the commands are listed in the register tables as a cross reference. If no command exists for the option the column is left blank.*

S13

Not used

Bit Mapped S14

Table 1:

0	---	---	Reserved
1	0 *1	E E1	Local character echo off Local character echo on
2	*0 1	Q Q1	Response messages on Response messages off
3	0 *1	V V1	Response messages as digit codes Response messages as words
4	*0 1	Q2	Ignore Response messages in originate mode only
5	*0 1	T P	Tone dial Pulse dial
6	---	---	Reserved
7	0 *1	*OR1 *OR	Forced answer Normal originate

** default*

Note: *Registers that contain more than one option are called "bit mapped" registers.*

S15

Reserved

System Tests S16

This register contains the status of system test options. For reference only.

Table 2:

Bit	Value	Command	Description
0	0 1		Analog loopback inactive Analog loopback in progress
1	---	---	Reserved
2	0 1		Digital loopback inactive Digital loopback in progress
3	0 1		Slaved digital loopback inactive Slaved digital loopback in progress
4	0 1		Remote digital loopback inactive Remote digital loopback in progress
5	0 1		Self test remote digital loopback inactive Self test remote digital loopback in progress
6	0 1		Self test analog loopback inactive Self test analog loopback in progress
7	---	---	Reserved

S17

Not used

Test Timeout S18

The amount of time, in 1 second increments, that a diagnostic test will run is determined by the value assigned to S18 (0-255). A value of 0 disables the timer allowing a test to run indefinitely. The default

value is 0.

S19, 20

Not used

Bit Mapped S21

Table 3:

6, 0	*00 10 01 11	&S &S1 &S2 &S3	DSR always on DSR on when off hook in data mode DSR off 5 seconds after disconnect DSR follows off hook (OH)
5, 1	*00 10 01 11	&C &C1 &C2 &C3	DCD always on DCD on while carrier present DCD on except for 5 seconds after disconnect DCD follows RTS on remote modem; not valid in reliable or buffered mode
2	0 *1	&R &R1	CTS follows RTS by S26 delay CTS always on
4, 3	*00 01 10 11	&D &D1 &D2 &D3	DTR ignored DTR on-to-off transition recalls asynchronous command state DTR on-to-off transition causes disconnect DTE on-to-off transition resets modem to current stored configuration and enters command mode
7	0 *1	Y Y1	Long space disconnect disabled Long space disconnect enabled

** default*

Bit Mapped S22

Table 4:

1, 0	00 01 *10 11	L L1 L2 L3	Speaker volume low Speaker volume low Speaker volume medium Speaker volume high
3, 2	00 *01 10 11	M M1 M2 M3	Speaker off Speaker on until carrier detect Speaker always on Speaker off when modem is dialing
6-4	000 001 010 011 *100	X X1 X2 X3 X4	CONNECT message only, blind dials, no busy detect CONNECT / appropriate code for rate, blind dials, no busy detect CONNECT / appropriate code for rate, waits for dial tone, no busy detect CONNECT / appropriate code for rate, blind dials, reports BUSY CONNECT / appropriate code for rate, waits for dial tone, reports BUSY
7	*0 1	&P &P1	Make / break ratio (US) 39/61 Make / break ratio (UK) 33/67

** default*

Bit Mapped S23

Table 5:

0	0 *1	&T5 &T4	Remote digital loop request denied Remote digital loop request granted
5-1	---	---	Reserved

Table 5:

7, 6	*00 01 10	&G &G1 &G2	No guard tones 550 Hz guard tone 1800 Hz guard tone

** default*

S24

Not used

DTR State Recognition S25

The S25 register specifies the amount of time (0-255) in 0.01 second (10 ms) increments that DTR must stay high or low in order to be recognized as such. The default value is 5 (0.05 second).

RTS/CTS Delay S26

The S26 register specifies the amount of time (0-255) in 0.01 second (10 ms) increments between the RTS signal and the CTS signal. The default value is 0.

Bit Mapped S27

Table 6:

1, 0	*00 01 10 11	&M &M1 &M2 &M3	Async Sync data / async dial Sync data / dial through DTR Sync data / manual dial
2	*0 1	&L &L1 *and* &L2	Dial-up line Leased line
3	--	--	Reserved
5, 4	*00 01 10	&X &X1 &X2	Internal clock External clock Receive clock
6	0 *1		Enable async DTR dialer Disable async DTR dialer
7	--	--	Reserved

** default*

Lookback Timer S28

The S28 register specifies the amount of time in 1.0 minute increments that the modem will remain in dial backup mode before retrying leased line mode. This is only used if automatic dial backup is enabled. A zero will disable automatic lookback to leased line. The default value is 15 minutes.

Table 7:

Bit	Value	Command	Description
7-0	0-255		Time in 1 minute increments (0=disabled)

***** *default*

Bit Mapped S29

Table 8:

0	*0 1	*NT1 *NT	Enable AT command set Disable AT command set
1	*0 1	*RO *RO1	Options retained at disconnect Options restored at disconnect
2	*0 1	*FT *FT1	Disable V.32 fast train Enable V.32 fast train
6-3	--	--	Reserved
7	*0 1	*FB *FB1	DTE fallback disabled DTE fallback enabled

** default*

Bit Mapped S30

Table 9:

0	--	--	Reserved
1	*0 1		V.25 ASCII V.25 EBCDIC
4-2	--	--	Reserved
5	*0 1		NRZ NRZI
7, 6	00 01 10 *11	 &M4 &M5 	V.25 disabled V.25 bisync enabled V.25 SDLC enabled Async enabled

Status Registers

** default*

4-Wire Leased Line Training Sequence S31

Table 10:

0	*0 1	--	V.33 training sequence V.32 training sequence
7-1	--	--	Reserved

* *default*

Bit Mapped S32

Table 11:

0	0 1	&L1 &L2	2-wire (leased line only) 4-wire (leased line only)
1	0 *1	*LC1 *LC2	Line current disconnect = short Line current disconnect = long
2	0 *1	*LC *LC1 *or* *LC2	Line current disconnect = disable Line current disconnect = enable
3	*0 1	*DB *DB1	Dial backup = manual Dial backup = automatic
7-4	--	--	Reserved

* *default*

S33

Reserved

Bit Mapped S34

Table 12:

0	*0 1	*AN *AN1	Bilateral analog = disable Bilateral analog = enable
1	*0 1	*DG *DG1	Bilateral digital = disable Bilateral digital = enable
2	*0 1	*LA *LA1	DTE commanded LAL = disable DTE commanded LAL = enable
3	*0 1	*RD *RD1	DTE commanded RDL = disable DTE commanded RDL = enable
7-4	--	--	Reserved

**default*

S35-38

Reserved

Connect Message S39

Table 13:

4-0	--	--	Reserved
5	*0 1	--	Send connect message DTE rate Send connect message DCE rate
7-6	--	--	Reserved

**default*

S40-50

Reserved

Bit Mapped S51

The S51 register selects dial line transmit level from -9 to -21 dBm in 1dB increments.

Table 14:

Bit	Value	Command	Description
4-0	9 to 21	*TDn	Transmit level in dBm (-9 through -21 dBm)
7-5	--	--	Reserved

**default*

Bit Mapped S52

The S52 register selects leased line transmit level from 0 to -21 dBm in 1 dB increments.

Table 15:

Bit	Value	Command	Description
3-0	*0 to 21	*TLn	Transmit level in dBm (0 through -21 dBm)
7-4	--	--	Reserved

** default*

801 V.32 Timeout S53

The S53 register selects 801 (ACU) V.32 timeout.

Table 16:

Bit	Value	Command	Description
0	*0 1		801 V.32 timeout long 801 V.32 timeout short
1	--	--	Reserved
3, 2	*00 01 10 11	%R %R1 %R2 %R3	Auto rate renegotiation threshold disabled Low BER Medium BER High BER
7-4	--	--	Reserved

* *default*

Flow Control S54

The S54 register selects the flow control options.

Table 17:

Bit	Value	Command	Description
1, 0	00 *01 10 11	\Q \Q1 \Q2 \Q3	Disable DTE flow control Enable DTE XON/XOFF flow control Enable CTS flow control to the DTE Enable bilateral CTS/RTS flow control
2	--	--	Reserved
3	*0 1	\G \G1	Disable modem port flow control Enable modem port XON/XOFF flow control
4	*0 1	\X \X1	No XON/XOFF characters to remote Pass XON/XOFF characters to remote
6, 5	00 *01 10 11	\Q4 \Q5 \Q6 \Q7	Disable flow control from DCE Enable XON/XOFF flow control Enable CTS flow control to the DTE Enable CTS flow control to the DTE
7	--	--	Reserved

* *default*

S55

Reserved

V.42 Compression Control S56

Table 18:

1, 0	00 01 10 *11	%C %C2 %C3 %C1	Compression disabled Compression enabled on transmit data only Compression enabled on receive data only Compression enabled on transmit and receive data
7-2	--	--	Reserved

* *default*

Number Code Application S57

Table 19:

0	*0 1	*RC *RC1	Standard number codes 15 - 4800 bps 18 - 9600 bps Alternate number codes 11 - 4800 bps 12 - 9600 bps
7-1	--	--	Reserved

** default*

Inactivity Timer S58

The S58 register specifies the number of minutes the modem waits before terminating a call when no data is sent or received. This register is active when in error control mode. 0 disables timer.

Table 20:

Bit	Val-ue	Command	Description
7-0	*0 1-255	\T \Tn	Disable Timer value in minutes (n=1-255)

** default*

Break Control S59

The S59 register determines the action taken when a

break is encountered. Refer to Break Control section in Chapter 5 for further explanation.

Table 21:

Bit	Value	Command	Description
2-0	000 001 010 011 100 *101	\K \K1 \K2 \K3 \K4 \K5	Break option 0 Break option 1 Break option 2 Break option 3 Break option 4 Break option 5
7-3	--	--	Reserved

* *default*

Bit Mapped S60

Table 22:

0	0 *1	%E %E1	Disable auto retrain Enable auto retrain
1	--	--	Reserved
2	*0 1	\C \C1	Disable auto-reliable data buffer Buffer data for 4 seconds or 200 characters
5-3	111 110 101 100 *011-000	\O \U \Y \Z	Originate an MNP link Accept an MNP link Switch to MNP from normal Switch to normal from MNP Mode selected from S70
6	0 *1	\R \R1	RI blinks for ring and remains on for duration of call RI blinks for ring and turns off when call is answered
7	*0 1	\V \V1	Disable protocol result codes Enable protocol result codes

** default*

DTE Options S61

The S61 register indicates the character size and parity. This register is for reference only.

Table 23:

Bit	Val-ue	Command	Description
2-0	--	--	Reserved

Table 23:

3	0 1		7 bit word length 8 bit word length
5, 4	00 01 10 11		Mark parity No parity Odd parity Even parity
7, 6	--	--	Reserved

** default*

Disconnect Buffer Delay S62

The S62 register determines the delay before disconnect, to allow buffers to empty, when disconnect conditions exist.

Table 24:

Bit	Value	Command	Description
7-0	*0 1-255	%D %Dn	Buffer disabled Disconnect buffer delay value (n=1-255 seconds)

** default*

Maximum Transmit Block Size S63

The S63 register sets the maximum transmit block size.

Table 25:

Bit	Value	Command	Description
7-0	63 127 191 *255	\A \A1 \A2 \A3	Maximum block size = 64 Maximum block size = 128 Maximum block size = 192 Maximum block size = 256

** default*

Auto-Reliable Fallback Character S64

The S64 register stores the selected ASCII value of the auto-reliable fallback character.

Table 26:

Bit	Value	Command	Description
7-0	*0 1-127	%A %An	Disable auto-reliable fallback character ASCII value 1-127 (n=1-127)

** default*

S65

Reserved

Bit Mapped S66

Table 27:

0	0 1	&Y &Y1	User option 1 loaded at powerup/reset User option 2 loaded at powerup/reset
7-1	--	--	Reserved

Link Speed Status S67

The S67 register indicates the true data link (DCE) speed. This register is for reference only.

Table 28:

Bit	Value	Command	Description

Table 28:

3-0	0000 0001 0010 0011 0100 0111 0101 0110 1000 1001		N/A 300 bps 1200 bps 2400 bps 4800 bps 7200 bps 9600 bps uncoded 9600 bps trellis 12000 bps 14400 bps
7-4	--	--	Reserved

** default*

S68

Reserved

DCE Independent Speed S69

The S69 register selects the DCE independent rate operation. When S69 is 0, DTE and DCE rates are equal and the maximum originate connect rate up to 14400 bps is determined by S80. When S69 is non-zero, the maximum originate connect rate is determined by S69.

Table 29:

Bit	Value	Command	Description
3-0	0000 0001 0010 0011 0100 0111 0101 0110 1000 *1001	%B %B1 %B2 %B3 %B4 %B5 %B6 %B7 %B8 %B9	Use rate indicated by S80 300 bps 1200 bps 2400 bps 4800 bps 9600 bps uncoded 9600 bps trellis 7200 bps 12000 bps 14400 bps
7-4	--	--	Reserved

* *default*

Operating Mode S70

The S70 register determines the protocol operating mode and action taken on an error correcting attempt failure. LAPM is assigned highest priority.

Example: With \N7 selected the modem tries a LAPM connection first; if unsuccessful the modem tries an MNP connection; if also unsuccessful the modem connects in normal mode. Modes allowing protocol fallback are referred to as auto-reliable.

Table 30:

Bit	Value	Command	Description
2-0	000	\N	Normal
	001	\N1	Direct
	010	\N2	MNP only (reliable)
	011	\N3	MNP or normal (auto-reliable)
	100	\N4	LAPM only (reliable)
	101	\N5	LAPM or normal (auto-reliable)
	110	\N6	LAPM or MNP only (auto-reliable)
	*111	\N7	LAPM or MNP or normal (auto-reliable)
3	0	\M	Disable V.42 fast detect
	*1	\M1	Enable V.42 fast detect
7-4	--	--	Reserved

** default*

Operating Mode Status S71

The S71 register indicates the level of error controlling protocol. This register is for reference only.

Table 31:

Bit	Value	Command	Description
2-0	000 001 010 011 100 101 110 111		Protocol not active Protocol negotiation in progress MNP level 2 active MNP level 3 active MNP level 4 active MNP level 5 active (MNP with data compression LAPM active LAPM with data compression active
7-3	--	--	Reserved

***** *default*

Bit Mapped S72

Table 32:

0	*0 1	\J \J1	Disable slaved DTE/DCE (constant speed DTE on) Enable slaved DTE/DCE (constant speed DTE off)
1	*0 1		Link parity option disabled Link parity option enabled
2	0 1		No link parity error Link parity error received (cleared on read)
3	0 1	 &R2	CTS does not follow DCD CTS follows DCD
4	0 1	 &R9	CTS does not equal RTS CTS equals RTS
6-5	--	--	Reserved
7	*0 1		Disable autocallback Enable autocallback

** default*

S73-77

Reserved

Autocallback Timer S78

The S78 register specifies the time in seconds that the modem waits before initiating autocallback. The default is 30 seconds.

Table 33:

Bit	Value	Command	Description
7-0	0-255		Time in seconds before autocallback

Break Length S79

The S79 register sets the length of the break sent to the DTE when a break signal is received. Range from 1-255 in 20 ms increments. Default is 35 (700 ms).

Table 34:

Bit	Value	Command	Description
7-0	1-255	\B \Bn	Send break Set break length (n=1-255)

Serial Port Speed S80

The S80 register indicates the serial port speed.

Table 35:

Bit	Value	Command	Description
3-0	0001 0010 0011 0100 0101 *0110 0111 1000 1001 1010 1011		300 bps 1200 bps 2400 bps 4800 bps 7200 bps 9600 bps 12000 bps 14400 bps 19200 bps 38400 bps 57600 bps
7-4	--	--	Reserved

** default*

S81-83

Reserved

Bit Mapped S84

Table 36:

0	*0 1		Any key abort enabled Any key abort disabled
1	*0 1		Remote DCD goes low in RDL and remote configuration Remote DCD goes high in RDL and remote configuration
2	*0 1		Fallback to V.22 rates normally Reduced time to fallback to V.22 rates
3	*0 1		Answerback normally Reduced answerback time
4	*0 1		With DTR disconnects, 4 DTR transitions initiate dial backup With DTR disconnects, 1 DTR transition initiates dial backup
7-5	--	--	Reserved

** default*

S85-90

Reserved

Chapter 7
V.25 bis Autodialer

GENERAL

V.25 bis is an option that allows dialing functions to be controlled using synchronous data.

Select V.25 bis through the appropriate &M command in the AT command set (Chapter 5).

If using the LCD

¥Scroll through the menu to Main Menu 5, MODIFY CONFIGURATION.

¥Advance to and enter the DTE PARAMETERS submenu.

¥Select SYNC DATA.

¥Advance to DIAL METHOD.

¥Select either V.25 BISYNC DIALER or V.25 SDLC DIALER or V.25 ASYNC DIALER and then select either ASCII or EBCDIC character format.

Note: *The modem must be configured as V.25 SDLC ASCII NRZ for use with an AS400 IBM computer.*

Autodialer Command Strings and Parameters

Most command strings for the autodialer include two parts: the command itself and the parameter(s) that follow. For the purposes of this chapter, parameters can be telephone numbers or anything appropriate to

V.25 bis as described in the following text. Parameters are separated by semicolons.

For example:

PRN *a; nnn . . . n*

where *a*=the phone number address in memory and *nnn . . . n* = the phone number

The *a* and the *nnn . . . n* are both parameters.

Not all commands have parameters. For example the CIC command has no parameter.

GUIDELINES

Use the following guidelines when working with V.25 bis software:

¥An indicator enclosed in less than / greater than signs < > represents a specific character in the appropriate character set, ASCII or EBCDIC.

<sp> - space

¥Each response below is considered an individual message per V.25 bis conventions. A dial command with intermediate call progress enabled (sync mode ASCII/EBCDIC character set) is illustrated:

From DTE

To DTE

<sy><sy><stx>CRN<sp>(205)555-0124<etx>

<sy><sy><stx>VAL<etb>

<sy><sy><stx>CNX<sp>@9600BPS

<etx>

¥Spaces in a command from the DTE are optional and ignored.

¥Command strings can be upper or lower case. Responses are always upper case.

¥Only synchronous data formats are implemented. They include Bisync and SDLC (NRZ format) in ASCII or EBCDIC.

Invalid Responses Explanations

Except when stated otherwise, the following explanations for invalid INV responses apply:

INVC

Any transmission error (parity, framing, etc.).

INVMS

Receiving too many characters for any command.

INVMS

Any command followed by a semicolon ;

INVPS

This message has one of three possible meanings:

¥Any parameter set ending with a semicolon ;

¥Any parameter set containing too many or not enough parameters; this includes

--any command entered without parameters that requires parameters

--any command entered with parame-

ters that does not require parameters.

¥Any parameter containing too many characters.

INVPV

This message has one of three possible meanings:

¥Any parameter set containing invalid characters

¥Any parameter or parameter set containing no valid (only ignored) characters

¥Any parameter set containing an out-of-range parameter

DIAL PARAMETERS

Table 7-1 lists and describes the parameters used in autodialing. The memory available for dialing can hold up to 40 characters. Parameters inserted for readability are not counted.

Table 1:

Character	Function
0 thru 9	DTMF and pulse digit
* and #	DTMF digit
:	Wait for dial tone
W	Wait for 2nd type of dial tone
>	Pause for 1 second
=	Pause for 3 seconds

Table 1:

<	Pause for programmed delay time
P	Pulse dialing
T	Tone dialing*
&	Flash (go on hook) for <Insert equation here> ms
;	Return to command mode after dialing
Space, dash, parenthesis, period	Parameters inserted for readability

V.25 bis COMMAND AND RESPONSE DEFINITIONS

The following sections describe the commands used with the V.25 bis autodialer and explain the responses received when each command is executed.

Dial Command CRN *nn...n*

The dial command is a CRN followed by the number to be dialed *nn...n*. The modem accepts up to 40 dial parameters, excluding the CRN command and any leading spaces.

Responses:

VAL

Valid command received. Transmitted on receiving an error-free command with no transmission error such as a parity error. This confirmation is sent before the command is executed.

INVCU

Invalid command - command unknown.

Example: TRN (205)-555-0124

INVMS

Invalid command - message syntax error.

Examples: CRN;(205)-555-0124
CRN; *(semicolon invalid)*

INVPS

Invalid command - parameter syntax error.

Examples: CRN (205)-555-0124
CRN (205)-555;0124
CRN

INVPV

Invalid command - parameter value error.

Examples: CRN (205)-555-012Q
CRN - - - -

CFIET

Call failure - reorder or busy.

CFIRT

Call failure - timeout occurred.

CFIDT

Call failure - no dial tone.

INC

Incoming ring detected.

Program Number Command
PRN *a; nn...n*

The program number command is PRN followed by the one digit decimal address *a* and the number to be stored *nn . . . n*. Each address can store up to 32 dial parameters. Ignored characters in the dial number are not stored. Nine stored numbers are available at addresses 1-9.

Responses:

Same as for the CRN command.

Intermediate Call Progress Responses

The following responses are given only if enabled. Refer to the OPTIONS section later in this chapter.

CNX<sp>@*nnnnn*BPS<sp>*ccccc* - where *nnnnn* is the line speed and *ccccc* is an identifier with a maximum of five characters, such as V.29. This connect response appears after handshake completed, but before DSR is activated. This response is required if the intermediate call progress option is enabled.

Dial Stored Number
CRS *a*

The command for dialing a stored number is CRS followed by the one digit address *a* for the stored number to be dialed.

Responses:

Same as for the CRN command plus

CFINS

Call failure - number not stored.

If the number is linked with other numbers, via a PRL command, failure responses are returned as

{sep}*a;*{call progress messages} . . .

where *a* is the address dialed, followed by the separator field <etb><sy><sy><stx> and call progress messages (CFI, etc.).

If the call fails to connect and the number is linked with other numbers, the autodialer tries to call the next number in the list of linked numbers.

Request List of Stored Numbers RLN

The request list of stored numbers command is an RLN.

Responses:

INVCU

Invalid command - command unknown.

Example: TLN

INVMS

Invalid command - message syntax error.

Example: RLN;

If no number is stored at the specified address nothing is returned for that address. The separator {sep} is a

<etb><sy><sy><stx>LSN <sp>

sequence for BISYNC format (the last LSN string terminates with <etx> per V.25 bis). For synchronous bit-oriented operation, each LSN string is treated as an individual message per V.25 bis.

All stored numbers are sent to the DTE as

LSN<sp>*a;nn...n*{sep}*a;nn...n...*

where *a* is the stored number address and *nn....n* is the number stored.

Disregard Incoming Call DIC

The command for disregarding an incoming call does not require parameters. If no call is incoming, the command is ignored.

Responses:

VAL

Valid command received. Transmitted on receiving an error-free command with no transmission error such as a parity error. This confirmation is sent before the command is executed.

INVCU

Invalid command - command unknown.

Example: TIC

INVMS

Invalid command - message syntax error.

Example: SIC;

Connect Incoming Call CIC

No parameters are required. If there is an incoming call, the modem immediately answers the call. If no call is incoming, the command is ignored.

Responses:

VAL

Valid command received. Transmitted on receiving an error-free command with no transmission error such as a parity error. This confirmation is sent before the command is executed.

INVCU

Invalid command - command unknown.

Example: TIC

INVMS

Invalid command - message syntax error.

Example: SIC;

Redial Last Number CRR *n*

The CRR *n* command redials the last number a maximum of *n* times. If no parameters are present, the modem redials once. Also, the maximum number of redials, the amount of time between redials, and other parameters may vary depending on application and national requirements if outside the U. S.

Responses:

Same as for the CRS command.

Failure response is

{sep}*r;*{call progress messages}...

where *r* is the recall count (1 <= *r* <= *n;* 1,2...,etc.), followed by a separator field

<etb><sy><sy><stx>

and call progress messages (CFI XX, etc.). If the call fails to connect, this is repeated for the specified number of times.

Link Number by Address
PRL *a;b*

This command links the number at address *a* with the number at address *b*. The addresses are one digit decimal values. Linking numbers enables different numbers to be dialed if a call failure occurs.

Only forward linking to one other number is allowed, so address 1 can be linked to 4 to 8 to 9 etc.; however (using this example), if address 4 is dialed by a CRS command without connection it links forward to 8 then to 9.

If all these fail to connect, the autodialer will not back-link to address 1 unless circular linking is used. Numbers may be linked as 4 to 5 to 3; however, if address 3 is dialed, back-linking to 5 is not allowed.

If circular linking (1 to 8 to 7 to 1) is used, dialing is discontinued after the addressed number in the dial command has been dialed twice. If only one parameter follows the PRL command, the number at address a is unlinked from its forward link.

For example, if the link list 4 to 8 to 3 to 7 to 9 to 1 exists and PRL 7 is received, 7 would be unlinked from 9, but not from 3. This would result in two link lists: 4 to 8 to 3 to 7 and 9 to 1.

Responses:

VAL

Valid command received. Transmitted on receiving an error-free command with no transmission error such as a parity error. This confirmation is sent before the command is executed.

INVCU

Invalid command - command unknown.

Example: TRL 1;5

INVMS

Invalid command - message syntax error.

Examples: PRL;1;5
PRL;

INVPS

Invalid command - parameter syntax error.

Examples: PRL 1;5;
PRL 1;0;0
PRL 1;
PRL
PRL 001;5

INVPV

Invalid command - parameter value error.

Examples: PRL 1;Q
PRL Q;1
PRL 1;45 where only addresses 01 - 09 are defined

Request List of Linked Numbers RLL

The request list of linked numbers command is an RLL with no parameters.

Responses:

INVCU

Invalid command - command unknown.

Example: TLL

INVMS

Invalid command - message syntax error.

Example: RLL;

LSL

List linked numbers.

In all LSL examples, if no number is stored at the specified address no response is sent. The separator field is an

<etb><sp><sp><stx>LSL<sp>

The last LSL string ends with <etx> per V.25 bis. For synchronous bit oriented operation, each LSL string is treated as an individual message per V.25 bis. All linked numbers are sent to the DTE as

LSL<sp>*a;l*{sep}*a;l*

where *a* = stored address and *l* = link address.

Request List of Version RLV

The request list of version information command is an RLV with no parameters.

Responses:

INVCU

Invalid command - command unknown.

Example: TLV

INVMS

Invalid command - message syntax error.

Example: RLV;

LSV

List version

The version information is sent to the DTE as

LSV<sp>S362700*xxx*01*yyyddr*<sp>

where *xxx* is the code revision of the microcontroller PROM and *yyy* is the code revision. The *dd* is the model dash number and the *r* is the printed circuit board revision.

MODEM OPTIONS

COMMAND
PRO *xxx;yy;0;0..*

The program options command is PRO followed by the starting register address (1 to 3 decimal digits), option count (1 or 2 decimal digits) and the data for each option (1 to 3 decimal digits per option). Refer to the OPTIONS section for available options with definitions, possible settings, and default values.

The modem must be able to accept 40 non-ignored characters besides the PRO command (leading zeros and semicolons are not considered ignored characters).

Responses:

VAL

Valid command received. Transmitted on receiving an error-free command with no transmission error such as a parity error. This confirmation is sent before the command is executed.

INVCU

Invalid command - command unknown.

Example: TRO 0;1;1

INVMS

Invalid command - message syntax error.

Examples: PRO;0;1;1
PRO;

INVPS

Invalid command - parameter syntax error.

Examples: PRO 0;1;0;
PRO 0;1;1;1
PRO
PRO 0;001;1

INVPV

Invalid command - parameter value error.

Examples: PRO 0;1;Q
PRO Q;1;1
PRO 0;0;0
PRO 68;1;0

when option 68 is undefined for the modem.

INVPV<sp>*xxx*

Invalid command - parameter value error.

Examples: PRO 10;5;0;0;0;2;1

This invalid message can be returned when a block of options is being changed. The conditions for this invalid response are as follows:

¥An undefined option number is specified. In the above example, if option 12 is undefined for a certain modem (and no other error conditions apply) options 10 and 11 would be changed as specified in the command message. The next option to be changed would be option 12. The modem would detect that this is an undefined option, stop execution of the command, and return an INVPV<sp>012 message. Options 10 and 11 would still be changed as commanded, options 13 and 14 would be unchanged.

¥An out-of-range value for a particular option is specified. In the above example, if the fourth value in the option string is undefined or out-of-range for option 13 in a certain modem (and no other error conditions apply) options 10 through 12 would be changed as specified in the command message. The next option to be changed would be option 13. The modem would then detect that the value is undefined or out-of-range for that option, stop execution of the command, and return an INVPV<sp>013 message. Options 10 through 12 would still be changed as commanded; options 13 and 14 would be unchanged.

Save Current Settings PRK

PRK saves option settings current.

Responses:

VAL

Valid command received. Transmitted on receiving an error-free command with no transmission error such as a parity error. This confirmation is sent before the command is executed.

INVCU

Invalid command - command unknown.

Example: TRK

INVMS

Invalid command - message syntax error.

Examples: PRK;0
PRK Q

Restore Factory Settings
PRP *n*

PRP *n* restores current option settings to factory option set *n* where *n* is a 1 digit decimal number.

Note: *Restoring a factory option set other than factory option 9 disables the V.25 synchronous dialer.*

If no parameter follows the command, the modem automatically selects factory option set 1.

Responses:

VAL

Valid command received. Transmitted on receiving an error-free command with no transmission error such as a parity error. This confirmation is sent before the command is executed.

INVCU

Invalid command - command unknown.

Example: TRP

INVMS

Invalid command - message syntax error.

Examples: PRP;1
PRP Q

INVPS

Invalid command - parameter syntax error.

Examples: PRP 1;
PRP 1;1
PRP 001

INVPV

Invalid command - parameter value error.

Example: PRP 5

where factory default 5 is not defined for the modem. Current modem factory options are 1 - 9.

Request List of Stored Options RLO *xxx;yy*

The request list of stored options command is RLO followed by an optional 1 to 3 digit decimal address and a 1 or 2 digit decimal count. The OPTIONS section lists all available options with definitions,

possible settings, and default values.

Responses:

INVCU

Invalid command - command unknown.

Example: TLO 0;1

INVMS

Invalid command - message syntax error.

Examples: RLO;0;1
RLO Q;1

INVPS

Invalid command - parameter syntax error.

Examples: RLO 0;1;
RLO 0;1;4
RLO 0;001

INVPV

Invalid command - parameter value error.

Examples: RLO 0;Q
RLO 0;0
RLO999;45

LSO

List stored options.

The separator {sep} is a

<etb><sp><sp><stx>LSO<sp>

sequence for the sync format (the last LSO string terminates with <etx> per V.25 bis). For synchronous bit oriented operation, each LSO string is treated as an individual message per V.25 bis.

If no parameters follow, all stored options are sent to the DTE as

LSO<sp>*xxx;ooo*{sep}*xxx;ooo...*

Each value must be padded with leading zeros so that each field has three characters. Option zero would be sent as

LSO<sp>000;000

If only an address follows the command, the single requested option is sent to the DTE as

LSO<sp>*xxx;ooo*

If address and count follow the command, the requested count of options starting with the specified address are sent to the DTE as

LSO<sp>*xxx;ooo*{sep}*xxx;ooo...*

OPTIONS

The V.25 bis autodialer options can be changed using the PRO or the RLO command. The options are:

000 - 001:

Not applicable

002:

Intermediate call progress messages
0 - Disable
1 - Enable
Default value = 0

003:

Blind dial
0 - Disable
1 - Enable
Default value = 0

004-006:

Not applicable

007:

Long space disconnect
0 - Disable
1 - Enable
Default value = 1

008-019:

Not applicable

020:

Programmable / permissive operation
0 - Permissive
1 - Programmable
Default value = 0

021-022:

Not applicable

023-049:

Reserved for future use

050:

Mode
0 - 2--wire dial-up operation (PSTN)
1 - 4--wire leased line operation
2 - 2--wire leased line operation
Default value = 0

051:

Primary transmit / receive rate
(See Rate Select section below.)
Default value = 36 (9600 bps)

052-054:

Not applicable

055:

Transmit clock
0 - Internal
1 - External
2 - Receive (slave)
Default value = 0

056:

Leased line transmit level -
Transmit level
(- {decimal} dBm)
Default value = 0

057-062:

Not applicable

063:

Autoanswer

0 - Disable
1 - Enable (answer after 1 to 255 rings)
Default value = 1

064:

Line current disconnect
0 - Off
1 - Short (8 ms)
2 - Long (90 ms)
Default value = 2

065-075:

Not applicable

076:

Speaker control
0 - Off
1 - On
2 - N/A
3 - N/A
4 - On until CD
5 - N/A
6 - Off while dialing
Default value = 4

077:

Speaker volume
0 - Low
1 - Medium
2 - High
Default value = 1

078-084:

Not applicable

085:

Constant carrier RTS/CTS delay
0 to 250 ms
Must be set in increments of 10 ms:
10, 20, 30 . . . 250
Default value = 0

086:

Not applicable

087:

DTR dropout timer
0 to 255 in 10 ms increments

DTR must turn off for this length of time to be recognized.
Default value = 5 (50 ms)

088:

Not applicable

089:

Pause for comma in dial string
0 - invalid
1 to 255 seconds
Default value = 2

090:

Carriage return character
(13 decimal is ASCII and EBCDIC default)

091:

Line feed character
(10 decimal is ASCII default;
37 decimal is EBCDIC default)

092:

Guard tone
0 = None
1 = 550 Hz
2 = 1800 Hz
Default value = 0

093:

Carrier detect delay
0 - Off 1 to 255 in increments of 10 ms
Default value = 6 (60 ms)

094:

Loss of carrier disconnect
0 - Off 1 to 255 in 100 ms increments
Default value = 14 (1.4 sec)

095:

DTR dial address
Stored telephone number address to dial on DTR off-to-on transition
Default value = 1

096:

DTR dial
0 - Disable
1 - Enable
2 - N/A
Default value = 0

097:

Not applicable

098:

Call timeout
0 - Off
1-255 sec
Default value = 30 sec

099-102:

Not applicable

103:

Signal quality retrain
0 - Disable
1 - Send training sequence on poor quality
Default value = 1

104-106:

Not applicable

107-899:

Reserved for future use

900-902:

Not applicable

903:

Bilateral loop
0 - Disable
1 - Enable
Default value = 0

During a test bilateral loop is defined as follows:

Test Commanded
Loop 1
Loop 2
Loop 3
Loop 4

Bilateral Loop
Loop 2
Loop 1
Loop 4
Loop 3

Loop definitions are per CCITT V.54.

904:

DTE commanded remote digital loopback
0 - Disable
1 - Enable
Default value = 0

905:

DTE commanded local analog loopback
0 - Disable
1 - Enable
Default value = 0

906:

Remote commanded test
0 - Disable
1 - Enable
Default value = 1

907:

Test timer
0 - Until DTR drops
TTT - 1 to 255 sec
Default value = 0

908:

Not applicable

909-999:

Reserved for future use

Rate Select

000-006:

Not applicable

007:

V.22 1200 bps

008:

V.22 bis 2400 bps

009-033:

Not applicable

034:

V.32 4800 bps echo canceling

035:

V.32 9600 bps echo canceling

036:

V.32 9600 bps trellis echo canceling

037 - 045: Not applicable

046:

V.32 bis 7200 bps trellis echo canceling

047:

V.32 bis 12,000 bps trellis echo canceling

048:

V.32 bis 14,400 bps trellis echo canceling

049-999:

Reserved for future use

Chapter 8
Protocols

CCITT V.42 bis ERROR CONTROL PROTOCOL

V.42 bis is an industry standard for error control adopted by the Consultative Committee for International Telephone and Telegraph (CCITT). The CCITT V.42 bis protocol incorporates two error control algorithms, LAPM and MNP. LAPM is a CCITT Link Access Protocol family member related to LAPB and LAPD currently in use in other communications applications. MNP is Microcom Networking Protocol that has become an industry standard by the number of its users.

The use of V.42 bis requires both local and remote modems to be V.42 bis compatible. Error control protocol is transparent to the user and requires no special hardware or software. Data to be transmitted is put in a buffer so the modem can retransmit it if an error occurs. The modem also buffers data received from the remote modem in case an error occurs and the data is retransmitted. To avoid overfilling the buffer, flow control is used to control data between the modem and the terminal. V.42 bis protocol options can be set by AT commands.

RELIABLE

When a LAPM or MNP link is established the modem is in reliable mode. V.42 bis allows negotiation with a remote modem to the highest level of protocol common to both units. Both LAPM and MNP control data errors by retransmitting any block of data that was corrupted in transit. LAPM is assigned highest priority and if not supported, then an MNP connection is attempted.

AUTO-RELIABLE

In auto-reliable mode the modem negotiates to the highest protocol (LAPM or MNP) common to both modems. However, if a reliable connection cannot be established, auto-reliable allows the protocol to fallback to normal mode.

CONSTANT SPEED INTERFACE

The modem serial port adapts to the data rate of the DTE and does not change speed if the modem telephone line connects at another speed. Therefore the DTE to DCE interface speed is constant.

DATA COMPRESSION

Using MNP Class 5 data compression, the modem can achieve data throughput approaching 28800 bps. With LAPM data compression, the modem can achieve data throughput approaching 57600 bps. This increase in speed is achieved by automatically analyzing the data stream and reducing the number of bits required to represent the characters. 100% error-free transmission is assured by the application of the MNP or LAPM error control protocol on the compressed data.

Compression takes place only if the modem detects

that the remote modem supports compression. If not, a reliable connection is made without compression.

Although data compression is compatible with any type of data, it is most efficient for ASCII text files. For maximum throughput when using data compression, the terminal should be set to a higher speed than the "true data link speed" with the constant speed interface on and flow control enabled. When transmitting or receiving data files in one direction, the throughput can be increased for V.42 bis by having extra buffer and more processor time with the &C2 and &C3 data compression commands.

NORMAL MODE

No error control with or without constant speed DTE interface. Data is buffered.

DIRECT MODE

The DTE speed and DCE speed are forced to be the same. No error control or buffering.

FLOW CONTROL

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 the DTE. As the modem continues to transmit data and the buffer empties, flow control is again used to start data from the DTE.

Chapter 9
Maintenance

Warning: *Disconnect power before performance maintenance. Although dangerous voltage levels are not exposed, disconnecting power will ensure an electric shock hazard is not present.*

GENERAL

The modem contains no internal electronic components that can be serviced or replaced by the user. Repairs should not be attempted by the user.

FUSE

If a fuse fails, replace it with one of equal rating. Repeated failure indicates a more serious problem.

MAINTENANCE

The modem provides maintenance free service. Periodically it is necessary to remove dust that has collected on internal components. Remove dust with a soft bristle brush and low pressure air or vacuum.

Before attempting diagnostic tests, check that all connectors and plugs are firmly inserted. The test procedures will identify the faulty component in a bad communications link.

If the unit appears faulty, contact Motorola UDS at one of the numbers listed on the Toll Free Numbers page at the end of the manual. Do not return the unit without prior instructions.

Appendix A Specifications

Size

Width

7.0 inches (17.78 cm)

Depth

10.5 inches (26.67 cm)

Height

2.25 inches (5.72 cm)

Weight

2 lbs. 13 oz. (1.28 kg)

Environmental Conditions

Temperature:

Operation

+32° F to +122° F
(0° C to + 50° C)

Storage

-40° F to + 158° F
(-40° C to + 70° C)

Humidity:

0 to 95% relative humidity:
noncondensing

Power

Specifications

Requirements

The modem can be ordered for operation with one of three power input options.

Voltage:

115 Vac ± 10%; 50-60 Hz,
230 Vac ± 10%; 50-60 Hz, or
12 to 60 Vdc

Power consumption: 14 watts

Telephone Line

Balanced 600 ohm type 3002 or equivalent 16 dB nominal loss, frequency translation up to ± 10 Hz

Digital Interface

Conforms to EIA-232D and CCITT V.24

Modem Data Rates

14400, 12000, 9600, and 7200 trellis coded, 9600 and 4800 uncoded as stated in CCITT recommendation V.32 bis,
2400 and 1200 compatible with CCITT recommendation V.22 bis,
300 compatible with Bell specification 103.

Modulation

14400, 12000, 9600, 7200, 4800, 2400 QAM with suppressed carrier (V.32 bis, V.22 bis compliant)

1200 PSK
300 FSK

Transmit Carrier

Frequencies

V.32 bis 1800 Hz

	Originate	Answer
	1200, 2400	1200 Hz ±.01% 2400 Hz ±.01%

300 bps
Mark:1270 Hz ±.5% 2225 Hz ±.5%
Space:1070 Hz ± .5%2025 Hz ± .5%

Internal Transmit Clock Frequency

Selected bit rate ± 0.01%

External Transmit Clock Frequency

Selected bit rate ± 0.01%

Transmit Output Level

Leased line 0 through -21 dBm
Dial line -9 through -21 dBm

Operation

4-wire, full-duplex, private line;
2-wire, full-duplex, private line or PSTN

Carrier Detect Level

Dynamic to -43 dBm

Telco Connection

Specifications

8-pin modular jack, dial and private lines

Testing

511 PN pattern (per V.52)
V.54 remote loopback control

Line Equalization

Automatic adaptive

RTS/CTS Delay

From 0 ± 2 ms to 150 ± 2 ms, user selectable in 10 ms increments. (The default is 0 ms)

Appendix B
Phone Jack Descriptions

DIAL LINE PIN FUNCTIONS

The 8-pin DIAL jack connects to the PSTN dial-up lines. Pin functions are

Pins 1, 2 -

Not used

Pin 3 MI -

Switch hook on exclusion key telephone

Pin 4 R -

Ring side of telephone line

Pin 5 T -

Tip side of telephone line

Pin 6 MIC -

Switch hook on exclusion key telephone

Pin 7 PR -

To data jack program resistor

Pin 8 PC -

To data jack program resistor

TELSET / LEASED

Phone Jack Descriptions

LINE PIN FUNCTIONS

The 8-pin TELSET / LEASED LINE jack allows a standard telephone or a leased line to be connected to the modem. The pin functions for this jack are

Pins 1, 2 -

Transmit pair - 4-wire leased line or Tx and Rx for 2-wire leased line

Pins 4, 5 -

Ring and tip (respectively) of telephone line for TELSET

Pins 7, 8 -

Receive pair - 4-wire leased line

Phone Jack Descriptions

Appendix C
Test Procedures

FAULT ISOLATION PROCEDURE

This test procedure and the indicator lights built into the modem allow a rapid check of the terminal, modem, and telephone line interfaces. This procedure can be used to verify normal system operation and to isolate faulty equipment in case of failure.

Ensure the units are turned on and remote tests are enabled at both sites before starting the fault isolation procedure.

Note: *In some cases the observer must distinguish between rapid LED blinking and steady on in tests.*

TELEPHONE INTERFACE

¥Connect the modem to the dial up line via the DIAL jack on the back panel.

¥Connect a telephone to the TELSET / LEASED LINE jack on the back panel of the modem.

¥Press the TALK/DATA button (to turn on the TALK/DATA LED on the L model) and wait for dial tone.

¥Dial the remote modem; the phone should operate normally.

FALLBACK RATES

Since there is no standard fallback procedure from V.32b rates to V.22 rates, problems may arise when a V.32 optioned for 14400 originates a call to a V.22 bis modem. If this is a problem, change the originate modem speed to 2400 bps from the front panel or with the AT command AT%B3.

MODEM AND TELEPHONE LINE CHECK

Step 1

¥Configure the modem for LOCAL ANALOG LOOP WITH TEST PATTERN. This forces the modem on hook, terminates the local modem leased lines into 600 ohms, and connects the local modem transmit output amplifier back to its own receiver. Transmit input data from the terminal is inhibited and is substituted with a V.52 test pattern.

¥This test checks operation of the local modem modulator and demodulator circuitry and should be attempted at both local and remote sites if operators are available.

¥When errors are present, the TEST PATTERN ERRORS display counts errors.

Note: *The following LED illustrations show indications for diagnostic tests. These indications are valid when DTE options are set by factory option set #1 and RTS is active from the DTE. Where indicated*

RD and / or TD may be on, off, or flashing depending on the type of DTE and its operating state.

¥If the circuitry is working properly, the front panel indicators show the following:

¥Configure the modem for LOCAL ANALOG LOOP to switch the transmitter back to its normal data input .

¥The modem should display on the local monitor whatever is entered at the local DTE.

¥If the transmit data input is in a mark hold condition, both the TD and RD indicators should remain off.

¥If the transmit data input is in a space hold condition, both the TD and RD indicators should come on. All other indicators should remain the same except for CS which should turn on.

¥If the indicators are correct, the modem is probably operating correctly.

¥If the preceding tests were not successful, call Technical Services.

Step 2

This step determines the performance of the local and remote modems and the telephone circuits. It also determines each modem's ability to receive a transmitted signal from the other site, properly equalize and decode the signal, and then loop this regenerated signal into the transmitter for transmission back to the other modem. This test applies to both leased line and dial line applications.

¥Configure the local modem for REMOTE DIGITAL LOOP WITH TEST PATTERN. This signals the remote modem to go into digital loop. The remote

modem receives and then retransmits the data back to the local mode. If digital bilateral loop is enabled at the remote, the remote DTE is looped back to itself.

¥An alternative to the above procedure is to request the operator at the remote modem to configure his modem for LOCAL DIGITAL LOOP. Configure the local modem for TEST PATTERN. The remote modem receives and retransmits the data back to the local modem.

¥The TEST PATTERN ERRORS display will count received errors.

¥At the local modem, the indicators should be:

¥To further test the modem and communications link, reverse the system loopback. First exit the existing loopback test. Reverse the roles of the local and remote modems and repeat step two.

Note: *If the bilateral digital loop is enabled at the local modem, the DTE interface is looped to itself through the modem and permits the DTE and interface circuitry to be checked.*

Step 3

This step determines the performance of the telephone line. This test is valid for 4-wire operation only.

¥Configure the modem for REMOTE ANALOG LOOP WITH TEST PATTERN. This signals the remote to connect its receive pair to its transmit pair through a buffer amplifier stage. The test pattern transmitted locally is now looped back to the local modem.

¥An alternative to the above procedure is to request the operator at the remote modem to place his modem in LOCAL ANALOG LOOP and enable his bilateral analog option. This places the remote modem in local analog loop test. It also connects the transmit phone line to the receive phone line through a buffer amplifier stage. At the local modem, configure for TEST PATTERN. The test pattern transmitted by the local modem is looped around through a buffer stage at the remote modem and back to the local modem.

¥At the local modem, the front panel indicators under ideal conditions should be:

¥The TEST PATTERN ERRORS display counts received errors.

In this test you are connecting two telephone line links in series, doubling the distortion effects. A telephone link indicated as marginal by this test may be satisfactory as used in normal operation.

¥After determining the quality of the telephone lines, exit the test.

¥If fault remains unidentified, call Technical Services.

AT COMMAND RECOVERY FOR L MODELS

For the L model of the modem, holding the TALK/ DATA button down for 5 seconds reenables AT commands. The TALK LED flashes 3 times to indicate that the command set has been loaded.

TEST CATEGORIES

Diagnostic tests are divided into four categories: online, offline, those with test patterns, and those without. For test pattern diagnostics the LCD displays a cumulative error count. For other tests the DTE transmission is the test signal. Disparity between DTE transmitted and received characters indicates errors.

Table C-1 indicates with an X the operating mode required for specific tests.

Table C-1
Test Operating Mode Requirements

Table 1:

Test	Offline	Online
LAL	X	
LAL/TP	X	
RAL (4-W)		X
RAL/TP (4-W)		X
LDL		X
RDL		X
RDL/TP		X
TP		X

Note: *Local Analog Loopback, with or without test pattern, is the only test available in protocol mode. A diagnostic test performed during dial backup will terminate when the modem performs leased line lookback.*

Local Analog Loop

The local modem transmitter is connected to its receiver so the analog signal normally sent over the telephone line is received locally. If operating on 2- or 4-wire private lines, the leased lines are terminated into 600 ohms (Figure C-1). If operating 2-wire over the PSTN, any call is terminated and the modem is forced on hook (Figure C-2).

Note: *Figure C-1 through C-8 include LED indications for diagnostic tests. These indications are valid when DTE options are set by factory option set #1 and RTS is active from the DTE. Where indicated, RD and / or TD may be on, off, or flashing depending on the type of DTE and its operating state.*

For 2-wire operation, Analog Bilateral Loopback is invalid. In 4-wire operation, Analog Bilateral Loopback connects the receive leased line to the transmit line through a buffer amplifier (Figure C-3).

Remote Analog Loop

This test is valid only in 4-wire operation. The initiating modem signals the remote modem to go to Remote Analog Loopback. The remote receive leased line connects to the transmit leased line through a buffer amplifier (Figure 3-4). The remote modem transmitter goes off, but its receiver stays connected and waits for the signal to end the test.

Local Digital Loop

The local modem receiver connects to its transmitter so received data is digitally processed and retransmitted to the remote site. If Digital Bilateral Loopback is enabled locally, the local DTE is looped back to itself (Figure C-5). If disabled, the local DTE receives a constant mark.

Remote Digital Loop

The initiating modem signals the remote modem to enter Digital Loopback. The remote modem receives the data, digitally processes it, and retransmits the data back to the local modem. If Digital Bilateral Loopback is enabled, the remote DTE is looped back to itself (Figure C-6).

Test Pattern

In Test Pattern, transmit data from the local DTE is blocked and replaced by a V.52 compatible test pattern. When the modem transmits the test pattern, it expects to receive the same pattern. The V.52 test pattern error detector is enabled and indicates received errors by the TEST PATTERN ERRORS display.

With Test Pattern

When Local Analog Loopback, Remote Analog Loopback, or Remote Digital Loopback is selected, the locate DTE transmits data may be replaced by a V.52 compatible test pattern (Figures C-7 and C-8). To do so answer yes to the LCD prompt.

Appendix D
Command Index and Defaults

GENERAL

This reference guide provides asynchronous command characters and their meanings. Pages listed provide initial information on the commands.
S-registers are listed as a cross reference.

Command	Page	S-Reg	Description
AT	5-2		Attention code - command prefix
A/	5-4		Repeat last command
+ + +	5-23	S2, S12	Escape sequence (pause, + + +, pause)
A	5-16		Answer
D	5-12		Dial
T	5-13	S14	Tone dial *
P	5-13	S14	Pulse dial
,	5-13	S8	Long pause (2 sec or S8 value)
W	5-13	S7	Wait for 2nd dial tone (S7 value)
!	5-13		Flash switchboard
R	5-14		Switch to answer mode after dialing
@	5-14		Wait for 5 seconds of silence
;	5-14		Return to command mode after dialing
S=n	5-15		Dial stored command line (n = dial command line)

Note: *The * in the command is part of the command; the * in the description indicates the default.*

Command Index and Defaults

** factory default*

Command	Page	S-Reg	Description
E	5-23	S14	Local character echo off
E1			Local character echo on *
F	5-24		Not supported - returns ERROR
F1			Disables online character echo
H	5-24		Hang up
I	5-24		Request product code
I1			Request EPROM CRC value
I3			Request product version
L or L1	5-24	S22	Speaker volume low
L2			Speaker volume medium*
L3			Speaker volume high
M	5-25	S22	Speaker off
M1			Speaker off when carrier is present *
M2			Speaker always on
M3			Speaker off when dialing and carrier is present
O	5-25		Restore data mode (after escape)
Q	5-6	S14	Response displays on *
Q1			Response displays off
Q2			Response displays on in originate mode only
Sn?	6-4		Read value in register n (decimal)
Sn?^			Read value in register n (hexadecimal)
Sn=v			Set v (value) in register n (decimal)
Sn=^v			Set v (value) in register n (hexadecimal)
Sn.#=1 or 0			Set single bit value in register
V	5-6	S14	Response codes
V1			Response messages *

** factory default*

Command	Page	S-Reg	Description
X	5-7	S22	CONNECT (code 1), for all speeds, no dial tone or busy signal detection
X1			Appropriate connect codes for rate, no dial tone detection
X2			Wait for dial tone (appropriate connect codes)
X3			Detect busy signal (appropriate connect codes)
X4			Wait for dial tone, detect busy signal * (appropriate connect codes)
Y	5-25	S21	Long space disconnect disabled
Y1			Long space disconnect enabled *
Z	5-36		Reset to user option set #1
Z1			Reset to user option set #2
&C	5-17	S21	DCD always on *
&C1			DCD on while carrier is present
&C2			DCD off 5 seconds after disconnect
&C3			DCD follows remote RTS
&D	5-18	S21	DTR ignored *
&D1			DTR recalls command mode
&D2			DTR disconnects
&D3			DTR disconnects and resets modem to stored configuration
&F or &F1	5-35		Restore factory configuration 1 *
&F2			Restore factory configuration 2
&F3			Restore factory configuration 3
&F4			Restore factory configuration 4
&F5			Restore factory configuration 5
&F6			Restore factory configuration 6
&F7			Restore factory configuration 7
&F8			Restore factory configuration 8
&F9			Restore factory configuration 9

Command Index and Defaults

** factory default*

Command	Page	S-Reg	Description
&G	5-26	S23	No guard tone *
&G1			550 Hz tone
&G2			1800 Hz tone
&L	5-26	S27	Dial line *
&L1		S32	Leased line 2-wire
&L2			Leased line 4-wire
&M	5-26	S27	Async dial / async data *
&M1			Async dial / sync data
&M2			Dials stored number when DTR off / on transition is detected / sync data
&M3			Manual dial / sync data
&M4		S30	V.25 bis autodialer with BISYNC protocol / sync data
&M5			V.25 bis autodialer with SDLC protocol / sync data
&P	5-28	S22	39/61 pulse make / break ratio *
&P1			33/67 pulse make / break ratio
&R	5-19	S21	CTS normal operating state
&R1			CTS forced on *
&R2		S72	CTS follows DCD
&R9			CTS equals RTS
&S	5-17	S21	DSR always on *
&S1			DSR on when ready to accept data
&S2			DSR off for 5 seconds after disconnect
&S3			DSR follows off hook (OH)
&T	5-21		Terminate current test
&T1			Initiate analog loopback
&T2			Initiate remote analog loopback
&T3			Initiate digital loopback
&T4		S23	Grant remote commanded digital loopback*
&T5		S23	Denies remote commanded digital loopback

** factory default*

Command	Page	S-Reg	Description
&T6			Initiate remote digital loopback
&T7			Initiate self test remote digital loopback
&T8			Initiate self test analog loopback
&T9			Initiate self test remote analog loopback
&V	5-36		View configuration profiles
&V1			Display received signal status
&W	5-34		Store current configuration to user option set #1
&W1			Store current configuration to user option set #2
&X	5-28	S27	Internal clock *
&X1			External clock
&X2			Receive clock
&Y	5-35	S66	Powerup with user option set #1
&Y1			Powerup with user option set #2
&Y?			Display powerup option set
&Zn	5-36		Store dial string (n=dial string)
%A	5-43	S64	Disable auto-reliable fallback character *
%An			Set auto-reliable fallback character to n (n=ASCII 1-127)
%B	5-28	S69	Use DTE speed
%B1			300 bps max
%B2			1200 bps max
%B3			2400 bps max
%B4			4800 bps max
%B5			9600 bps max
%B6			9600 bps trellis coded max
%B7			7200 bps trellis coded max
%B8			12000 bps trellis coded max
%B9			14400 bps trellis coded max *

Command Index and Defaults

** factory default*

Command	Page	S-Reg	Description
%C	5-50	S56	Compression disabled
%C1			Compression enabled on transmit and receive data *
%C2			Compression enabled on transmit data only
%C3			Compression enabled on receive data only
%D	5-29	S62	Disable disconnect buffer delay *
%Dn			Set disconnect buffer delay in seconds n (n=1-255)
%E	5-29	S60	Disable auto retrain
%E1			Enable auto retrain *
%P=	5-38		Sets remote configuration security code to value entered after equal sign (0-99999999)
%P=D			Disabled
%P?			Displays remote configuration security code of local modem
%P=<blank>			Clears the security code*
%R	5-30	S53	Disable auto rate renegotiation *
%R1			Enable auto rate renegotiation using low BER
%R2			Enable auto rate renegotiation using medium BER
%R3			Enable auto rate renegotiation using high BER
%T	5-21		Transmit test pattern
%T=	5-39		Followed by a remote configuration security code, establishes remote configuration
%V	5-30		Display product revision level
%Z	5-30		Permissive (RJ11) *
%Z1			Programmable (RJ45)

** factory default*

Command	Page	S-Reg	Description
\A	5-49	S63	Maximum block size of 64 characters
\A1			Maximum block size of 128 characters
\A2			Maximum block size of 192 characters
\A3			Maximum block size of 256 characters *
\B	5-49	S79	Transmit a break signal
\Bn			Sets break length in 20 ms increments, n=1-255, default is 35 (700 ms)
\C	5-50	S60	Disable auto-reliable buffer *
\C1			Buffer data for 4 seconds or 200 characters
\G	5-46	S54	Disable modem port flow control *
\G1			Enable modem port XON/XOFF flow control
\J	5-41	S72	Disable slaved DTE/DCE speed * (constant speed DTE on)
\J1			Enable slaved DTE/DCE speed (constant speed DTE off)
\Kn	5-46	S59	Selects action when encountering a break
\K			Break option 0
\K1			Break option 1
\K2			Break option 2
\K3			Break option 3
\K4			Break option 4
\K5			Break option 5 *
\M	5-42	S70	V.42 fast detect data sequence disabled
\M1			V.42 fast detect data sequence enabled *
\N	5-42	S70	Normal mode
\N1			Direct mode
\N2			MNP only
\N3			MNP or normal
\N4			LAPM only
\N5			LAPM with normal fallback
\N6			LAPM with MNP fallback
\N7			LAPM with MNP and normal fallback *

Command Index and Defaults

** factory default*

Command	Page	S-Reg	Description
\O	5-50	S60	Originate a reliable link
\Q	5-44	S54	Disable DTE flow control
\Q1			Enable DTE XON/XOFF flow control *
\Q2			Enable CTS flow control to the DTE
\Q3			Enables bilateral CTS/RTS flow control
\Q4			Disable DCE flow control
\Q5			Enable DCE XON/XOFF flow control *
\Q6			Enable CTS flow control to the DTE
\Q7			Enable CTS flow control to the DTE
\R	5-18	S60	Ring indicate, blinks for ring and remains on for duration of call
\R1			Ring indicate, blinks for ring and turns off when call is answered *
\T	5-48	S58	Disable inactivity timer *
\Tn			Set inactivity timer to n (n=1-255 minutes)
\U	5-51	S60	Accept an MNP link
\V	5-43	S60	Disable protocol result codes *
\V1			Enable protocol result codes
\X	5-45	S54	No XON/XOFF characters to remote DCE *
\X1			Pass XON/XOFF characters to remote DCE
\Y	5-51	S60	Switch to MNP from normal mode
\Z	5-51	S60	Switch to normal from MNP mode
*AN	5-22	S34	Disables bilateral analog loop *
*AN1			Enables bilateral analog loop
*AUn	5-15		Dial number stored at location n upon transition of DTR in command mode (n=1-9) autodial number

** factory default*

Command	Page	S-Reg	Description
*CNx, n 9)	5-36		Store phone number n in location x (x=1-
*DB *DB1	5-31	S32	Manual dial backup operation * Automatic dial backup operation
*DG *DG1	5-22	S34	Disables bilateral digital loop * Enables bilateral digital loop
*FB *FB1 back	5-20	S29	Ignore pin 23 * Pin 23 transition causes DTE speed fall-
*FT *FT1	5-31	S29	Disable fast train * Enable fast train
*LA *LA1	5-22	S34	Ignore pin 18 * DTE commanded LAL enabled
*LB	5-31		Return to leased line from dial backup
*LC *LC1 *LC2	5-32	S32	Line current disconnect disabled Short (8 ms) line current disconnect Long (90 ms) line current disconnect *
*LD	5-32		Manual dial backup from leased line
*ND	5-36		Displays the nine stored numbers
*NT *NT1	5-32	S29	AT command set disabled AT command set enabled *
*OR *OR1	5-33	S14	Originate * Forced answer
*RC *RC1	5-9	S57	15 - 4800 bps, 18 - 9600 bps * 11 - 4800 bps, 12 - 9600 bps
*RD *RD1	5-22	S34	Ignore pin 21 * DTE commanded RDL enabled
*RO *RO1	5-38	S29	Retain options at disconnect * Restore options at disconnect

Command Index and Defaults

** factory default*

Command	Page	S-Reg	Description
*TDn	5-33	S52	Sets dial transmit level to n where n is a number between 9 and 21 corresponding to -9 to -21 dBm
*TLn	5-33	S52	Sets leased line transmit level to n where n is a number between 0 and 21 corresponding to 0 to -21 db
$V	5-30		Display product serial number
Security Commands			
$S=x	5-40		Sets an empty password location to x
$C=x,y	5-40		Changes either password where x represents the old password and y is the new one
$C=x,-	5-40		Deletes password x from memory
$DR	5-40		Reset security
$D?	5-40		Displays the current status of security
$D=x	5-40		Disables security where x is either password
$E=x	5-40		Enables security where x is either password
$E?	5-40		Displays the current security status

STATUS REGISTERS

S-Reg	RO/RW	Page	Function	Default
S0	RW	6-6	Ring to answer	1
S1	RO	6-6	Ring count	
S2	RW	6-6	Escape sequence character	43 (+)
S3	RW	6-6	End-of-line character	13 (CR)
S4	RW	6-6	Line feed character	10 (LF)
S5	RW	6-6	Backspace character	8 (BS)
S6	RW	6-7	Pause before blind dialing	2 (2 sec)
S7	RW	6-7	Pause for carrier	30 (30 sec)
S8	RW	6-7	Pause for comma	2 (2 sec)
S9	RW	6-7	Carrier validation	6 (0.6 sec)
S10	RW	6-7	Loss carrier delay time	14 (1.4 sec)
S11	RW	6-7	DTMF tone duration	80 (80 ms)
S12	RW	6-8	Escape sequence pause	50 (1 sec)
S14	RW	6-9	Bit mapped	
S16	RO	6-10	System tests	0
S18	RW	6-10	Test timer	0
S21	RW	6-11	Bit mapped	
S22	RW	6-12	Bit mapped	
S23	RW	6-12	Bit mapped	
S25	RW	6-13	DTR recognition time	5 (0.5 sec)
S26	RW	6-13	RTS/CTS delay	0
S27	RW	6-13	Bit mapped	
S28	RW	6-13	Lookback timer	15 min
S29	RW	6-14	Bit mapped	
S30	RW	6-14	V.25 mode selection	
S31	RW	6-15	4-wire leasded line train	
S32	RW	6-15	Bit mapped	
S34	RW	6-16	Bit mapped	
S39	RW	6-16	Connect message rate	0
S51	RW	6-17	Bit mapped	-10 dBm
S52	RW	6-17	Bit mapped	
S53	RW	6-17	801 V.32 timeout	0 (long)
S54	RW	6-18	Flow control DTE	0
S56	RW	6-18	V.42 compression	
S57	RW	6-19	Number code application	0

Command Index and Defaults

RO=Read only
RW=Read or write

S-Reg	RO/RW	Page	Function	Default
S58	RW	6-19	Inactivity timer	0
S59	RW	6-19	Break control	5
S60	RW	6-20	Bit mapped	
S61	RO	6-20	DTE character size, parity	6
S62	RW	6-21	Disconnect buffer delay	0
S63	RW	6-21	Maximum block size	255
S64	RW	6-21	Auto-reliable character	0
S66	RW	6-21	Bit mapped	
S67	RO	6-22	Link speed status	
S69	RW	6-22	Maximum DCE speed	
S70	RW	6-23	Operating mode	1
S71	RO	6-23	Operating mode status	
S72	RW	6-24	Bit mapped	
S78	RW	6-24	Autocallback timer	30
S79	RW	6-25	Break length	35
S80	RO	6-25	Serial port speed	6
S84	RW	6-26	Bit mapped	

RO=Read only
RW=Read or write

V.25 bis DIALER COMMANDS

Synchronous Command	Page	Description
CIC	7-8	Connect incoming call command
CRN *nn...n*	7-4	Dial command (*nn...n* = number to be dialed) 0 - 9DTMF and pulse digit * #DTMF digit :Wait for dial tone WWait for second type of dial tone >Pause for 1 second = Pause for 3 seconds <Pause for programmed delay time PPulse dial TTone dial &Flash (go on hook) for 1/2 second ;Parameter separator SpaceClarity characters dash parenthesis period
CRR *n*	7-8	Redial the last number a maximum of *n* times
CRS *a*	7-6	Dial stored number command (*a* = address)
DIC	7-7	Disregard incoming call command
PRK	7-14	Save current option settings
PRL *a;b*	7-9	Link number at address *a* with number

		at address *b*
PRN *a; nn...n*	7-5	Program number command (*nn...n* = number to be dialed, *a* = address)
Synchronous Command	**Page**	**Description**
PRO *xxx;yy;0;0...*	7-11	Program options command (*xxx* = register address, *yy* = option count)
PRP *n*	7-14	Restores current option settings to the factory defaults in default bank n (1-9)
RLL	7-10	Request list of linked numbers command
RLN	7-6	Request list of stored numbers command
RLO *xxx;yy*	7-15	Request list of stored options command (*xxx* = register address, *yy* = option count)
RLV	7-11	Request list of version information command

Response Message	Meaning
CFIAB	Call failure - answer back tone but no connection
CFIDT	Call failure - no dial tone
CFIET	Call failure - reorder or busy
CFILD	Call failure - link list complete
CFINS	Call failure - number not stored
CFINT	Call failure - no answer back tone, no ringback
CFIRT	Call failure - timeout occurred

CNX @ 14400 bps V.32 bis	Intermediate call progress - connection made at 14400

Response Message	Meaning
CNX @ 12000 bps V.32 bis	Intermediate call progress - connection made at 12000
CNX @ 9600 bps V.32 bis	Intermediate call progress - connection made at 9600
CNX @ 7200 bps V.32 bis	Intermediate call progress - connection made at 7200
CNX @ 4800 bps V.32 bis	Intermediate call progress - connection made at 4800
CNX @ 2400 bps V.32 bis	Intermediate call progress - connection made at 2400
CNX @ 1200 bps V.32 bis	Intermediate call progress - connection made at 1200
INC	Incoming ring detected
INVCU	Invalid command - command unknown
INVMS	Invalid command - message syntax error
INVPS	Invalid command - parameter syntax error
INVPV	Invalid command - parameter value error
VAL	Valid command received

FACTORY OPTION SETS

FACTORY OPTION SET #1 (ASYNCHRONOUS DIAL-UP WITH V.42 bis PROTOCOL) (AT&F or AT&F1)

¥MODEM OPTIONS
DCE rate - 14400 trellis
Normal originate
Fast train disabled
Auto retrain enabled
SQ auto rate disabled
Internal transmit clock
Dial line transmit level -10 dBm
Dial line
Jack type RJ11 (permissive)
Line current disconnect long
Long space disconnect enabled
V.22 guard tone disabled

¥TEST OPTIONS
Bilateral analog loop disabled
Bilateral digital loop disabled
DTE local test disabled
DTE remote test disabled
Remote commanded test enabled
Test timeout off

¥PROTOCOL OPTIONS
LAPM protocol enabled
MNP protocol enabled
Protocol fallback enabled
Data compression normal
Constant DTE speed
DTE flow control XON/XOFF
DCE flow control XON/XOFF
XON/XOFF pass through disabled
Inactivity timer off
Break option 5
V.42 fast detect enabled

¥DIAL LINE OPTIONS
Tone dial
Auto dial #1
Wait for dial tone
Wait delay 2 seconds

Pause delay 2 seconds
Call timeout 30 seconds
Answer on 1 ring
801 V.32b timeout long
Autocallback disabled

¥DTE OPTIONS
Async data
DTE rate - 9600
8 bit
No parity
Async controlled dialer
AT command set enabled
Ignores DTR
DSR forced high
DCD forced high
CTS forced high
DTE fallback disabled
Options retained at disconnect

¥SPEAKER OPTIONS
Volume medium
On until carrier detect

FACTORY OPTION SET # 2 (ASYNCHRONOUS DIAL-UP WITHOUT V.42 bis PROTOCOL) (AT&F2)

¥MODEM OPTIONS
DCE rate = 14400 *
Normal originate
Fast train disabled
Auto retrain enabled
SQ auto rate disabled
Internal transmit clock
Dial TX level -10 dBm
Dial line
Jack type RJ11 (permissive)
Line current disconnect long
Long space disconnect enabled
V.22 guard tone disabled

¥TEST OPTIONS
Bilateral analog loop disabled
Bilateral digital loop disabled
DTE local test disabled
DTE remote test disabled
Remote commanded test enabled
Test timeout off

Command Index and Defaults

¥PROTOCOL OPTIONS
LAPM protocol disabled *
MNP protocol disabled *
Direct mode
DTE flow control disabled *
DCE flow control disabled *
XON/XOFF pass through disabled
Inactivity timer off
Break Option 0
V.42 fast detect disabled *

¥DIAL LINE OPTIONS
Tone dial
Auto dial #1
Wait for dial tone
Wait delay 2 seconds
Pause delay 2 seconds
Call timeout 30 seconds
Answer on 1 ring
801 V.32b timeout long
Autocallback disabled

¥DTE OPTIONS
Async data
DTE rate = 9600
8 bit
No parity
Async controlled dialer
AT command set enabled
Ignores DTR
DSR forced high
DCD forced high
CTS forced high
DTE fallback disabled
Options retained at disconnect

¥SPEAKER OPTIONS
Volume medium
On until carrier detect

FACTORY OPTION SET #3 (SYNCHRONOUS DIAL-UP) (AT&F3)

¥MODEM OPTIONS
DCE rate - 14400 trellis
Normal originate
Fast train disabled
Auto retrain enabled
SQ auto rate disabled
Internal transmit clock
Dial TX level -10 dBm
Dial line
Jack type RJ11 (permissive)
Line current disconnect long
Long space disconnect enabled
V.22 guard tone disabled

¥TEST OPTIONS
Bilateral analog loop disabled
Bilateral digital loop disabled
DTE local test disabled
DTE remote test disabled
Remote commanded test enabled
Test timeout off

¥PROTOCOL OPTIONS
LAPM protocol disabled *
MNP protocol disabled *
Direct mode *
DTE flow control disabled *
DCE flow control disabled *
XON/XOFF pass through disabled
Inactivity timer off
Break Option 0 *
V.42 fast detect disabled *

¥DIAL LINE OPTIONS
Tone dial
Auto dial #1
Wait for dial tone
Wait delay 2 seconds
Pause delay 2 seconds
Call timeout 30 seconds
Answer on 1 ring
801 V.32b timeout long
Autocallback disabled

Command Index and Defaults

¥DTE OPTIONS
Sync data *
Dial method manual *
AT command set disabled *
DTR disconnects *
DSR normal *
DCD normal *
CTS follows RTS *
RTS/CTS delay 0 ms *
DTE fallback disabled
Options retained at disconnect

¥SPEAKER OPTIONS
Volume medium
On until carrier detect

FACTORY OPTION SET # 4 (SYNCHRONOUS 4-WIRE LEASED LINE) (AT&F4)

¥MODEM OPTIONS
DCE rate - 14400 trellis
Normal originate
Fast train disabled
Auto retrain enabled
SQ auto rate disabled
Internal transmit clock
Dial TX level is -10 dBm
Leased line *
4-wire *
Lease Tx level is 0 dBm *
Manual dial backup *
Lookback timer is 15 min *
Jack type RJ11 (permissive)
Line current disconnect long
Long space disconnect enabled
V.22 guard tone disabled

¥TEST OPTIONS
Bilateral analog loop enabled *
Bilateral digital loop enabled *
DTE local test disabled
DTE remote test disabled
Remote commanded test enabled
Test timeout off

¥PROTOCOL OPTIONS
LAPM protocol disabled *
MNP protocol disabled *
Direct mode *
DTE flow control disabled *
DCE flow control disabled *
XON/XOFF pass through disabled
Inactivity timer off
Break option 0 *
V.42 fast detect disabled *

¥DIAL LINE OPTIONS
Tone dial
Auto dial #1
Wait for dial tone
Wait delay 2 seconds
Pause delay 2 seconds
Call timeout 60 seconds *

Answer on 1 ring
801 V.32b timeout long
Autocallback disabled

¥DTE OPTIONS
Sync data *
AT command set disabled *
Ignores DTR
DSR normal *
DCD normal *
CTS follows RTS *
RTS/CTS delay 0 ms *
DTE fallback disabled
Options retained at disconnect

¥SPEAKER OPTIONS
Volume medium
Speaker off *

FACTORY OPTION SET #5 (ASYNCHRONOUS 4-WIRE LEASED LINE WITH V.42 bis PROTOCOL) (AT&F5)

¥MODEM OPTIONS
DCE rate - 14400 trellis
Normal originate
Fast train disabled
Auto retrain enabled
SQ auto rate disabled
Internal transmit clock
Dial Tx level is - 10 dBm
Leased line *
4-wire *
Lease Tx level is 0 dBm *
Manual dial backup *
Lookback timer is 15 min *
Jack type RJ11 (permissive)
Line current disconnect long
Long space disconnect enabled
V.22 guard tone disabled

DTE fallback disabled
Options retained at disconnect

TEST OPTIONS
Bilateral analog loop disabled
Bilateral digital loop disabled
DTE local test disabled
DTE remote test disabled
Remote commanded test enabled
Test timeout off

¥PROTOCOL OPTIONS
LAPM protocol enabled
MNP protocol disabled *
Protocol fallback disabled *
Data compression normal
Constant DTE speed
DTE flow control XON/XOFF
DCE flow control XON/XOFF
XON/XOFF pass through disabled
Inactivity timer off
Break option 5 *
V.42 fast detect enabled

Command Index and Defaults

¥DIAL LINE OPTIONS
Tone dial
Auto dial #1
Wait for dial tone
Wait delay 2 seconds
Pause delay 2 seconds
Call timeout 30 seconds
Answer on 1 ring
801 V.32b timeout long
Autocallback disabled

¥DTE OPTIONS
Async data
DTE rate - 9600
8 bit
No parity
AT command set enabled
Ignores DTR
DSR forced high
DCD forced high
CTS forced high

¥SPEAKER OPTIONS
Volume medium
Speaker off

** Indicates variation from factory option set #1*

FACTORY OPTION SET # 6 (ASYNCHRONOUS 4-WIRE LEASED LINE WITHOUT V.42 bis PROTOCOL) (AT&F6)

¥MODEM OPTIONS
DCE rate 14400 trellis
Normal originate
Fast train disabled
Auto retrain enabled
SQ auto rate disabled
Internal transmit clock
Dial Tx level is - 10 dBm
Leased line *
4-wire *
Lease Tx level is 0 dBm *
Manual dial backup *
Lookback timer is 15 min *

Jack type RJ11 (permissive)
Line current disconnect long
Long space disconnect enabled
V.22 guard tone disabled

¥TEST OPTIONS
Bilateral analog loop disabled
Bilateral digital loop disabled
DTE local test disabled
DTE remote test disabled
Remote commanded test enabled
Test timeout off

¥PROTOCOL OPTIONS
LAPM protocol disabled *
MNP protocol disabled *
Direct mode
DTE flow control disabled *
DCE flow control disabled *
XON/XOFF pass through disabled
Inactivity timer off
Break option 0 *
V.42 fast detect disabled

¥DIAL LINE OPTIONS
Tone dial
Auto dial #1
Wait for dial tone
Wait delay 2 seconds
Pause delay 2 seconds
Call timeout 30 seconds
Answer on 1 ring
801 V.32b timeout long
Autocallback disabled

¥DTE OPTIONS
Async data
DTE rate = 9600
8 bit
No parity
AT command set enabled
Ignores DTR
DSR forced high
DCD forced high
CTS forced high
DTE fallback disabled
Options retained at disconnect

¥SPEAKER OPTIONS
Volume medium
Speaker off

FACTORY OPTION SET # 7 (SYNCHRONOUS 2-WIRE LEASED LINE NORMAL ORIGINATE) (AT&F7)

¥MODEM OPTIONS
DCE rate - 14400 trellis
Normal originate
Fast train disabled
Auto retrain enabled
SQ auto rate disabled
Internal transmit clock
Dial TX level is - 10 dBm
Leased line *
2-wire *
Lease Tx level is 0 dBm *
Manual dial backup *
Lookback timer is 15 min *
Jack type RJ11 (permissive)
Line current disconnect long
Long space disconnect enabled
V.22 guard tone disabled

¥TEST OPTIONS
Bilateral analog loop enabled *
Bilateral digital loop enabled *
DTE local test disabled
DTE remote test disabled
Remote commanded test enabled
Test timeout off

¥PROTOCOL OPTIONS
LAPM protocol disabled *
MNP protocol disabled *
Direct mode *
DTE flow control disabled *
DCE flow control disabled *
XON/XOFF pass through disabled
Inactivity timer off
Break option 0 *
V.42 fast detect disabled *

¥DIAL LINE OPTIONS
Tone dial
Auto dial #1
Wait for dial tone
Wait delay 2 seconds
Pause delay 2 seconds

Call timeout 60 seconds *
Answer on 1 ring
801 V.32b timeout long
Autocallback disabled

¥DTE OPTIONS
Sync data *
AT command set disabled *
Ignores DTR
DSR normal *
DCD normal *
CTS follows RTS *
RTS/CTS delay 0 ms *
DTE fallback disabled
Options retained at disconnect

¥SPEAKER OPTIONS
Volume medium
Speaker off

FACTORY OPTION SET # 8 (SYNCHRONOUS 2-WIRE LEASED LINE FORCED ANSWER) (AT&F8)

¥MODEM OPTIONS
DCE rate - 14400 trellis
Forced answer *
Fast train disabled
Auto retrain enabled
SQ auto rate disabled
Internal transmit clock
Dial TX level is - 10 dBm
Leased line *
2-wire *
Lease Tx level is 0 dBm *
Manual dial backup *
Lookback timer is 15 min *
Jack type RJ11 (permissive)
Line current disconnect long
Long space disconnect enabled
V.22 guard tone disabled

¥TEST OPTIONS
Bilateral analog loop enabled *
Bilateral digital loop enabled *
DTE local test disabled
DTE remote test disabled
Remote commanded test enabled
Test timeout off

¥PROTOCOL OPTIONS
LAPM protocol disabled *
MNP protocol disabled *
Direct mode *
DTE flow control disabled *
DCE flow control disabled *
XON/XOFF pass through disabled
Inactivity timer off
Break option 0 *
V.42 fast detect disabled *

¥DIAL LINE OPTIONS
Tone dial
Auto dial #1
Wait for dial tone
Wait delay 2 seconds
Pause delay 2 seconds

Call timeout 60 seconds *
Answer on 1 ring
801 V.32b timeout long
Autocallback disabled

¥DTE OPTIONS
Sync data *
AT command set disabled *
Ignores DTR
DSR normal *
DCD normal *
CTS follows RTS *
RTS/CTS delay 0 ms *
DTE fallback disabled
Options retained at disconnect

¥SPEAKER OPTIONS
Volume medium
Speaker off

FACTORY OPTION SET #9 (SYNCHRONOUS V.25 bis DIALER) (AT&F9)

¥MODEM OPTIONS
DCE rate - 14400 trellis
Normal originate
Fast train disabled
Auto retrain enabled
SQ auto rate disabled
Internal transmit clock
Dial TX level is -10 dBm
Dial line
Jack type RJ11 (permissive)
Line current disconnect long
Long space disconnect enabled
V.22 guard tone disabled

¥TEST OPTIONS
Bilateral analog loop disabled
Bilateral digital loop disabled
DTE local test disabled
DTE remote test disabled
Remote commanded test enabled
Test timeout off

¥PROTOCOL OPTIONS
LAPM protocol disabled *
MNP protocol disabled *
Direct mode *
DTE flow control disabled *
DCE flow control disabled *
XON/XOFF pass through disabled
Inactivity timer off
Break option 0 *
V.42 fast detect disabled *

¥DIAL LINE OPTIONS
Tone dial
Auto dial #1
Wait for dial tone
Wait delay 2 seconds
Pause delay 2 seconds
Call timeout 30 seconds
Answer on 1 ring
801 V.32b timeout long
Autocallback disabled

Command Index and Defaults

¥DTE OPTIONS
Sync data *
V.25 SDLC dialer *
Character type ASCII *
SDLC data format NRZ *
DTR disconnect *
DSR normal *
DCD normal *
CTS follows RTS *
RTS/CTS delay 0 ms *
DTE fallback disabled
Options retained at disconnect

¥SPEAKER OPTIONS
Volume medium
On until carrier detect

Command Index and Defaults

** Indicates variation from factory option set #1*

A

ABT	Abort Timer OR Answer Back Tone
ac	Alternating Current
ACK	Acknowledgment, positive
ACR	Abort Call, Retry
ACU	Automatic Call Unit
A/D	Analog-to-Digital
ADD	Address Field
ADDR	Address
AGC	Automatic Gain Control
ASCII	American Standard Code for Information Interchange (7 level)
AT&T	American Telephone and Telegraph

B

BC	Bearer Capability
BCD	Binary Coded Decimal
BER	Bit Error Rate
BERT	Bit-Error-Rate-Test (set)
BIL LB	Bilateral Loopback
Bit	Binary Digit
bps	Bits Per Second
BSC	Binary Synchronous Communications
BUFF	Elastic Buffer

C

C	Celsius
CA	Circuit Assurance
CBX	Computerized Private Branch Exchange
CC	Carrier Control
CCITT	International Consultative Committee for Telegraph and Telephone
CCU	Communications Control Unit
CD	Carrier Detect
CFICB	Call Failure Indication - Local DCE Busy
CFIDT	Call Failure Indication - No Dial Tone
CFINT	Call Failure Indication - No Answer Back Tone
CFIRT	Call Failure Indication - Ringback Detected
Ch Gnd	Chassis Ground
CIC	Connect Incoming Call
CMOS	Complementary Metal Oxide Semiconductor
CNX	Connect Complete
COM	Computer Output Microfilm
CO	Central Office
COS	Call Originate Status
CPE	Customer Premise Equipment
CPH	Characters Per Hour
CPU	Central Processing Unit

Abbreviations and Acronyms

CR	Carriage Return
CRC	Cyclic Redundancy Check
CRQ	Call Request
CSA	Canadian Standards Association
CSDC	Circuit Switched Digital Capability
CSU	Channel Service Unit
CSULL	Channel Service Unit Local Loopback
CTRL	Control Field
CTS, CS	Clear to Send

D

DAA	Data Access Arrangement (AT&T)
dB, db	Decibel
dc	Direct Current OR Digital Connection
DCE	Data Circuit Terminating Equipment OR Data Communications Equipment
DCD	Data Carrier Detect
DCPSK	Differentially Coherent Phase- Shift Keying
DDD	Direct Distance Dialing
DDS	Digital Data Service OR Dataphone Digital Service (AT&T)
DDS/MR	Digital Data Service / Multi Rate
DIC	Disregard Incoming Call
Dip	Dual In-line Package
DIS, DS	Disable
DLE	Data Link Escape
DLO	Data Line Occupied
DMS	Digital Multiplexer System
DOC	Department of Communications (Canada)
DOS	Disk Operating System
DPR	Digit Present
DRS	Data Rate Select
DSR	Data Set Ready
DSU	Data Service Unit
DTE	Data Terminal Equipment
DTMF	Dual Tone Multi Frequency
DTN	Dial Tone Detected
DTR	Data Terminal Ready

E

EBCDIC	Extended Binary Coded Decimal Interchange Code (8 level)
EIA	Electronic Industries Association
EIA-232C, EIA-232D	Interface between DTE and Data Interchange Communication Equipment employing serial binary data
EN	Enabled
ENQ	Enquiry
EOA	End of Address
EOM	End of Message
EON	

	End of Number
EOT	End of Text OR End of Transmission
EPROM	Erasable Programmable Read Only Memory
ER	Error
ESC	Escape (key)
ETB	End of Block
ETC	External Transmit Clock
ETX	End of Text
EXT	External

F

FA	Feature Activator
FB	Fallback
FCC	Federal Communications Commission
FDM	Frequency Division Modulation
FDX	Full-Duplex Transmission
FF	Form Feed
FGND	Frame Ground
FL	Flag
FLL	Fixed loss loop
FM	Frequency Modulation
Fox message	Test message (The quick brown fox jumps over the lazy dog) 0123456789
FSK	Frequency-Shift Keying
FX	Foreign Exchange

H

HDLC	High Level Data Link Control
HDX	Half-Duplex Transmission
Hz	Hertz (cycles per second)

I

INC	Incoming Call
INV	Invalid
INVCU	Invalid Command - Command Unknown
INVMS	Invalid Command - Message Syntax Error
INVPS	Invalid Command - Parameter Syntax Error
INVPV	Invalid Command - Parameter Value Error
I/O	Input / Output
IS	International Standard
ISDN	Integrated Services Digital Network

K

KBD	Keyboard
kbps	Kilobits Per Second

L

LAL	Local Analog Loopback
LAPD	Link Access Protocol - D Channel
LAPM	Link Access Protocol for Modems
LB OPTS	

Abbreviations and Acronyms

	Loopback Options
LCD	Liquid Crystal Display OR Line Current Disconnect
LDL	Local Digital Loopback
LDM	Limited-Distance Modem
LED	Light Emitting Diode
LF	Line Feed
LINK	Analog Telephone Line Connection
LL	Local Loopback
LO	Line Occupancy
LRC	Longitudinal Redundancy Check
LSD	Long Space Disconnect
LSI	Large-Scale Integrated (circuit)
LSO	List of Stored Options
LSV	List Version
LT	Loop or Link Termination

M

mA	Milliamps
MHz	MegaHertz
Modem	Modulator / Demodulator
MR	Modem Ready
MR/RI	Modem Ready / Ring Indicate
ms	Millisecond
MUX	Multiplexer

N

NAK	Negative Acknowledgment
NET STAT	Network Status
NRZ	Non Return to Zero
NRZI	Non Return to Zero Inverted
NS	No Signal
NT	Network Termination

O

OH	Off Hook
OS	Out-of-Service

P

PBX	Private Branch Exchange
PC	Personal Computer
pc	Printed circuit (board)
PIW	Power Indication
PN	Pseudo random
PND	Present Next Digit
POTS	Plain Old Telephone Service
PRI	Primary
PRO	Program Option
PROG, PR	Programmable
PROM	Programmable Read Only Memory
PRP	Restored Factory Straps
PR/TM	Power / Test Mode / Error
PSK	Phase Shift Keying
PSTN	Public Service Telephone Network

PWI	Power Indication

Q

QAM	Quadrature Amplitude Modulation

R

R	Reference Designator
RAD	Random Access Method
RAL	Remote Analog Loopback
RAM	Random Access Memory
RC	Receive Clock
RCD	Receiver-Carrier Detector
RCV, RCVR	Receiver
RD	Receive Data
RD/ER	Receive Data / Error
RDI	Receive Data Inhibit
RDL	Remote Digital Loopback
RI	Ring Indication
RL	Remote Loopback
RLO	Request List of Stored Options
RLSD	Received Line Signal Detector
RLV	Request List of Version
rms	Root-Mean-Square
RMT LB	Remote Loopback
RNG	Ringback Detection
RO	Receive Only
ROM	Read Only Memory
RT	Remote Terminal
RTS, RS	Request to Send
RX	Receive

S

S or S/T	Reference Designator
SCC	Serial (or Satellite) Communications Controller
SD	Send Data
SDLC	Synchronous Data Link Control (IBM)
SGND, SG	Signal Ground
SH	Switch Hook
SIM SW CR	Simulated Switched Carrier
SNR	Signal / Noise Ratio
SPID	Service Profile Identifier
SQD	Signal Quality Detector
SQM	Signal Quality Monitor
SS	Systems Status
STX	Start of Text
SYN	Synchronization Character

T

T	Reference Designator
TA	Terminal Adapter
TC	Transmit Clock
TD	Transmit Data
TE	Terminal Equipment

Abbreviations and Acronyms

TEI	Terminal Endpoint Identifier
TELCO	Telephone Company
TELSET	Telephone Set
TM	Test Mode
TP	Test Pattern
TR	Terminal Ready
TST	Test
TTD	Temporary Text Delay
TTL	Transistor-to-Transistor Logic
TX	Transmit

U

U	Reference Designator
UART	Universal Asynchronous Receiver / Transmitter
USOC	Universal Service Ordering Code

V

V.	CCITT Code Designation
V.24	List of definitions for interchange circuits between data terminal equipment and data circuit-terminating equipment (and provisional amendments, May 1977)
Vac	Volts Alternating Current
VAC	Value Added Carrier
VAL	Valid
Vdc	Volts Direct Current

W

WATS	Wide Area Telecommunications Access Method (AT&T)

X

X.	CCITT Recommendation Designation
XMIT	Transmit
XOFF	Transmitter Off
XON	Transmitter On
XTC	External Transmit Clock

COPYRIGHT

Motorola
20 Cabot Boulevard
Mansfield, MA 02048
(508) 261-4000

TRADEMARKS

NOTICE

UPDATES

Updates to the products and the manual are obtainable at participating Motorola dealers and distributors, or directly from Motorola on the same terms and conditions as those offered by Motorola.