MOTOROLA

Internet and Networking Group

V.3600
Modem User's Guide

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Updates

Check Motorola Web sites as listed under "Service and Support" at the end of this *User's Guide* for the latest updates to our products.

Regulatory Information

FCC Requirements

This equipment complies with FCC rules Part 68. Located on the equipment is the FCC Registration Number and Ringer Equivalence Number (REN). You must provide this information to the telephone company if requested.

The Registration Number and REN is inscribed on the printed circuit board on insert cards, or on a label attached to either the chassis bottom or metal end-plate on standalone or rack models. The FCC requires that these numbers be prominently displayed on an outside surface of the equipment.

The REN is used to determine the number of devices you may legally connect to your telephone line. In most areas, the sum of the REN of all devices connected to one line must not exceed five (5.0). Contact your telephone company to determine the maximum REN for your calling area.

A variety of Universal Service Ordering Code (USOC) telephone wall jacks are available for different types of devices or services. The USOC jack required for this unit is RJ11/RJ41S/JM8.

The telephone company may change technical operations or procedures affecting your equipment. You will be notified of changes in advance to give you ample time to maintain uninterrupted telephone service.

If you experience trouble with this telephone equipment, please contact

Motorola
20 Cabot Boulevard
Mansfield, Massachusetts 02048
Telephone (800) 544-0062

for information on obtaining service or repairs. The telephone company may ask that you disconnect this equipment from the network until the problem has been resolved. If your equipment continues to disrupt the network the telephone company may temporarily disconnect service. If this occurs you will be informed of your right to file a complaint with the FCC.

This equipment may not be used on coin service provided by the telephone company. Connection to party lines is subject to state tariffs.

An FCC compliant telephone cord and modular plug are provided with this equipment, which is designed to connect to the telephone network or premises wiring using a compatible modular jack that is Part 68 compliant. See installation instructions in Chapter 2, Installation for details.

FCC Fax Branding Requirements

The Telephone Consumer Protection Act of 1991 makes it unlawful for any person to use a computer or other electronic device to send any message via a telephone, fax machine, or modem unless such message clearly contains in a margin at the top or bottom of each transmitted page or on the first page of the transmission, the date and time it is sent and an identification of the business or other entity, or other individual sending the message and the telephone number of the sending machine or such business, other entity or individual.

Programming of this information is a function of the fax software which runs on your computer. In order to program this information, please consult the documentation provided with your fax software.

FCC Part 15 Declaration Of Conformity

FOR HOME OR OFFICE USE
Model Name: V.3600, 115 VAC version only

 Caution

This equipment uses, generates, and can radiate radio frequency energy interfering with radio communications if not installed and used according to the instruction manual. It has been tested and complies with the limits for a Class B computing device according to FCC Rules, Part 15. Operation of this equipment in a residential area may cause interference. If it does, you must correct the cause of the interference.

Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Shielded Cables

This product has been tested and complies with FCC limits for a Class B computing device. Testing was done with <u>shielded computer cables</u>. Using unshielded cables could cause your system to emit excess radio frequency, increasing the chance of interference. To comply with FCC regulations it is necessary to use <u>shielded computer cables</u> with your installation.

FOR OFFICE USE ONLY
Model Name: V.3600, all other versions

⚠ Caution

> This equipment uses, generates, and can radiate radio frequency energy interfering with radio communications if not installed and used according to the instruction manual. It has been tested and complies with the limits for a Class A computing device according to FCC Rules, Part 15. Operation of this equipment in a residential area may cause interference. If it does, you must correct the cause of the interference.

Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Shielded Cables

This product has been tested and complies with FCC limits for a Class A computing device. Testing was done with <u>shielded computer cables</u>. Using unshielded cables could cause your system to emit excess radio frequency, increasing the chance of interference. To comply with FCC regulations it is necessary to use <u>shielded computer cables</u> with your installation.

Special Requirements For Canada

Certain requirements exist for data communication products manufactured for use in Canada. Principle among these requirements is the application of the IC label as described below. However, certain data communication products do not require the IC label nor adherence to IC requirements. If this is the case the IC label will not be affixed to the units.

Industry Canada (IC) Requirements

IC labels are affixed to each unit sold in Canada. This label has the certification number for that particular unit. The numbers are different for each model.

The Industry Canada label identifies certified equipment. This certification means that the equipment meets certain telecommunications network protective, operational, and safety requirements. IC does not guarantee the equipment will operate to the user's satisfaction.

Before installing this equipment, users should ensure that it is permissible to be connected to the facilities of the local telecommunications company. The equipment must also be installed using an acceptable method of connection. In some cases, the company's inside wiring associated with a single line individual service may be extended by means of a certified connector assembly (telephone extension cord). The customer should be aware that compliance with the above conditions may not prevent degradation of service in some situations.

Repairs to certified equipment should be made by an authorized Canadian maintenance facility designated by the supplier. Any repairs or alterations made by the user to this equipment, or equipment malfunctions, may give the telecommunications company cause to request the user to disconnect the equipment. For their own protection users should ensure that the electrical ground connections of the power utility, telephone lines and internal metallic water pipe system, if present, are connected together. This precaution may be particularly important in rural areas.

Caution: Users should not attempt to make installation connections themselves, but should contact the appropriate electric inspection authority or electrician.

Ringer Equivalence Number

The Ringer Equivalence Number (REN) assigned to each terminal device provides an indication of the maximum number of terminals allowed to be connected to a telephone interface. The termination on an interface may consist of any combination of devices subject only to the requirement that the sum of the Ringer Equivalence Numbers of all the devices does not exceed five (5).

CANADIAN EMISSION REQUIREMENTS (V.3600, 115 Vac)

This Class B digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numérique de la classe B respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

CANADIAN EMISSION REQUIREMENTS (V.3600, other versions)

This Class A digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numérique de la classe A respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

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Chapter 1
Introduction

The Motorola V.3600 Series Modem provides synchronous, asynchronous, and fax capabilities for data communications or facsimile links between a local computer and a remote computer, fax, or data terminal equipment (DTE) located anywhere a standard or cellular telephone can reach. Data can be transmitted over standard dial-up lines, private leased telephone lines, or wireless communication.

The V.3600 Series Modem communicates at standard data rates up to 33,600 bps with compatible modems connected to similarly equipped computers, computer services, and data bases. Advanced error control and data compression ensure data integrity and increase data throughput.

When used with a Class 1 Fax software package, the modem can exchange fax documents at data rates up to 14,400 bps with any Group 3 fax machine or PC with a fax modem.

A high-level security feature allows secure operation of the modem, both locally and remotely.

Shelf-Mount Units

This *User's Guide* supports the desktop and shelf-mount versions of the V.3600. Operation and function are generally the same for both, but when there is a difference, the information primarily supports the desktop unit. Installation for each version is described in Chapter 2.

Features

The V.3600 is a flexible telecommunications tool that offers the following standard features.

Data Mode

- Full-duplex operation on two-wire public connections or two-wire or four-wire private telephone connections with two-wire public automatic or manual backup
- 300, 1200, 2400, 4800, 7200, 9600, 12000, 14400, 16800, 19200, 21600, 24000, 26400, 28800, 31200, 33600 bps DCE data rates
- Compatible with these standards:
  CCITT V.34
  CCITT V.33
  CCITT V.32 bis
  CCITT V.32
  CCITT V.29
  CCITT V.27
  CCITT V.22 bis
  CCITT V.22
  CCITT V.21
  CCITT V.13
  Bell 212A
  Bell 103
- Compatible with a variety of software packages
- Synchronous operation at all DCE data rates except Bell 103 300 and V.23
- Asynchronous operation at all DTE data rates up to 230.4 kbps
- CCITT V.42 bis and MNP level 5 data compression
- CCITT V.42 and MNP 4 error control protocol
- LCD configuration and status for easy operation
- Front panel lockout
- Autodial and Autoanswer capability
- Autobaud DTE rate and character format selection
- AT command set
- V.25 bis autodialer
- Configuration memory
- Phone number storage

• Caller ID
• Distinctive ring
• Multiple levels of security with auto callback and password protection and up to 50 users
• Automatic speed matching to originating modem
• Remote configuration using command mode or LCD
• Built-in standard diagnostics for testing phone line quality and modems at each end
• Flash upgrades

Fax Mode
• Fax speeds to 14.4 kbps
• HDLC framing to allow T.30 Error Correction Mode
• Standard Class 1 interface conforms to EIA-578
• Group 3 compatibility: CCITT V.21 Channel 2, V.27 ter, V.29, V.17
• Autoanswer under software control
• Automatic fax/data detection

Software

Software operates the features of the V.3600.

Communications Software

You must have communications software to transfer data. After installing the modem, consult your communications software user's manual for information on the software, commands, and features.

Class 1 Fax Communications Software

For sending faxes, a Class 1 fax software package is required.

Internet Browser

To connect to the Internet, Internet browser software is required.

Description

Functional

The V.3600 processes serial asynchronous data from a DTE at all standard rates from 300 bps to 230.4 kbps*, and serial synchronous data at rates from 300 to 33.6 kbps. Transmission can be over either dial-up lines or either two- or four-wire leased lines. The maximum line speed is 33.6 kbps. Built-in test features can determine system performance and isolate faults in the data link. Operation and configuration are controlled by the front panel LCD, the AT command set, or the V.25 bis command set.

> *The 230.4 kbps DTE speed is available, but the V.3600 will not autobaud to 230.4 kbps. With the modem set for 115.2 kbps, enter AT\J2 to enable the speed and enter AT\J3 to disable it.

Physical

The V.3600 has a 32 character LCD front panel with three pushbuttons for option selection (Figure 1-1).
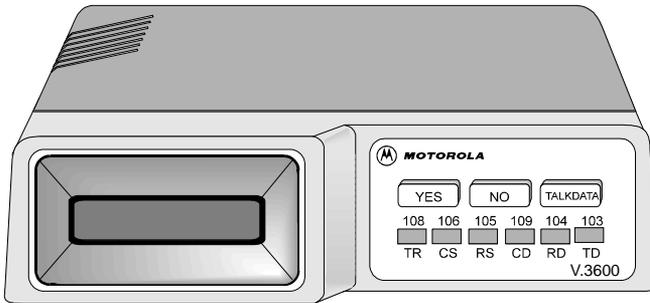
Figure 1-1. Typical Front Panel

The V.3600 rear panel has an EIA-232 DTE connector, an 8-pin TELSET/LEASED LINE jack, an 8-pin DIAL jack, the power switch, fuse, and cord (Figure 1-2).
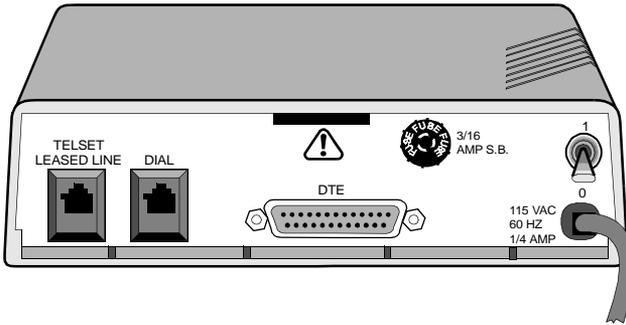
Figure 1-2. Rear Panel (115 Vac Model)

RM16M Unit

The shelf-mount RM16M unit (Figure 1-3) has edge connectors that insert into the shelf backplane. The shelf backplane performs the same functions as the standalone rear panel. Refer to the "Shelf-Mount RM16M V.3600 Installation" section on page 2-9.
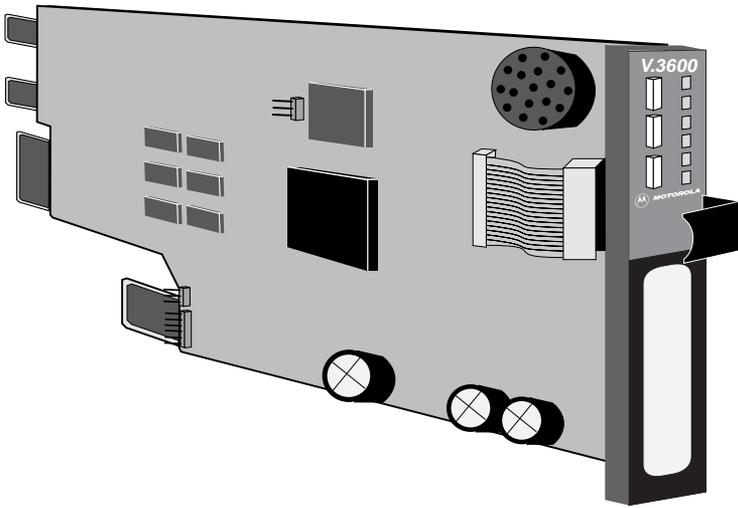
Figure 1-3. RM16M Version of the V.3600

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

Electrical Installation

The rear panel (Figure 2-1) includes DTE cable and telephone line connectors.
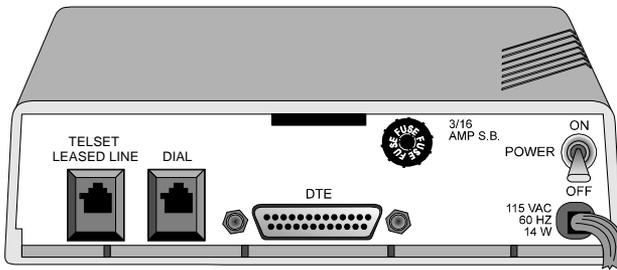
Figure 2-1. Rear Panel Connections (115 Vac Model)

AC Power Connection
Power is supplied through a 6-foot line cord with a grounded 3-wire plug.

DC Power Connection

⚠ 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 12-60 VDC power input, connect the power to the terminal block attached to the modem back panel. A chassis ground connection is also supplied on the terminal block.

If the modem is equipped for +/- 12/+5 VDC power input, connect the VDC power to the amp connector. 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. You must use a shielded DTE cable to comply with EMC requirements. Pin signals are shown in Figure 2-2 and are described in Table 2-1.
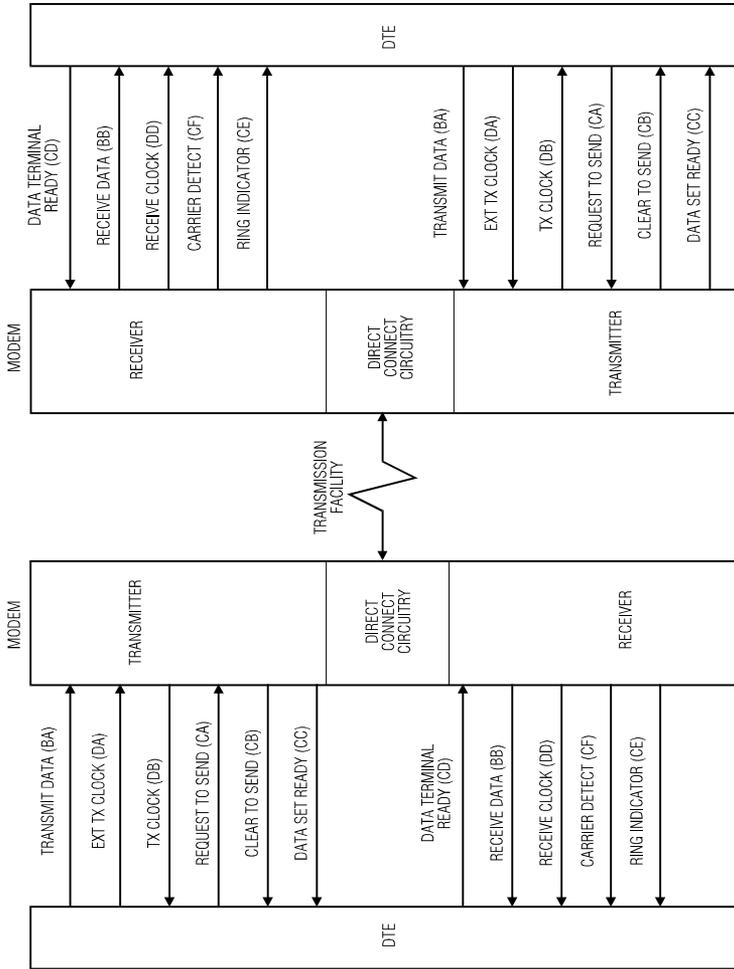
Figure 2-2. Digital Interface Signals

Table 2-1. Pin Signal Descriptions

Pin	EIA-232D	CCITT V.24	Signal	Description
1		101	Shield	No connection
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 positive-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) that has positive-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	Signal or 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.
** Refer to Appendix C, Hardware Options.
† This function can be disabled or its logic sense reversed by hardware straps.

Table 2-1. Pin Signal Descriptions (Continued)

Pin	EIA-232D	CCITT V.24	Signal	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 an external data source: Positive clock transitions correspond to data transitions.
17	DD	115	Receive Clock	A receive data rate clock output for use by an external data sink: Positive clock transitions correspond to data transitions.
18	--	141	Local Loopback	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 direct dial 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. Positive 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.
** Refer to Appendix C, Hardware Options.
† This function can be disabled or its logic sense reversed by hardware straps.

Telephone Line Connection

The modem operates in these line-related modes:

- Dial
- Leased

Dial Mode: PSTN Connection (DIAL jack)

The public switched telephone network (PSTN) is a two-wire dial network. Modems are registered with the Federal Communications Commission (FCC) for direct connection to the PSTN. The label on the chassis bottom gives the FCC registration number and other information required for network operation.

Direct connection to the PSTN is shown in Figure 2-3.
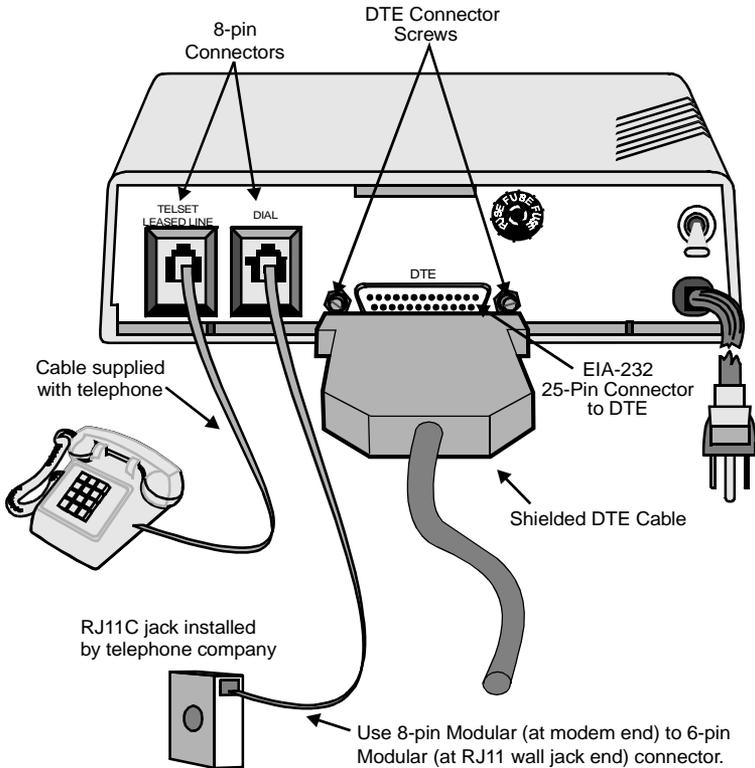
Figure 2-3. Dial-up Connection (115 Vac Model)

Leased Line Connection (TELSET/LEASED LINE Jack)

Private or leased lines use four-wire or two-wire lines. In this mode, the user configures the unit for four-wire or two-wire operation, depending on the private line service used.

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.

Figure 2-4 shows a typical modem hookup for operation over private leased lines with dial backup.
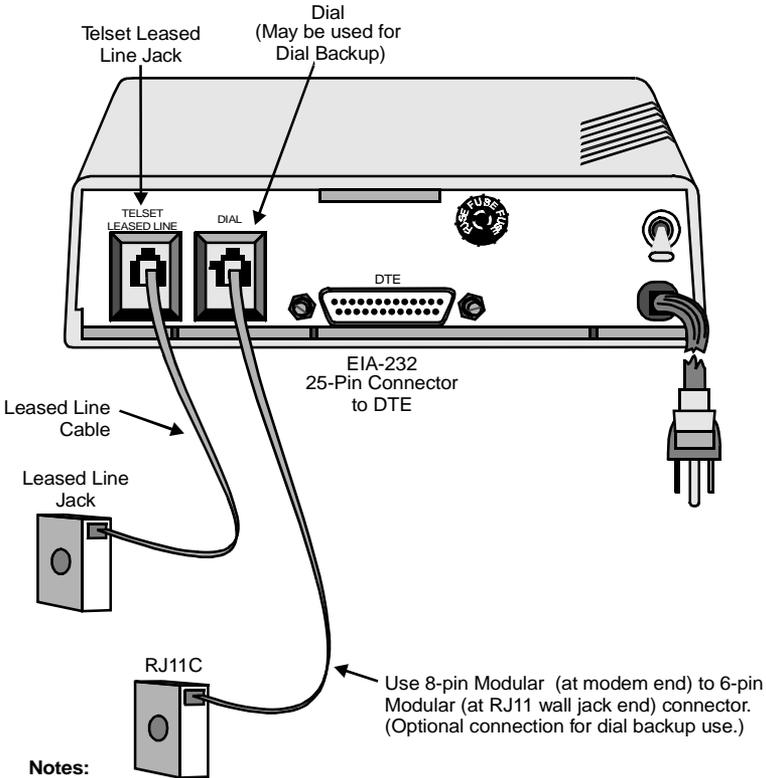
Notes:

1. Set the transmit output level to 0dBm.

2. DTR, which is the signal on pin 20 of the DTE interface, must be active or the option DTE IGNORED must be set for 2-wire OR 4-wire leased line operation.

3. The connection shown includes dial backup. Connect only the leased-line jack to the modem's Telset jack for regular Leased-line use.

4. For a 2-wire Leased-line connection, Pins 1 and 2 of the Leased-line connection are used for Tx and Rx data. For a 4-wire Leased-line connection, Pins 1 and 2 are used for Tx, and Pins 7 and 8 are used for Rx.

5. For connector pin-outs, refer to Appendix B.

Figure 2-4. Leased Line Connection (115 Vac Model)

Shelf-Mount RM16M V.3600 Installation

Go to Appendix C, Hardware Options to check the board options before installation.

Shelf-mount RM16M V.3600s should be installed or replaced by personnel familiar with shelf-mount installation. The unit has an edge connector that inserts into a receptacle located on the backplane and power bus.

📖 **Note**
> Figure 2-5 represents a typical dialup connection using one of the most common rack shelves. Connect cables as appropriate for any compatible RM16M shelf.

RJ11C jack, installed by telephone company

To DTE

Shelf backplane
(with RM16M V.3600 installed)
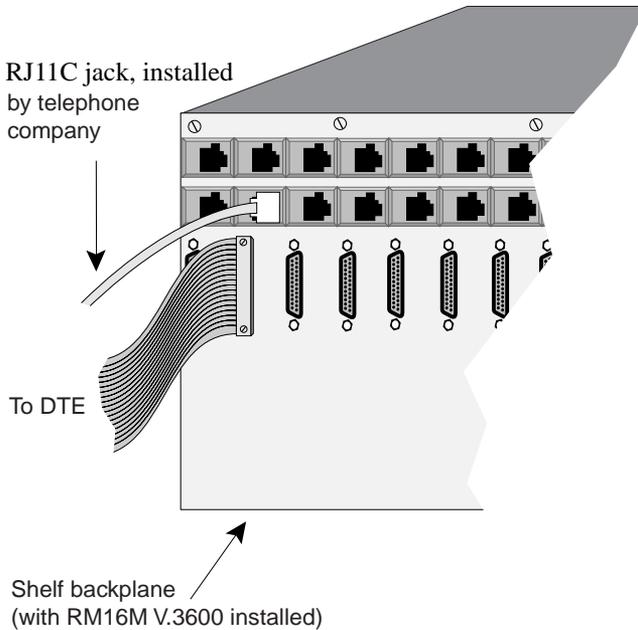
Figure 2-5. RM16M Connections

Chapter 3
Getting Started

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. Chapter 4 explains LCD operation.
- AT Commands - The AT command set can be used to select modem options. Chapter 5 describes AT commands.
- Status Registers - A series of special ATS commands allows the operator to change the decimal or hexadecimal value of a memory byte to change one or more options in that byte. Chapter 10 describes S-registers.
- Single Bit Status Registers - A second series of special ATS commands allows the user to change single bits within a byte to change an option. Chapter 10 also explains single bit control.
- Software Program - A wide 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 discuss software programs.
- V.25 bis Commands - An extended set of V.25 commands allows selection of modem options during synchronous operation. Refer to Chapter 11.

Power-Up

A power-up procedure is not required. Turn on the modem using the ON/OFF power switch on the rear panel. The modem is factory configured to operate in most public switched telephone applications. If you have stored a desired option set it will be automatically be restored at power-up.

Placing a Call

There are three methods for placing a call:

Dialing with a Standard Telephone

1) Lift the telephone receiver. Wait for the dial tone.
2) Dial the number of the remote site.
3) When the answer back tone is heard, immediately press the TALK/DATA button and hang up the telephone. The modems go through a connection sequence and establish a data link. If a data link is not established, return to Step 1.
4) After the link is established, hang up the telephone.

Autodialing from Front Panel

1) If the number to be dialed has not been stored, advance to Main Menu #6, CHANGE PHONE NUMBER.
2) Enter the number by using the NO pushbutton to scroll the menu and YES to select.
3) After the number is entered, press YES to store the number.
4) Advance the LCD to Main Menu #2, DIAL STORED NUMBER.
5) Select the number to dial and press YES. The number is dialed, and the modems follow the same process as two telephones.

Autodialing from a Terminal with the AT Commands

To dial a number, for example 555-1212, type AT D 555-1212 and press Enter, or enter ATDSn where *n* equals one of the stored telephone number locations 1-9.

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 on page 5-13 for additional dialing commands.

Answering a Call

There are three ways to answer a call:

Autoanswering
Normally the modem is configured to autoanswer on the first ring. If a telephone is plugged into the TELSET/LEASED LINE jack, it will also ring.

Answering Manually
When detecting a ring, the modem LCD displays ringing status.

Press TALK/DATA to answer the call and place the modem in the data mode.

Answering from Terminal with AT Command Set
The modem displays the ring response.

To answer a call, type ATA. The modem sends an answer-back tone and attempts to connect to the remote modem.

Ending a Call

There are two ways to complete a call:

Ending a Call Using the Front Panel
1) Press the TALK/DATA pushbutton. DO YOU WANT TO DISCONNECT will be displayed.
2) Answer YES.

Ending a Call from a Terminal with the AT Command Set
1) Enter +++ and the modem will enter command mode.
2) Enter ATH and the modem will terminate the call.

Reasons for Call Termination

The conditions described in Table 3-1 cause call termination.

Table 3-1. Reasons for Call Termination

Condition	Description
Abort Disconnect (No answer, busy signal, no modem, etc.)	Default 30 sec; select 1 to 255 sec (S-register 7).
ATH	Disconnect command.
Loss of Carrier Disconnect	Select 100 ms to 25.5 sec (S-register 10).
Receive Long Space Disconnect	Disabled or select 2 sec.
DTR Disconnect	Disabled or select 10 ms to 2.55 sec (S-register 25).
Loss of Line Current	
Cleardown	A disconnect method used in V.32 and V.34 mode.
LCD Display	When TALK/DATA is pressed, the LCD displays DO YOU WANT TO GO TO TALK? When YES is pressed modem hangs up, if no telephone is connected or if the connected telephone is not off hook. Pressing NO displays DO YOU WANT TO DISCONNECT? Press YES to disconnect.
Train Timeout	Modem fails to establish communication with remote site. Default is 30 seconds (S-register 7).
Protocol Link Establishment Failure	Reliable mode only; failure to establish reliable link.
Inactivity Timeout	Default is 0 or disabled; select for disabled or 1 to 255 minutes (S-register 8).
Protocol Retry Limit Exceeded	12 retransmissions of the frame.
Minimum DCE Speed	A connection occurred at a rate less than minimum.
Security Password Failure	Maximum password entry attempts exceeded.
Security Callback	Security callback is enabled and a new remote connection is established. The modem disconnects and places a call to the programmed number.

Table 3-1. Reasons for Call Termination (Continued)

Condition	Description
Signal Quality	Leased line operation with dial backup enabled; extended loss of carrier or 4 unsuccessful retrains in 3 minutes causes dial backup.
Test Mode entered	Certain test modes require call termination.
Modem power is turned off.	

Chapter 4
Front Panel Operation

The liquid-crystal display (LCD) front panel provides easy real-time access to modem configuration and status. You can use the LCD at any time to modify modem options or to get information about modem operation and status. All of the major modem options can be controlled through the LCD interface without an external terminal or phone line connection. Operation of the LCD can be secured using a password protection feature. A remote modem can even be configured using the local LCD, through the use of the front panel remote configuration feature.

LED Descriptions

The V.3600 LED indicator functions are as follows:

- TR (Terminal Ready). TR lights when the DTE asserts Data Terminal Ready. This signal is input on pin 20 (CCITT V.24/108.2).
- CS (Clear to Send). CS lights when the modem is ready to send data to the DTE. This signal is output on pin 5 (CCITT V.24/106).
- RS (Request to Send). RS lights when the DTE is ready to send data to the modem. This signal is input on pin 4 (CCITT V.24/105).
- CD (Carrier Detect). CD lights when the received audio carrier signal is detected or, if enabled, when error control protocol negotiation is complete. This signal is output on pin 8 (CCITT V.24/109).
- RD (Received Data). RD lights for a data space condition at the receive data output, indicating receive data output activity. This signal is output on pin 3 (CCITT V.24/104).
- TD (Transmit Data) TD lights for a data space condition at the transmit data input, indicating transmit data input activity. This signal is input on pin 2 (CCITT V.24/103).

LCD Menus

The V.3600 has seven main LCD menus that support modem operations. Table 4-1 lists them, in the following sequence:

- MODEM STATUS
- DIAL STORED NUMBER
- DISPLAY STATUS
- SELECT TEST
- MODIFY CONFIGURATION
- CHANGE PHONE NUMBERS
- FRONT PANEL FEATURES

LCD Menu Operation

The LCD menu is shown in Table 4-1, as follows:

- The first column lists the seven main menu categories.
- The second column is the submenus, listing functions for each category in the main menu.
- The third column lists specific items for submenu functions.
- The fourth column lists option choices or status for the specific items in the third column.
- The fifth and sixth columns in the table show associated AT commands and S-registers as a cross reference.

Each column item has a corresponding header in the previous column. If an option setting is selected or if all settings have been scrolled through, the display returns to the header.

Because of the menu structure and option choices, not all main menus use all four columns in Table 4-1. However, option selection and sequence are the same.

While operating in the option menu, pressing NO scrolls vertically down the columns; pressing YES advances horizontally across the columns. However, responding to the LCD prompt is the best way to reach an option. If NO is pressed and held, the LCD scrolls through the menus. Press the TALK/DATA button to return to the previous menu.

Table 4-1. LCD Menu Option Selection

Main Menu	LCD Messages			S-Reg
1 MODEM-STATUS	V.34 33600 IDLE *Shows the current modulation, bit rate, and modem status.*	(Press NO to advance to MAIN 2)		S91 S67

Main Menu	Submenu	Submenu Item	Item Option	AT Com.	S-Reg
2 DIAL STORED-NUMBER?		DIAL #1-9	YES, NO	DSn (n=1-9)	---
3 DISPLAY STATUS? *(status only)*	DTE SIGNALS	QM ON/OFF DSR ON/OFF OH ON/OFF RI ON/OFF	DISPLAY STATUS	---	---
	PROTOCOL*	NONE MNP 2, 3, 4, 5 LAPM	DISPLAY STATUS	---	---
	COMPRES-SOR*	NONE MNP 5, V.42b	DISPLAY STATUS	---	---
	CARRIER DESCRIP-TIONS*	RECEIVE LEVEL NEAR END ECHO LEVEL FAR END ECHO LEVEL FAR END ECHO DELAY FREQUENCY TRANSLATION BAUD RATE RX BIT RATE TX BIT RATE	DISPLAY STATUS	---	---
	LAST DIS-CONNECT REASON	DISPLAY STATUS		I5	
4 SELECT TEST?	(Offline test only)	LOCAL ANALOG LOOP	INITIATE, EXIT	&T1	S16
		LOCAL ANALOG LOOP WITH TP	INITIATE, EXIT	&T8	S16
	(Online test)	LOCAL DIGITAL LOOP †	INITIATE, EXIT	&T3	S16

∗ *When modem is not online, the display flashes and shows the status from the last connection.*
† *Modem must be online with protocols disabled.*

Table 4-1. LCD Menu Option Selection (Continued)

Main Menu	Submenu	Submenu Item	Item Option	AT Com.	S-Reg
4, cont.	SELECT TEST? (continued)	(Online test continued)	REMOTE DIGITAL LOOP †	INITIATE, EXIT	&T6	S16
			REMOTE DIGITAL LOOP WITH TP †	INITIATE, EXIT	&T7	S16
			TEST PATTERN†	INITIATE, EXIT	%T	---
5	MODIFY CONFIGU-RATION?	CHANGE MODEM OPTIONS?	CHANGE LEASED/ DIAL LINE?	2 WIRE/ 4 WIRE	&L1, &L	S27
			CHANGE MODULATION?	AUTO-MODE V.21 BELL 103 B212A V.22 bis V.27 ter * V.29 * V.33 * V.32bis V.34	*MM *MM1 *MM2 *MM4 *MM5 *MM6 *MM8 *MM10 *MM11 *MM12	S88
			CHANGE MAX DCE RATE?	33600 31200 28800 26400 24000 21600 19200 16800 600 14400 12000 7200 9600 9600U ** 4800 2400 1200 300 DTE SPEED	%B18 %B17 %B16 %B15 %B14 %B13 %B12 %B11 %B10 %B9 %B8 %B7 %B6 %B5 %B4 %B3 %B2 %B1 %B	S69

*Lease line only.
** 9600U is only valid for V.32 bis modulation.
† Modem must be online with protocols disabled.

Table 4-1. LCD Menu Option Selection (Continued)

Main Menu	Submenu	Submenu Item	Item Option	AT Com.	S-Reg
5 cont.	MODIFY CONFIGU-RATION? (continued)	CHANGE MODEM OPTIONS? (continued)	CHANGE MIN DCE RATE?	33600 31200 28800 26400 24000 21600 19200 16800 600 14400 12000 7200 9600 9600U ** 4800 2400 1200 300 DTE SPEED	%L18 %L17 %L16 %L15 %L14 %L13 %L12 %L11 %L10 %L9 %L8 %L7 %L6 %L5 %L4 %L3 %L2 %L1 %L	S69
			CHANGE V.34 RATE THRESH-OLD?	LOW BER MED BER HIGH BER	*TH *TH1 *TH2	---
			V.34 ASYM RATES	ENABLE DISABLE	*AS1 *AS	S96
			NORMAL ORIGINATE FORCED ANSWER*	NORMAL ORIG. FORCED ANS.	*OR *OR1	S14
			V.22 GUARD TONE	DISABLE 550 Hz 1800 Hz	&G &G1 &G2	S23
			V.32 FAST TRAIN	ENABLE DISABLE	*FT1 *FT	S29
			AUTO RETRAIN	ENABLE DISABLE	%E1 %E	S60
			SQ AUTO RATE	HIGH BER MED BER LOW BER DISABLED	%R3 %R2 %R1 %R	S53
			TRANSMIT CLOCK SELECT	INTERNAL EXTERNAL RECEIVE	&X &X1 &X2	S27

∗*Lease line only.*
∗∗ *9600U is only valid for V.32 bis modulation.*

Table 4-1. LCD Menu Option Selection (Continued)

Main Menu	Submenu	Submenu Item	Item Option	AT Com.	S-Reg
5 cont.	MODIFY CONFIGU-RATION? (continued)	CHANGE MODEM OPTIONS? (continued)	DIAL TRANSMIT LEVEL	-9 dBm to -21 dBm	*TDn	S51
			RING FREQUENCY LIMIT	ENABLE DISABLE	*RL1 *RL	--
			LEASE TRANS-MIT LEVEL*	0 to -21 dBm	*TLn	S52
			LINE CURRENT DISCONNECT†	OFF SHORT LONG	*LC, *LC1, *LC2	S32
			LONG SPACE DISCONNECT†	ENABLE DISABLE	Y1 Y	S21
			DIAL BACKUP*	MANUAL AUTO-MATIC	*DB *DB1	S32
			LOOKBACK TIME*	0 DIS-ABLED to 255 MINUTES	---	S28
		CHANGE PROTOCOL OPTIONS?	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 COM-PRESSION	DISABLE NORM TX RX	%C %C1 %C2 %C3	S56

∗ *Lease line only.*
† *Dial line only.*

Table 4-1. LCD Menu Option Selection (Continued)

Main Menu	Submenu	Submenu Item	Item Option	AT Com.	S-Reg
5 cont. MODIFY CONFIGU-RATION? (continued)	CHANGE PROTOCOL OPTIONS? (continued)	DTE SPEED	DTE=DCE CONSTANT DTE	\J1 \J	S70
		DTE FLOW CONTROL	DISABLE XON/XOFF CTS RTS/CTS	\Q \Q1 \Q2 \Q3	S54
		DCE FLOW CONTROL	DISABLE XON/XOFF CTS	\Q4 \Q5 \Q6, \Q7	S54
		XON/XOFF PASS THROUGH	ENABLE DISABLE	\X1 \X	S54
		INACTIVITY TIMER	OFF, 15, 30, 45, 60, 75, 90 MIN	\TLn	S58
		BREAK OPTION	0, 1, 2, 3, 4, 5	\K, \K1, \K2, \K3, \K4, \K5	S59
		V.42 FAST DETECT	ENABLE DISABLE	\M1 \M	S70
	CHANGE DTE OPTIONS?	DATA OPERATION	SYNC ASYNC	&M1, 2, 3, 4, 5, 6 &M	S27 S30
		DTE RATE (Async)	300, 600,1200, 2400, 4800, 7200, 9600, 12000, 14400, 16800, 19200, 21600, 24000, 26400, 28800, 31200 33600 38400 57600, 115200	---	S80
		CHAR SIZE (Async)	7 BIT 8 BIT	---	S61
		PARITY (Async)	NO, EVEN, ODD	---	S61

Table 4-1. LCD Menu Option Selection (Continued)

Main Menu	Submenu	Submenu Item	Item Option	AT Com.	S-Reg
5 cont.	MODIFY CONFIGU-RATION? (continued)	CHANGE DTE OPTIONS? (continued)	DIAL METHOD	ASYNC DTR, MANUAL, V.25 BISYNC, V.25 SDLC V.25 bis ASYNC	&M1, &M2 &M3 &M4 &M5 &M6	S27 S30
			AT COMMAND SET	ENABLE DISABLE	*NT1 *NT	S29
			CHARACTER TYPE (V.25 only)	ASCII, EBCDIC	---	S30
			SDLC DATA FORMAT	NRZ, NRZI	---	S30
			DTR STATE	IGNORE RECALL CMD DISCON-NECT RESET	&D &D1 &D2 &D3	S21
			DSR STATE	NORMAL FORCED HIGH OFF 5 SEC ON DISCON-NECT FOLLOWS OH	&S1 &S &S2 &S3	S21
			DCD STATE	NORMAL FORCED HIGH OFF 5 SEC ON DISCON-NECT FOLLOWS REMOTE RTS	&C1 &C &C2 &C3	S21
			CTS STATE	NORMAL FORCED HIGH CTS FOLLOWS DCD CTS=RTS	&R &R1 &R2 &R9	S21 S72

Table 4-1. LCD Menu Option Selection (Continued)

Main Menu	Submenu	Submenu Item	Item Option	AT Com.	S-Reg
5 cont. MODIFY CONFIGU-RATION? (continued)	CHANGE DTE OPTIONS? (continued)	RTS/CTS DELAY	0 to 150 ms (10 ms)	---	S26
		DTE COM-MANDED FALLBACK	ENABLE DISABLE	*FB1 *FB	S53
		OPTIONS RES/ RETND AT DISC	RESTORED RETAINED	*RO1 *RO	S29
	CHANGE TEST OPTIONS?	BILATERAL DIGITAL LOOP	ENABLE DISABLE	*DG1 *DG	S34
		DTE LOCAL TEST	ENABLE DISABLE	*LA1 *LA	S34
		DTE REMOTE TEST	ENABLE DISABLE	*RD1, *RD	S34
		REMOTE COM-MANDED	ENABLE DISABLE	&T4 &T5	S23
		TEST TIMEOUT	OFF, 60, 120, 180. 240 SEC	---	S18
	CHANGE DIAL OPTIONS?	DIAL TYPE	PULSE, TONE	P, T	S14
		AUTODIAL #	OFF, 1 - 9	*AUn (n=1-9)	---
		DIAL TONE	BLIND DIAL WAIT FOR DIAL TONE	X, X1, X3 X2, X4	S22
		WAIT DELAY (Blind Dial)	1, 2, 3, 4, 8, 16, 32 SEC	---	S6
		PAUSE DELAY	1, 2, 3, 4, 8, 16, 32 SEC	---	S8
		CALL TIMEOUT	15, 30, 45, 60, 75, 90, 105, 120 SEC	---	S7
		ANSWER RING #X	1, 2, 4, 8, 16	---	S0
		AUTOCALLBACK	ENABLE, DISABLE	---	S72
	CHANGE SPEAKER OPERATION?	VOLUME CONTROL	LOW HIGH	L1, L2 L3	S22

Table 4-1. LCD Menu Option Selection (Continued)

Main Menu	Submenu	Submenu Item	Item Option	AT Com.	S-Reg
5 c o n t. MODIFY CONFIGU-RATION? (continued)	CHANGE SPEAKER OPERATION? (continued)	SPEAKER CONTROL	ON UNTIL CARR DETECT ALWAYS ON OFF WHILE DIALING ALWAYS OFF	M1 M2 M3 M4	S22
	LOAD/STORE OPTION SET?	LOAD FACTORY OPTION	NO, 1-9	&Fn (n=1-9)	---
		LOAD USER OPTION SET	1 2	Z0 Z1	---
		STORE PRESENT OPTIONS	1 2	&W &W1	---
		USER OPTION AT RESET	1 2	&Y &Y1	---
6 CHANGE PHONE NUMBERS?		PHONE NUMBER	ENTER NUMBER 32 digits	&Zx=n (n=phone # and modifi-ers) *CNx,n	---
7 FRONT PANEL FEA-TURES?		CHANGE RMT PASSWORD?	ENTER PASS-WORD	%P	---
		ENTER REMOTE CONFIGURA-TION	ENTER REM CFG PASS-WORD	%T	---
		EXIT REMOTE CONFIGURA-TION	EXIT	&T	---
		CHANGE FRONT PANEL PASS-WORD	ENTER PASS-WORD *	---	---
			ACTIVATE SECURITY	---	---

∗*Password of 0000 disables front panel security.*

Front Panel Security

The Front Panel Security feature provides password protection for front panel menu access. The modem is shipped from the factory with this feature disabled.

The Front Panel Security password is a 4-digit string that can be set to any combination of digits from "0000" to "9999". Selecting a password of "0000" disables Front Panel Security; any other password enables it.

IMPORTANT: Without your password, you cannot access front panel configuration. Keep your password in a safe place. If you forget your Front Panel Security password, contact Technical Support. Refer to "Calling Technical Support" section on page 12-2.

When this feature is enabled, it can be activated in these ways:

- Explicitly, by a front panel screen under Main Menu #7
- By the modem, when no front panel buttons have been pressed for 3 minutes

When Front Panel Security is activated, the front panel menu returns to Main Menu #1 and the front panel is secured.

In secured state, the Main Menu #1 screen continues to maintain modem status, but a password must be entered before other front panel screens may be accessed. Pressing any front panel button causes the modem to prompt for the front panel password. After the password has been entered, a message briefly displays the result of the password validation process and, depending on the result, Front Panel Security either becomes inactive or returns to its active state.

During password entry, the front panel buttons are operate as follows:

- Pressing NO makes the character at the cursor change to the next valid password character.
- Pressing YES while the cursor is on any of the first three password characters makes the cursor advance to the next password character. When the cursor is on the last password character, pressing YES makes the modem accept the displayed password.
- Pressing TALK/DATA while the cursor is on the first password character aborts password entry. When the cursor is on any other character, this button makes the cursor move to the first character.

Chapter 5
AT Commands

This chapter describes commands used to select options and operate the modem. Some options depend on, or are restricted by, the mode of operation. Appendix E provides a quick reference list.

Command Categories

The modem offers these major categories of command statements:

- Response (page 5-5)
- Dial (page 5-13)
- Answer (page 5-17)
- Terminal Interface (page 5-19)
- General (page 5-22)
- Private Line (page 5-33)
- Configuration (page 5-37)
- Remote Configuration (page 5-41)

Other AT command groups are discussed in these chapters:

- Protocol (Chapter 6)
- Test (Chapter 7)
- Security (Chapter 8)
- Fax (Chapter 9)
- S-registers (Chapter 10)

Operation Modes

In asynchronous operation, the modem functions in one of these 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 escape command is performed by entering the escape character (+ is the default) three times. The data communication link remains established but data transmission is suspended. The modem then accepts commands as it does in 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 does not accept or execute command instructions.

Example: The modem is in the command state. The D command and phone number are used to dial a remote modem. The local modem waits to receive an answer back tone from the remote modem. When the local modem receives the carrier, it leaves the command state and goes online in the data mode. At this time, both modems are using the telephone line and a communication link is established.

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 command, is typed using the computer/terminal 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 keyboard symbols such 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:

1) Type `AT`. This is the Attention Code telling the unit a command statement follows.
2) Type the command.
3) Press the `Enter` key to send the command statement to the modem.

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

```
ATD554-1212
```

This statement can be read as "Attention: Dial 554-1212."

Another `AT` command statement example is:

```
ATZ
```

This statement can be read as "Attention: execute the `Z` command."

After entering a command line the modem returns a response message indicating whether or not the command was accepted or giving the data requested by the command line.

To clear command statements from the buffer you can:

- Turn the modem off,
- Enter `AT`, or
- Use the DTR reset feature ("Data Terminal Ready — &D" section on page 5-20).

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

The attention code (`AT`) may be upper or lower case but not a combination like `aT`.

- Press the `Enter` key to execute a command.
- The command buffer can hold 80 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 the "Local Character Echo — E" section on page 5-22 for details.

Command Statement Buffer

The modem temporarily stores up to 80 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 80 characters or less.

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

```
ATD (212) 554-1212
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 Enter to execute the command.

Repeating a Command — A/

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

Example: The ATD5551212 command has been executed, and the phone is busy. To repeat the instruction type A/. Do not use AT before this command: AT empties the buffer.

Numbered Commands

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.

📖 **Note**
> The zero (0) may be omitted; the commands M and M0 are identical. This manual uses the nonzero form. 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 Enter key sends the entire command string to the modem, which executes each command individually in the order it appears in the command statement reading from left to right.

For example, the command statement ATQ0V0L3DT5551212 means
   • AT Attention.
   • Q Allow response messages to be sent.
   • V Select digit code responses.
   • L3 Select high volume.
   • DT Tone dial 555-1212.

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

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

📖 **Note**
> **Bold text** indicates command parameter defaults.

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

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

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

Response Displays — Q

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

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

Negotiation Displays — W

The W command enables or disables negotiation response messages. These messages are verbose negotiation status displays to alert the user to the link rate, protocol, and DTE rate.

Command	*Operation*
W	Disables negotiation displays
W1	Enables negotiation displays
W2	Displays DCE link rate only

Connect Message Codes — \V

The V.3600 AT\V command provides the following connect message options.

Command	*Operation*
AT\V	CONNECT DTE rate
AT\V1	CONNECT DTE rate/protocol
AT\V2	CONNECT DCE rate
AT\V3	CONNECT DCE rate/protocol
AT\V4	CONNECT DCE rx rate/DCE tx rate/modulation mode/protocol

Call Progress / Connect Speed Messages X

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

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

The X command followed by a dial command makes the modem 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 connection rate. With a basic response, the modem does not detect a busy or no dial tone condition.

The X1 command followed by a dial command makes the modem 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 does not detect a busy or no dial tone situation.

The X2 command followed by a dial command makes the modem 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 does not detect a busy situation in this mode.

The X3 command followed by a dial command makes the modem 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 is displayed. The modem does not detect a no dial tone situation.

The X4 command followed by a dial command makes the modem 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 is displayed.

The X4 command combines 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 in S6 and then dials.

Number Code Application — *RC

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

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

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

Response Number Codes / Messages

Response number codes, messages, and their meanings are as follows. The connect rates are serial port rates (DTE), not DCE rates.

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 not detected 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)
10	CONNECT 2400	DTE rate 2400 bps
11, 15	CONNECT 4800	DTE rate 4800 bps
12, 18	CONNECT 9600	DTE rate 9600 bps
20	CONNECT 300	DTE rate 300 bps
22	CONNECT 7200	DTE rate 7200 bps
23	CONNECT 12000	DTE rate 12000 bps
24	CONNECT 14400	DTE rate 14400 bps
25	CONNECT 16800	DTE rate 16800 bps
26	CONNECT 19200	DTE rate 19200 bps
27	CONNECT 21600	DTE rate 21600 bps
28	CONNECT 24000	DTE rate 24000 bps
29	CONNECT 26400	DTE rate 26400 bps
30	CONNECT 28800	DTE rate 28800 bps

Code	Message	Meaning
31	CONNECT 31200	DTE rate 31200 bps
32	CONNECT 32000	DTE rate 32000 bps
33	CONNECT 33600	DTE rate 33600 bps
34	CONNECT 38400	DTE rate 38400 bps
35	CONNECT 57600	DTE rate 57600 bps
36	CONNECT 115200	DTE rate 115200 bps
37	CONNECT 230400	DTE rate 230400 bps
38	CONNECT 300/V42bis	V.42 bis 300 bps connection
39	CONNECT 600/V42bis	V.42 bis 600 bps connection
40	CONNECT 1200/V42bis	V.42 bis 1200 bps connection
41	CONNECT 2400/V42bis	V.42 bis 2400 bps connection
42	CONNECT 4800/V42bis	V.42 bis 4800 bps connection
43	CONNECT 7200/V42bis	V.42 bis 7200 bps connection
44	CONNECT 9600/V42bis	V.42 bis 9600 bps connection
45	CONNECT 12000/ V42bis	V.42 bis 12000 bps connection
46	CONNECT 14400/ V42bis	V.42 bis 14400 bps connection
47	CONNECT 16800/ V42bis	V.42 bis 16800 bps connection
48	CONNECT 19200/ V42bis	V.42 bis 19200 bps connection
49	CONNECT 21600/ V42bis	V.42 bis 21600 bps connection
50	CONNECT 24000/ V42bis	V.42 bis 24000 bps connection
51	CONNECT 26400/ V42bis	V.42 bis 26400 bps connection
52	CONNECT 28800/ V42bis	V.42 bis 28800 bps connection
53	CONNECT 31200/ V42bis	V.42 bis 31200 bps connection

Code	Message	Meaning
54	CONNECT 32000/ V42bis	V.42 bis 32000 bps connection
55	CONNECT 33600/ V42bis	V.42 bis 33600 bps connection
56	CONNECT 38400/ V42bis	V.42 bis 38400 bps connection
57	CONNECT 57600/ V42bis	V.42 bis 57600 bps connection
58	CONNECT 115200/ V42bis	V.42 bis 115200 bps connection
59	CONNECT 230400/ V42bis	V.42 bis 230400 bps connection
60	CONNECT 300/V42	V.42 300 bps connection
61	CONNECT 600/V42	V.42 600 bps connection
62	CONNECT 1200/V42	V.42 1200 bps connection
63	CONNECT 2400/V42	V.42 2400 bps connection
64	CONNECT 4800/V42	V.42 4800 bps connection
65	CONNECT 7200/V42	V.42 7200 bps connection
66	CONNECT 9600/V42	V.42 9600 bps connection
67	CONNECT 12000/V42	V.42 12000 bps connection
68	CONNECT 14400/V42	V.42 14400 bps connection
69	CONNECT 16800/V42	V.42 16800 bps connection
70	CONNECT 19200/V42	V.42 19200 bps connection
71	CONNECT 21600/V42	V.42 21600 bps connection
72	CONNECT 24000/V42	V.42 24000 bps connection
73	CONNECT 26400/V42	V.42 26400 bps connection
74	CONNECT 28800/V42	V.42 28800 bps connection
75	CONNECT 31200/V42	V.42 31200 bps connection
76	CONNECT 32000/V42	V.42 32000 bps connection
77	CONNECT 33600/V42	V.42 33600 bps connection
78	CONNECT 38400/V42	V.42 38400 bps connection
79	CONNECT 57600/V42	V.42 57600 bps connection

Code	Message	Meaning
80	CONNECT 115200/V42	V.42 115200 bps connection
81	CONNECT 230400/V42	V.42 230400 bps connection
82	CONNECT 300/MNP5	MNP5 300 bps connection
83	CONNECT 600/MNP5	MNP5 600 bps connection
84	CONNECT 1200/MNP5	MNP5 1200 bps connection
85	CONNECT 2400/MNP5	MNP5 2400 bps connection
86	CONNECT 4800/MNP5	MNP5 4800 bps connection
87	CONNECT 7200/MNP5	MNP5 7200 bps connection
88	CONNECT 9600/MNP5	MNP5 9600 bps connection
89	CONNECT 12000/MNP5	MNP5 12000 bps connection
90	CONNECT 14400/MNP5	MNP5 14400 bps connection
91	CONNECT 16800/MNP5	MNP5 16800 bps connection
92	CONNECT 19200/MNP5	MNP5 19200 bps connection
93	CONNECT 21600/MNP5	MNP5 21600 bps connection
94	CONNECT 24000/MNP5	MNP5 24000 bps connection
95	CONNECT 26400/MNP5	MNP5 26400 bps connection
96	CONNECT 28800/MNP5	MNP5 28800 bps connection
97	CONNECT 31200/MNP5	MNP5 31200 bps connection
98	CONNECT 32000/MNP5	MNP5 32000 bps connection
99	CONNECT 33600/MNP5	MNP5 33600 bps connection
100	CONNECT 38400/MNP5	MNP5 38400 bps connection
101	CONNECT 57600/MNP5	MNP5 57600 bps connection
102	CONNECT 115200/MNP5	MNP5 115200 bps connection
103	CONNECT 230400/MNP5	MNP5 230400 bps connection
104	CONNECT 300/MNP	MNP 300 bps connection
105	CONNECT 600/MNP	MNP 600 bps connection
106	CONNECT 1200/MNP	MNP 12000 bps connection
107	CONNECT 2400/MNP	MNP 24000 bps connection
108	CONNECT 4800/MNP	MNP 4800 bps connection
109	CONNECT 7200/MNP	MNP 7200 bps connection

Code	Message	Meaning
110	CONNECT 9600/MNP	MNP 9600 bps connection
111	CONNECT 12000/MNP	MNP 12000 bps connection
112	CONNECT 14400/MNP	MNP 14400 bps connection
113	CONNECT 16800/MNP	MNP 16800 bps connection
114	CONNECT 19200/MNP	MNP 19200 bps connection
115	CONNECT 21600/MNP	MNP 21600 bps connection
116	CONNECT 24000/MNP	MNP 24000 bps connection
117	CONNECT 26400/MNP	MNP 26400 bps connection
118	CONNECT 28800/MNP	MNP 28800 bps connection
119	CONNECT 31200/MNP	MNP 31200 bps connection
120	CONNECT 32000/MNP	MNP 32000 bps connection
121	CONNECT 33600/MNP	MNP 33600 bps connection
122	CONNECT 38400/MNP	MNP 38400 bps connection
123	CONNECT 57600/MNP	MNP 57600 bps connection
124	CONNECT 115200/MNP	MNP 115200 bps connection
125	CONNECT 230400/MNP	MNP 230400 bps connection
132	NUMBER LIST FULL	The delayed telephone number list cannot hold any more numbers.
133 xx	DELAYED NUMBER WAIT	The number is on delayed list and call is delayed for xxx minutes

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.

Dialing — D

To dial a number, for example 555-1212, insert the D command in the dialing sequence.

```
AT D 555-1212
```

The modem dials the number, either pulse or tone, whichever is 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 as follows.

Command	Operation
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
;	Return to command mode after dialing
@	Wait for silence
S	Dial stored command line or number

Tone Dialing — T

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

```
AT D T 323-1111
```

In this example, the modem tone dials the telephone number. The dialing method selected remains in effect until changed.

Pulse Dialing — P

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

```
AT D P 554-9902
```

Insert Long Pause — ,

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

```
AT D P 9, 1-800-554-1000
```

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

Wait for Second Dial Tone — W

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

```
AT D 9 W 323-8000
```

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

Hook Flash — !

To flash the switchboard, insert an exclamation mark in the dialing sequence.

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

This inserts a 0.5 second on hook condition, usually for transferring a call or similar use.

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

Switching to Answer Mode after Dialing — R

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

```
AT D 554-2345 R
```

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

Remaining in Command Mode — ;

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

```
AT D 234-5678;
```

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

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

```
AT DTn;
```

where n= additional tones to be sent.

Wait for 5 Seconds of Silence — @

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

```
AT D 399-4700 @ 2251 ;
```

In this example the modem dials the number and, after the connection, waits for 5 consecutive seconds of silence. 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 ;
```

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

Dialing a Stored Telephone Number — Sn

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

```
AT D S9
```

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

📖 Note
DS and DS1 are the same location.

Autodial Number Location — *AUn

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

Voice Calls

To make a voice call, dial the number with the telephone. To use the dial command for the call, enter the following dialing sequence:

```
AT D (number);
```

The *;* modifier recalls the command mode and prevents the modem from training. The remote site must be answered by the telephone for the voice call to be successful.

Switching from Voice to Data

After dialing, place the modems at both ends in data mode by pressing the TALK/DATA button. The *DA1 command can also be used to change from talk mode to data mode.

Answering A Call

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

- Manually
- AT Command
- Autoanswer

Manual Answer

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

AT Command Answer — A

The modem can be made to answer a call by entering ATA when the phone rings.

Autoanswer — S0

Autoanswer is controlled by register S0. S0 determines which ring the modem answers on. S0 can be loaded with a value between 1 and 255 for autoanswer. Entering ATS0=0 disables autoanswer. Decide which ring the modem is to answer on and set S0 to that decimal value.When S0 is one or greater, the modem automatically answers on the selected ring and connects with the calling modem.

📖 Note

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

Caller ID — *ID

If the telephone company is providing Caller ID services to the local phone line, the V.3600 can report Caller ID to the DTE. *

📖 **Note**

The communications software package may need reconfiguring to look for the "Caller Number:" message prefix so that it knows when to look for a phone number.

Command	*Operation*
*ID	Disable Caller ID
*ID1	Enable Caller ID

When Caller ID is enabled, one of the messages in Table 5-2 appears on the computer screen after the first RING message:

Table 5-2. Caller ID Messages

The modem sends this message...	If:
CALLER<sp>NUMBER:(505)555-1313	The number was delivered by the phone company
CALLER<sp>NUMBER:OUT<sp> OF <sp>AREA	The number was not available from the phone company
CALLER<sp>NUMBER:PRIVATE	Delivery was blocked by the caller
CALL FAILURE<sp>NUMBER: ERROR	The number was received in error

If the telephone company provides Enhanced Caller ID, the caller's name appears after the caller phone number.

Distinctive Ring — *DR

If the telephone company is providing distinctive ring service to the local phone line, the V.3600 can report the type of ring to the DTE.[*] The data communications software package must allow distinctive ring.

　*Caller ID and Distinctive Ring are compatible only with USA standards.

Command	**Operation**
*DR=0	Disable Distinctive Ring
*DR=1	Enable Distinctive Ring

When distinctive ring is enabled, one of the messages in Table 5-3 appears on the DTE instead of the regular RING message:

Table 5-3. Distinctive Ring Messages

The modem sends this message...	**If the Ring Was a:**
RING A	Single ring (1 ring burst)
RING B	Double ring (2 ring bursts)
RING C	Triple ring (3 ring bursts)

Terminal Interface Commands

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

Data Carrier Detect — &C

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

Command	**Operation**
&C	DCD always on
&C1	DCD on when 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 V.13).

📖 **Note**
AT&C3 is used to simulate switched carrier operation.

📖 **Note**

For simulated switched carrier operation &C3 must be selected on both modems. Not available in the B103 and V.21 modulation modes.

Data Set Ready — &S

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

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

Data Terminal Ready — &D

In data mode DTR may be used for modem control.

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

📖 **Note**

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

Serial Port Ring Indicator (Pin 22) — \R

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

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

Request to Send / Clear to Send — &R

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

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

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

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

DTE Controlled Fallback Rate (Pin 23) — *FB

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

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

General Commands

This series of commands controls various standard options that in most cases apply to any mode of operation.

Changing from Data Mode to Command Mode — +++

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 mode transmissions and allows command mode operations without breaking or otherwise disturbing the telephone line connection. The modem responds with OK when it detects the escape code. Return to data mode by entering the O command.

📖 **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 E command to correct the double characters or disable character echo by the modem.

If the screen shows no characters, enter the `E1` command to turn modem echo on or enable local echo on the terminal.

Command	Operation
E	Echo off
E1	Echo on

Online Character Echo — F

In some lower speed modems the `F` 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, H1

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

Enter the `H1` command to take the modem off hook. The modem automatically goes off hook when a dial command is keyed in.

Fast Disconnect — H2, H3

The results of the `H` command can be modified by the `H2` and `H3` commands. `H2` or `H3` will not cause a hang up but will affect the method of hanging up the next time the `H` command is issued. If `H2` is entered, the `H` command will hang up according to CCITT V.32 standards. If operating in V.32 bis mode the `H2` command could take several seconds. If `H3` (the fast command) is entered, the `H` command will hang up much more rapidly at those speeds.

Command	Operation
H	The modem hangs up.
H1	Forces modem off hook
H2	Sets `H` command to normal hangup procedure (long space, cleardown, protocol)
H3	Sets `H` command to fast hang up

EPROM Check — I

PC software packages may issue the I 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 checksum to be calculated on the EPROM, enter the I1 command. The modem returns four ASCII characters representing the cyclic redundancy check (CRC) in hexadecimal form. Enter the I3 command to request the product version.

Command	Operation
I	Request product code
I1	Request EPROM checksum value
I3	Request product version
I4	Returns Motorola V.3600
I5	Last disconnect reason

Speaker Volume L

The L commands offer three volume levels.

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

Speaker Control — M

The M commands enable or disable the speaker for monitoring purposes.

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

Return Online — O

Use the `O` command when you are 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. Enter the `O1` command to cause a retrain to occur before going back to data 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 the `Y` command to disable this feature and prevent unintentional disconnects.

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

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

V.22 bis Guard Tones — &G

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

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

Asynchronous / Synchronous Mode Selection — &M

The `&M` commands select synchronous or asynchronous operation and synchronous dial method.

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

Command	Operation
&M	Async data/dialer mode (V.25 bis disabled)
&M1	Sync data mode / async dialer
&M2	Sync data mode / DTR dials if active
&M3	Sync data mode / manual dial
&M4	Sync data mode (ASCII) with V.25 bis BISYNC dialer
&M5	Sync data mode (NRZ) with V.25 bis SDLC dialer
&M6	Sync data mode with V.25 bis async dialer
&M7	Async data mode with V.25 bis async dialer
&M8	Sync data mode (EBCDIC) with V.25 bis BISYNC dialer
&M9	Sync data mode (EBCDIC, NRZ) with V.25 bis async dialer
&M10	Sync data mode (ASCII, NRZI) with V.25 bis SDLC dialer
&M11	Sync data mode (EBCDIC, NRZI) with V.25 bis SDLC dialer

IMPORTANT: Synchronous DTE must be available to communicate with the modem if the V.25 bis dialer is enabled.

Make / Break Dial Pulse Ratio — &P

Use the &P command for the dial pulse to be on for 39% and off for 61% of one cycle. Use the &P1 command for the dial pulse to be on for 33% and off for 67% of one cycle.

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

Synchronous Transmit Clock Source — &X

The &X commands select internal, external, or receive clock as the transmit clock source.

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

V.34 Rate Selection Thresholds — *TH

The *TH commands sets the V.34 rate selection thresholds. The V.34 modulation dynamically selects the optimum bit rate to run, based on line quality.

Command	Operation
*TH	Low V.34 threshold (10^{-6} BER)
*TH1	Medium V.34 threshold (10^{-4} BER)
*TH2	High V.34 threshold (10^{-2} BER)

V.34 Asymmetric Bit Rates — *AS

The *AS command enables or disables the V.34 asymmetric bit rate capability. This feature allows the modem to run different bit rates on the receiver and transmitter.

Command	Operation
*AS	Disable V.34 asymmetric bit rates
*AS1	Enable V.34 asymmetric bit rates

Modulation *MM

The *MM command sets the current modulation type to use when attempting to make a connection. Using this command automatically selects the maximum DCE speed (%B) for the selected modulation.

Command	Operation
*MM	Automode (typically used on dial line)
*MM1	V.21
*MM2	B103
*MM3	Reserved
*MM4	B212A

Command	Operation
*MM5	V.22 bis
*MM6	V.27 bis 4-wire leased only
*MM7	Reserved
*MM8	V.29 4-wire leased only
*MM9	Reserved
*MM10	V.33 4-wire leased only
*MM11	V.32 bis
*MM12	V.34

Maximum DCE Speed — %B

The `%B` commands set 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 the `%Bn` command where n=1 to 18.

Command	*Operation*
%B	Use DTE speed
%B1	300 bps
%B2	1200 bps
%B3	2400 bps
%B4	4800 bps
%B5	9600 uncoded bps *
%B6	9600 bps
%B7	7200 bps
%B8	12000 bps
%B9	14400 bps
%B10	600 bps
%B11	16800 bps
%B12	19200 bps
%B13	21600 bps
%B14	24000 bps
%B15	26400 bps

Command	Operation (Continued)
%B16	28800 bps
%B17	31200 bps
%B18	33600 bps

∗*Valid for V.32 bis modulation only*

📖 **Note**
Use the `%B` command after the `*MM` command when specific modulations are required.

Minimum DCE Speed — %L

If the modem connects at a rate lower than the minimum DCE speed, it disconnects the link automatically.

Command	Operation
%L	Disabled
%L1	Disabled
%L2	1200 bps
%L3	2400 bps
%L4	4800 bps
%L5	9600 uncoded bps *
%L6	9600 bps
%L7	7200 bps
%L8	12000bps
%L9	14400 bps
%L10	600 bps
%L11	16800 bps
%L12	19200 bps
%L13	21600 bps
%L14	24000 bps
%L15	26400 bps
%L16	28800 bps
%L17	31200 bps
%L18	33600 bps

∗*Valid for V.32 bis modulation only*

Auto Retrain — %E

This option allows the modem to automatically retrain in response to poor received signal quality without reconnecting. The modem always responds to a retrain request from the remote modem.

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

Automatic Rate Adaption — %R

Automatic rate adaption (ARA) allows the modem to automatically decrease the DCE rate when the allowable bit error rate is exceeded. If the 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 guidelines apply to automatic rate adaption:
- Automatic rate adaption is disabled during direct mode.
- Manual rate adaption is disabled from the front panel when automatic rate adaption is enabled.
- Only one increment or decrement in the DTE rate is allowed at a time during rate adaption from the initiating modem.
- When online, initiator rate adaption occurs a maximum of every 12 to 14 seconds from the last occurrence of a rate adaption.
- 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.

Command	*Operation*
%R	Disable automatic rate adaption
%R1	Enable automatic rate adaption using low BER: 1 in 10^5
%R2	Enable automatic rate adaption using medium BER: 1 in 10^4
%R3	Enable automatic rate adaption using high BER: 1 in 10^3

Manual Rate Adaption — *RR

The *RR command forces the modem to re-adapt the DCE rate of the remote modem.

Command	*Operation*
*RR	Rate adaption to 2400
*RR1	Rate adaption to 4800
*RR2	Rate adaption to 7200
*RR3	Rate adaption to 9600
*RR4	Rate adaption to 12000
*RR5	Rate adaption to 14400
*RR6	Rate adaption to 16800
*RR7	Rate adaption to 19200
*RR8	Rate adaption to 21600
*RR9	Rate adaption to 24000
*RR10	Rate adaption to 26400
*RR11	Rate adaption to 28800
*RR12	Rate adaption to 31200
*RR13	Rate adaption to 33600

Product Revision Level %V

The %V command displays the product revision level.

Online Quick Reference — $H

The $H command displays an AT command set quick reference. The
Enter key terminates the page displays and any other key scrolls
through the pages.

Command	Operation
$H	Displays online quick reference
$H=<*string*>	Search online quick reference for string.

Product Serial Number — $V

The $V command displays the product serial number.

Talk / Data — *DA

The *DA commands select talk or data mode.

Command	Operation
*DA	Switches modem to talk
*DA1	Switches modem to data

V.32 Fast Train — *FT

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

Command	Operation
*FT	Disable fast train
*FT1	Enable fast train

Incoming Call — *IC

The *IC command makes the modem disregard an incoming call.

Line Current Disconnect — *LC

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

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

Disable AT Command Set — *NT

The `*NT` command disables the AT command set.

The `*NT1` command allows the user at a remote modem to enable AT command operation of another modem via remote configuration.

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

If the AT command set of a local modem is accidentally disabled and must be recovered locally, reset the options through the front panel LCD, Main Menu #5, submenu CHANGE DTE OPTIONS?, "AT COMMAND SET" section on page 4-8.

Dial Line Transmit Level — *TDn

Command	Operation
*TDn	Sets dial line TX level to *n* where *n* is a number 9 through 30 corresponding to a TX level of -9 to -30 dBm

Private Line 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. 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 dial-up line for dial backup.

📖 **Note**
> The V.3229, V.3227, V.3225, and V.3257 modems use V.33 as
> the modulation type. The V.3600 must be set up to V.33 to
> connect to these modems.

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 dial-up 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 and the other for normal originate. When connected via
leased line the modems will connect and begin communicating with
each other.

The &L command is used to select private line (leased line) operating
mode. The *OR commands select the origination or answer mode when
operating in the leased line configuration.

📖 **Note**
> DTR must be held high in 2-wire or 4-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
> makes the modem initiate the 2-wire training sequence. DSR
> goes off during the training procedure.

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.

Dial Backup

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

- 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

In 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.

IMPORTANT: Both methods will cause the modem to dial the prestored autodial number. The originate modem will wait for five seconds and then initiate the call. The answer modem will wait for a ring. The modems then train and begin communicating over the dial-up line. If the dial connection is unsuccessful after three attempts, a retrain on the leased line will be initiated.

In manual mode, the return to leased line is only done when commanded. In automatic mode the return to leased line is initiated after the lookback time in register S28 has elapsed. To prevent unnecessary termination of the dial line connection, a leased line lookback test is performed. 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.

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. During this time the dial line connection is maintained if a return to dial line operation is required. 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 a leased line lookback.

Dial / Leased Line — &L

`&L` selects line operation as required:

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

Dial Backup *DB

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

Return to Leased Line from Dial Backup — *LB

During dial backup operation, `*LB` makes the modem return to leased line operation.

During leased line operation with forced answer enabled, `*LB` makes the modem wait for a dial backup call.

Manual Dial Backup — *LD

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

Answer / Originate — *OR

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

Command	Operation
*OR	Force originate
*OR1	Force answer

Leased Line Transmit Level — *TLn

Command	Operation
*TLn	Sets leased line TX level to *n* where *n* is a number 0 through 30 corresponding to a TX level of 0 to -30 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 on page 5-41.

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.

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. The active profile is
maintained in volatile memory referred to as S-registers.

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 Z command. The &Y command
selects one of the two 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 transferred to the active profile and then modified
to fit a specific application if needed. The &F command recalls one of
the nine factory configurations.

Storing a Configuration — &W

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

Command	*Operation*
&W	Store options to user option set 1
&W1	Store options to user option set 2
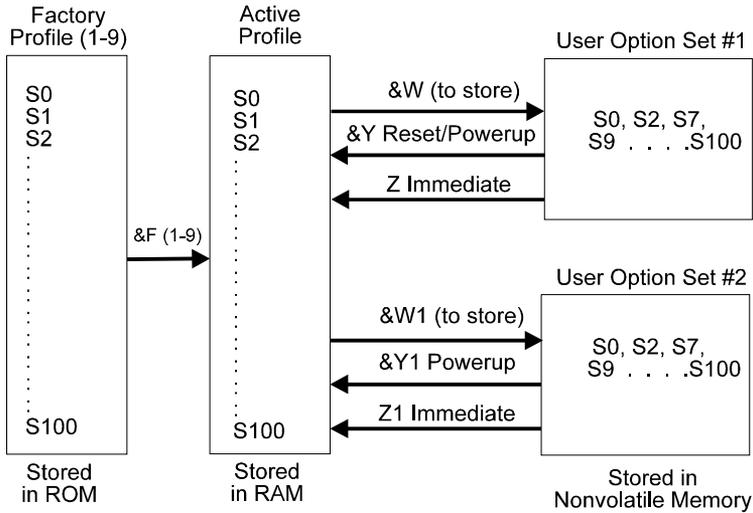
Figure 5-1. Configuration Storage and Recall

Powerup Option Set — &Y

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

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

Load Factory Options — &Fn

The `&Fn` command loads one of the existing configuration sets, providing a complete configuration for a compatible system/network environment. Refer to the Appendix H for a complete list of the options in each set.

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

Reset to Stored Configuration — Z

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

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

View Configuration Profiles/Received Signal Options &V

This command lets the user view the current configuration profile in the form of S-register values. &V1 displays the received signal options.

Command	Operation
&V	Displays configuration profiles
&V1	Displays received signal options
&V2	Displays active profile

Storing a Telephone Command Line — &Zx=n, *CNx,n, *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.

To store a telephone command line in a location, enter the &Zx=n command where x = the location and n = the number:

        AT &Z 8 = 554-1212

In this example the command sequence to dial the indicated number is stored at location 8 for later dialing.

Note

> Neither the AT prefix nor the D command should follow the &Zx=n.

- &Zx=n - Stores telephone number n, including dial modifiers, at location x (0-9, up to 31 digits).
- *CNx,n - Stores telephone number n, including dial modifiers, at location x (0-9, up to 31 digits).
- *CNx, - Clears telephone number location x
- *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:

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

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

Soft Download Password — %P1, $Y

Select a numeric password to permit/inhibit software downloading via flash memory if desired. The process is detailed in Appendix H.

Command	Operation
%P1=pw	Set software download password to 0-99999999
%P1=D	Disable software download
%P1?	Display software download password
$Y	Enable soft download flash

Remote Configuration

This mode of operation allows viewing or modifying the options of a remote modem that supports Motorola or Motorola UDS remote configuration. Remote configuration is performed using the front panel LCD or, more commonly, AT commands from the local terminal. Remote configuration is initiated by the local (master) modem through a proprietary protocol, a security code, and an acknowledgment from the remote (slave) unit to be modified. The security code is inserted and provides protection from unauthorized entry. The modems are shipped from the factory without a security code.

Note

Remote configuration is supported at all rates except 300 bps.

Remote Configuration Security

The correct security 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.

Return DTE service again to the remote modem by issuing the O 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 &T command will exit remote configuration mode.

Remote configuration may be entered immediately 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.

Remote Security Code — %P=

A security code prevents unauthorized access to remote configuration mode. This code is separate from low and high security passwords, which are discussed in Chapter 8. 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 %P=(desired code) command.

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

Command	Operation
%P=	Sets security code to a value 0 to 99999999 entered after the equal sign
%P?	Requests 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

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

IMPORTANT: Do not forget your remote security code. Keep your code in a safe place. If you do forget your code, contact Technical Support. Refer to the "Calling Technical Support" section on page 12-2.

Entering Remote Configuration — %T=, &T

This mode of operation allows you to view or modify the option set of a compatible remote modem. Enter the %T= (security code of remote) command to initiate remote configuration.

The modem is shipped from the factory with security code (blank). This allows remote configuration by using (blank) as the security code.

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

Remote Configuration can also be specified by the dial command by placing %T (password) after the dial digits (the equal sign is left off). For example,

```
ATD 555-1212%T01234
```

Enabling/Disabling Remote Configuration — *RA

The *RA commands enable and disable remote configuration.

Command	Operation
*RA	Disable remote configuration
*RA1	Enable remote configuration

Remote Configuration DTE Speed — *RB

This option forces DTE speed to a particular setting, if desired.

Command	Operation
*RB	Remote configuration DTE speed = 300 bps
*RB1	Remote configuration DTE speed = 600 bps
*RB2	Remote configuration DTE speed = 1200 bps
*RB3	Remote configuration DTE speed = 2400 bps
*RB4	Remote configuration DTE speed = 4800 bps
*RB5	Remote configuration DTE speed = 7200 bps
*RB6	Remote configuration DTE speed = 9600 bps
*RB7	Remote configuration DTE speed = 12000 bps
*RB8	Remote configuration DTE speed = 14400 bps
*RB9	Remote configuration DTE speed = 16800 bps
*RB10	Remote configuration DTE speed = 19200 bps
*RB11	Remote configuration DTE speed = 21600 bps
*RB12	Remote configuration DTE speed = 24000 bps
*RB13	Remote configuration DTE speed = 26400 bps
*RB14	Remote configuration DTE speed = 28800 bps
*RB15	Remote configuration DTE speed = 28400 bps
*RB16	Remote configuration DTE speed = 57600 bps
*RB17	Remote configuration DTE speed = 115200 bps

Remote Configuration Format — *RF

Set word length, parity, and stops for remote configuration.

Command	*Operation*
*RF	7 data bits, mark parity, 1 stop bit
*RF1	7 data bits, no parity, 2 stop bits
*RF2	7 data bits, odd parity, 1 stop bit
*RF3	7 data bits, even parity, 1 stop bit
*RF4	8 data bits, mark parity, 1 stop bit
*RF5	8 data bits, no parity, 1 stop bit
*RF6	8 data bits, odd parity, 1 stop bit
*RF7	8 data bits, even parity, 1 stop bit

Remote Configuration Saving or Discarding Options — *RQ

This option allows the opportunity to discard an undesirable option.

Command	*Operation*
*RQ	Save remote configuration option selection and exit
*RQ1	Discard remote configuration option selection and exit

Chapter 6
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, which has become an industry standard by the large 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.

Note
Error control protocols are only valid when using asynchronous DTE options.

Reliable Mode

When an 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 Mode

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 DCE-to-DCE data link 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 33600 bps. With LAPM data compression, the modem can achieve data throughput approaching 115200 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 connect 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.

📖 **Note**

In direct mode, with the DCE link established at a rate other than the original DTE speed, the modem issues 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.

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 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. The modem can use hardware flow control (RTS/CTS) or in-band flow control (XON/XOFF).

Protocol Commands

These commands enable or control the various data compression, flow control, and error correction options of the modem. Table 6-1 lists the features associated with each mode.

📖 **Note**

Bold text indicates command parameter defaults.

Table 6-1. Operating Modes and Features

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
Auto-reliable (MNP and LAPM)	Enabled	On or off	Allowed	Buffered	On

Disconnect Buffer Delay — Q%D

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

Command	Operation
%D	**Disconnect buffer delay disabled**
%Dn	Disconnect buffer delay value (n = 1-255 seconds)

Serial Port (DTE) Constant Speed — \J

The \J command allows DCE and DTE to operate at different speeds. The \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.

Command	Operation
\J	**Disable slaved DTE/DCE (constant speed DTE on)**
\J1	Enable slaved DTE/DCE (constant speed DTE off)
\J2	Enable 230.4 kbps as DTE speed
\J3	Disable 230.4 kbps as DTE speed

📖 Note
The 230.4 kbps DTE speed is available, but the DTE will not autobaud to 230.4 kbps. With the modem set for 115.2 kbps, enter AT\J2 to enable the speed, and reset the DTE for 230.4 kbps. When the modem is set for 230.4 kbps, enter AT\J3 to disable it if needed. Reset the DTE for 115.2 kbps.

V.42 Optional Detection Phase — \M
This is a data sequence that speeds up the LAPM link negotiation time if V.42 LAPM is supported by the remote modem.

Command	Operation
\M	V.42 fast detect data sequence disabled
\M1	**V.42 fast detect data sequence enabled**

Operating Mode — \N
Select the V.42 bis mode to be used in data mode. An \Nn command issued during command mode while a connection is in progress will not affect the current connection but will be acted on for subsequent connections. LAPM or MNP protocol operation is referred to as MNP-only mode, and the auto-reliable modes allow protocol fallback.

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; disconnect if not successful
\N7	**LAPM, MNP, or normal — try both protocols; fallback to normal if not successful**

Auto-Reliable Fallback Character — %An

Select 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 the `%An` command to set the auto-reliable fallback character (n=1-27 decimal representing an ASCII character).

Command	Operation
%A0	**Disable auto-reliable fallback character**
%An	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, \N6, \N7).

Serial Port Flow Control — \Q

The \Q commands set 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 the 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.

- The \Q - \Q3 commands affect both DTE and DCE flow control.
- The \Q4 - \Q7 commands affect only flow control by the DCE.
- The \Q command disables flow control bilaterally.

When the \Q1 command is used, 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.

When the \Q2 command is used, the modem uses CTS off to stop the data from the DTE and CTS on to restart it.

When the \Q3 command is used, the modem uses CTS off to stop the data from the DTE and CTS on to restart it. The DTE uses RTS off to stop data from the modem and RTS on to restart it.

The \Q4 command disables flow control by the DCE.

The \Q5 command enables XON/XOFF flow control by the DCE only.

The \Q6 and \Q7 commands force the modem to use RTS off to stop data from the modem and RTS on to restart it. This does not affect DTE flow control.

Command	Operation
\Q	Disable bilateral flow control
\Q1	Enable bilateral XON/XOFF flow control
\Q2	Enable DTE CTS flow control, disable DCE flow control
\Q3	**Enable CTS/RTS bilateral flow control**
\Q4	Disable DCE flow control
\Q5	Enable DCE XON/XOFF flow control
\Q6	Enable DCE RTS flow control
\Q7	Enable DCE RTS flow control

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 MNP-only or
normal. It enables or disables sending local flow control characters
(XON/XOFF) to the remote modem as well as being acted on in the
local modem. In MNP-only 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.

IMPORTANT: With \X1 in effect, local flow control characters are
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.

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

Data Link Flow Control — \G

This flow control paces data from the remote modem to the local
modem during a normal connection. When the \G1 command is sent,
the modem uses XON/XOFF to start/stop data transmission from the
remote modem. This command is ignored during an MNP connection.

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

Note
The V.3600 will transmit the XON/XOFF characters to start/
stop data transmission from the remote modem. The V.3600
will not respond to the XON/XOFF characters. This activity
ensures that a false XON/XOFF is not detected resulting in
data loss.

Break Control — \Kn

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

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**

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* (no protocol, data buffered).

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* (no protocol, data not buffered).

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

A break is received from the remote modem while the modem is in *connect state* during a *normal connection* (no protocol, data buffered).

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 break to the serial port in sequence with any data received from the remote modem

A transmit break command is issued while the modem is in *command state* during a *reliable* (protocol) or *normal connection* (no protocol, data buffered).

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

Inactivity Timer — \T
The \T command specifies the number of minutes the modem will stay online without transmitting or receiving data before hanging up. When the value is set to 0, the timer is disabled.

Command	Operation
\T	**Disable inactivity timer**
\Tn	Set inactivity to n (n=1-255) minutes

Maximum Reliable Block Size — \A
The \A command sets the maximum transmit block size for MNP connections. Use this command to force the modem to transmit smaller blocks in an MNP connection. A smaller block size maximizes throughput when marginal line conditions are causing errors. The modem sends a block up to the size specified by the \A command.

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**

Transmit Break / Set Break Length — \B

The \B commands tell the local modem to send a break signal to the remote modem. In all modes except direct, S79 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 \Bn where n=1-255 in 20 ms increments. The default is 35 (700 ms).

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; default= 35 (700 ms)

Set Auto-Reliable Buffer — \C

This determines whether or not a modem in reliable mode will buffer data received from a modem that is not in reliable mode during the 4 seconds in which the modems try to establish a reliable link. Use these commands when the modem is in the auto-reliable mode and is expected to process a call from a modem not in a reliable mode.

Command	Operation
\C	**Disable auto reliable data buffer**
\C1	Buffer data for 4 seconds or 200 characters

V.42bis Data Compression — %C

The %C command determines application of data compression while running LAPM protocol.

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

Chapter 7
Test Mode Operation

Diagnostic tests are used to isolate faults in the communications path. Diagnostic tests 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 &T command. When in test modes without a test pattern, issue the escape sequence +++ to return to command mode before terminating the test with the &T command.

> ### 📖 Note
> Local analog loopback with or without a test pattern is the only test available in protocol mode.

Test Categories

Diagnostic tests fall into two categories: those that can be performed online or offline and those that must be performed online. Refer to Table 7-1.

Table 7-1. Diagnostic Tests

Test	Offline	Online
Local Analog Loopback (LAL)	X	X
Local Analog Loopback with Self Test (LAL/TP)	X	X
Local Digital Loopback (LDL)		X
Remote Digital Loopback (RDL)		X
Remote Digital Loopback with Self Test (RDL/TP)		X
Test Pattern (TP)		X

> ### 📖 Note
> These tests do not apply to fax mode and should only be performed when the modem is configured for data operation.

LDL, RDL, and RDL/TP tests are initiated after making an online data connection in normal or direct mode only. LAL and LAL/TP are initiated while in offline command mode. These tests can be initiated by AT commands or by using the LCD front panel SELECT TEST menus. Refer to Table 7-2.

> **Note**
> **Bold text** indicates command parameter defaults.

Table 7-2. Test Commands

Command	Operation
&T	Terminate any test
&T1	Initiate local 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
%T	Transmit test pattern

Terminating a Test in Progress — Q&T

Tests can be terminated manually or automatically. The &T command terminates a test manually. The modem automatically goes to command mode during LDL, LAL/TP, and RDL/TP tests. Enter the &T command to terminate the tests. For LAL and RDL, enter the escape sequence (+++) before the &T command to go to the command mode.

By preloading register S18 with 1 to 255, each test mode automatically times out after the specified number of seconds and exits back to the command mode. Loading S18 with 0 disables the auto timeout feature and the test will run continuously until manually terminated.

For example, to run the self test analog loopback test for 30 seconds, enter

        ATS18=30&T8

The modem should respond with 000 after 30 seconds.

Testing the Local Modem

Test local operation with the modem offline in command mode. Use LAL and LAL/TP to test the local modem and the communications to the local DTE.

📖 **Note**

Figures 7-1 through 7-5 include LED test indications. 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.

Local Analog Loopback — &T1

In Local Analog Loopback the modem transmitter connects to its receiver so the analog signal normally sent over the telephone line is received locally.

If operating on leased lines, the lines are terminated into 600 ohms (Figure 7-1). If off hook on a dial-up line, the modem is forced on hook.
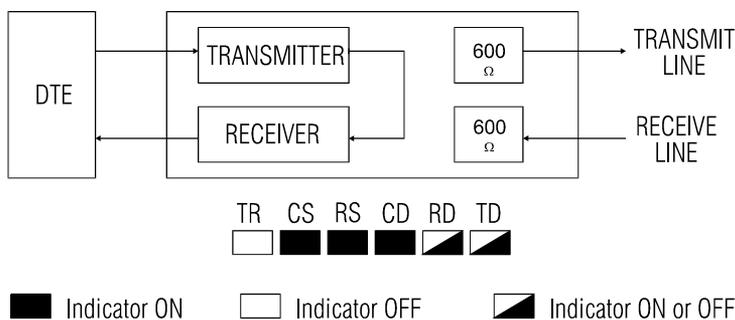
Figure 7-1. Local Analog Loopback
(4-Wire Operation and 2-Wire Operation)

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

Test the local DTE and cable by entering the &T1 command. Enter a test message and verify it is echoed on the screen. If it is not returned exactly as entered, the terminal equipment or data cable is at fault.

To determine if the data cable is defective replace it with a properly configured cable with electrical continuity. If the cable checks out but the problem remains, the DTE is defective.

If all local equipment checks out, proceed to the"Testing the Remote Modem" section on page 7-4.

Issue an escape sequence followed by &T1 to exit analog loopback.

Local Analog Loopback with Self Test — &T8

When the modem is offline in command mode, enter the &T8 command to put the modem in Self Test Local Analog Loopback (Figure 7-2).

The modem transmits a test pattern. The test pattern is looped back to the receiver and checked for errors. Entering the &T command causes the modem to exit Self Test Analog Loopback. The modem responds with a three digit value between 0 and 255 representing the number of errors during test pattern detection. If errors occur, repeat the test to verify the consistency of the problem.
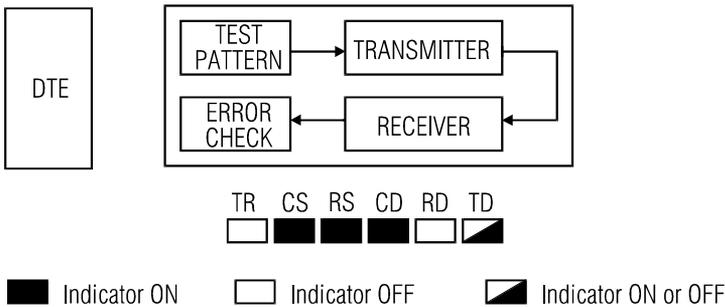
Figure 7-2. Local Analog with Test Pattern

Testing the Remote Modem

Use LDL, RDL, and RDL/TP in the online data mode to test the remote modem and phone line. Enter the escape sequence after making a connection to return to command mode. The appropriate test command, &T3, &T6, or &T7, can then be entered to initiate an online test.

Local Digital Loopback — &T3

After making the data connection, enter the escape sequence to return to command mode. Entering `&T3` puts the local modem in digital loopback. The remote operator can now send a test message which is looped back to the remote terminal screen.

If the test timer `(S18)` was loaded before issuing the `&T3` command the local modem exits the test after the specified number of seconds and returns to command mode. If not, enter `&T` to exit the test. Enter the command to return to online data mode.

The local modem receiver connects to its transmitter so received data is retransmitted to the remote site.

If Digital Bilateral Loopback is enabled locally, the local DTE is looped back to itself (Figure 7-3). If disabled, the local DTE receives a constant mark.
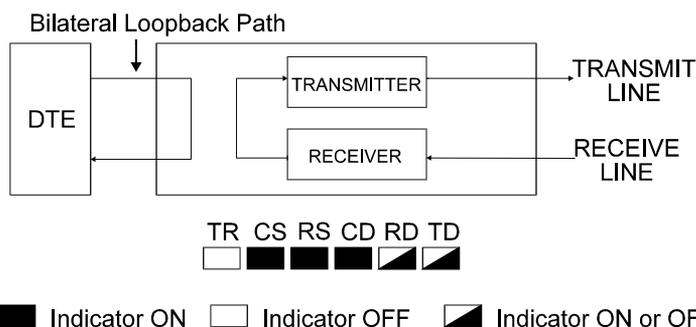
Figure 7-3. Local Digital Loopback with Bilateral Loopback Enabled

Grant/Deny RDL Request — &T4, &T5

Local operators can deny a request from the remote modem for remote digital loopback.

To allow your modem to be placed in RDL by a remote operator, enter

> **AT&T4**

To prevent your modem from entering RDL, enter

> **AT&T5**

Remote Digital Loopback — &T6

The initiating modem signals the remote modem to go to Digital Loopback. The remote modem receives and then retransmits data back to the local modem. If Digital Bilateral Loopback is enabled on the remote modem, the remote DTE is looped back to itself (Figure 7-4).
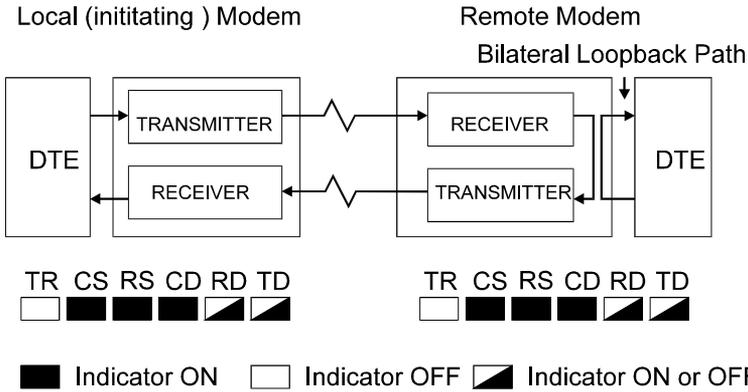
Figure 7-4. Remote Digital Loopback with Digital Bilateral Loop Enabled at the Remote Site

After making the data connection, enter the escape sequence to return to command mode. Entering `&T6` places the remote modem in digital loopback provided the remote operator has entered the `&T4` command to allow an RL request. Enter a test message and verify the message is being looped back to your terminal screen. If the message is incorrect, use the analog loopback tests on both modems to isolate the problem. If both modems run analog loopback without errors, the problem could be with the phone line.

Remote Digital Loopback with Self Test — &T7

After making the data connection, enter the escape sequence to return to command mode. Entering `&T7` places the remote modem in digital loopback provided the remote operator enters `&T4` to allow an RL request. Once in RDL/TP, the local modem transmits a test pattern and automatically verifies that the remote modem is looping the pattern back (Figure 7-5). Enter `&T` to exit RDL/TP and return to command mode. Enter the `O` command to return online in data mode.

Exiting RDL/TP the modem responds with a three digit value between 0 and 255 representing the number of errors which occurred during test pattern detection. If errors occur, repeat the test several times to verify the consistency of the problem, then use the analog loopback tests to isolate the problem.
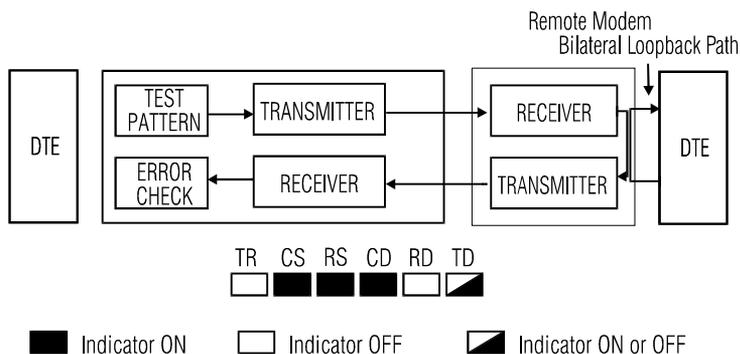
Figure 7-5. Local Modem Initiating Remote Digital Loopback with Test Pattern

Test Pattern — %T

In Test Pattern, transmitted 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.

Bilateral Digital Test Enable / Disable — *DG

Enable or disable bilateral test functions.

Command	Operation
*DG	**Bilateral digital loop disabled**
*DG1	Bilateral digital loop enabled

DTE Controlled Remote Digital Loopback (Pin 21) — *RD

To enable DTE Controlled Remote Digital Loopback, enter `*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. The test
ends when it detects an on-to-off transition of pin 21 and then returns to
online data mode. To disable this function enter the `*RD` command.

Command	Operation
`*RD`	**Ignore pin 21**
`*RD1`	RDL enabled (pin 21)

Note

If the test timeout option is enabled and pin 21 remains high,
the modem returns to online mode at the end of the test
timeout period and does not re-enter the test mode until an
off-to-on transition of pin 21 is detected.

DTE Controlled Local Analog Loopback (Pin 18) *LA

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

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

Note

If the test timeout option is enabled and pin 18 remains high,
the modem returns to idle mode at the end of the test timeout
period and does not re-enter the test mode until an off-to-on
transition of pin 18 has been detected.

Chapter 8
Security

The V.3600 series of modems provides three features to assure secure operation of the modem. These features are front panel password protection, autocallback, and secure mode of operation. Front panel password protection is discussed in Chapter 4.

Two levels of major security operation are available: high and low. The AT commands for each level are explained below.

IMPORTANT: Security requires that you have available your "superuser" password, explained in the "Superuser" section on page 8-6 and in the "Setting Passwords — $Pn=pw$pw" section on page 8-8. Systems administrator functions cannot be accessed without this password. If you forget the superuser password, contact Technical Support. Refer to "Calling Technical Support" section on page 12-2.

Autocallback Security

Autocallback is an additional security feature that is separate from Low and High Security. Autocallback forces an answering modem to dial the selected autodial (*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 a direct call. Access autocallback via Main Menu #5 on the LCD. Refer to Chapter 4 for further information. S72 enables/disables autocallback. S78 determines the delay in seconds before autocallback is initiated.

Low Security Operation

Low security operation provides password protection against unauthorized dial-up access. High security is another feature which is discussed later in the "High Security" section on page 8-4. 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 Low Security

The modem is not factory set for security and operates like a standard V.34, except for additional AT commands 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 Low 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 YOUR PASSWORD ?

To respond to the password prompt, enter

 `AT$`

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 to 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, 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 of 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 Menu #1 consists of the following display:

> SECURE 33600
> XXXX

Restrictions in Security Operation

If the caller gives the wrong password, while security is enabled, the modem will disconnect.

Low Security Commands

The following AT commands operate low security:

Set Password — $S=x
The $S=x command sets an empty password location to x. This command only applies when no password or only one is stored in memory. It cannot be used to change a password.

Changing a Password — $C=x, y
The $C=x,y command changes either password where x represents the old password and y is new one.

Deleting a Password — $C=x, -
The $C=x,- command 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
The $D=x command disables security where x is either password.

Security Status — $D?, $E?
The $D? or $E? command displays the current status of security (on or off).

Enabling Security — $E=*x*
The $E=x command enables security where x is either password.

High Security

Compatibility
An originating modem does not require security capabilities to connect with a secured V.3600. Access to the V.3600 host is gained by following the appropriate logon procedure as described in following text. All security operations are controlled by the secured V.3600.

Capacity

The modem stores in nonvolatile memory the password, security level, callback phone number, and status information for 50 users.

Operating without High Security

The modem is factory set with security disabled. In this mode the local DTE is connected to the local modem as usual, but the command to enable or view the status of the security feature will be accepted and processed.

Operating with High Security

With high security enabled, each user must follow the appropriate logon procedure. The procedure for remote users is determined by their assigned security level. Upon termination of the connection, the secured modem waits for the next call and password sequence. A local user must logon to the secured V.3600 to use the unit.

If a power outage occurs, the logged -on user must logon again when the power is restored. For optimum security operation a reliable connection should be used.

Security Levels

The V.3600 provides three levels of security to prevent unauthorized access by a remote user.

Level 1: Password Only

This is the lowest level of dial-up security. The user dialing in is prompted for an ID and password; if invalid, the modem hangs up.

Level 2: Password with Callback

This security level also accepts only calls from preset telephone numbers. After the user enters a correct ID and password, the modem looks up the telephone number and calls the user back at that number.

Level 3: Password with Callback and Password Re-Entry

This is the highest level of security and is similar to Password with Callback except that after the user answers the callback call, the modem prompts again for the password.

Superuser

The superuser has access to all user information for administrative purposes and can change user logon requirements and privileges.

Superuser status can be gained at the local modem or from a remote Motorola or UDS modem via remote configuration, if the "Remote Superuser" option is enabled.

The superuser must first logon as a regular user, then request the superuser privilege.

Incorrect attempts to gain superuser privilege are logged in the user's status information field in nonvolatile memory. After seven invalid attempts, the user is suspended from access to the V.3600 until cleared by the superuser.

To reinstate a suspended user, logon as a different regular user, then request superuser privilege in order to clear the illegal attempts count.

If the local superuser disables security, the only security commands available are those used to enable security or to check security status.

Passwords

Passwords can be changed or deleted by the superuser. The regular user can change his password only if the "user changes" option has been enabled by the superuser. Refer to the "Extended Features — $W" section on page 8-9 for more details.

When calling from a remote location, the user is prompted for a password. After the password is entered, the user is either allowed direct access or disconnected and called back depending on the assigned security level.

During password entry or logon, each password character is displayed as an X on the DTE screen. The backspace key can be used for editing. For remote logon, press the Esc key at any time before pressing Enter to clear the password entry.

Incorrect password attempts exceeding the threshold set in S77 for a specific user will cause the modem to disconnect. Each call exceeding the threshold increments the ILLEGAL ATTEMPTS counter by one.

After seven calls (the default in remote configuration), the ILLEGAL ATTEMPTS counter will have reached maximum and the user will be suspended.

Default Passwords

The modem is shipped from the factory with a default password for the superuser and for one regular user. They are

- SUPERUSER — (System administrator)
- USER 1 — (User number 1)

Passwords for users 2 through 50 are left blank.

It is recommended that the superuser change the default SUPERUSER and USER 1 passwords as soon as possible.

High Security Commands

These commands are only available to a local superuser.

Enabling High Security — $EH=pw

The `$EH=pw` command enables high security, where `pw` is the superuser's password.

To initialize high security for the first time enter

> **`AT$EH=SUPERUSER`**

To enable security, enter

> **`AT$1=USER1`**

followed by

> **`AT$S=SUPERUSER`**

to gain superuser status. Passwords, security levels, and callback numbers can now be entered or modified.

When superuser activities are completed, return to regular user status by entering `AT$$`. In regular user status, `AT$$` is the final local logoff command.

Disabling High Security — $D

Enter the $D command to disable security. The modem will operate as a nonsecure unit except that it will respond to enable and check security status commands.

Setting Passwords — $Pn=pw$pw

Select a password between 4 and 34 printable ASCII characters.

To store the password enter

      AT$Pn=pw$pw

where n is the user number (0-50) and pw is the new password which is entered twice to ensure that is has been entered correctly.

The $ character is used as the marker between the dual password entries and cannot be used as part of the password.

Passwords cannot be recalled from nonvolatile memory.

📖 **Note**

      The superuser password is critical because the security feature cannot be configured without it.

After logon as USER 1 and gaining superuser privileges, enter the $Pn command to modify passwords.

For the superuser enter

      AT$P0=pw$pw

For user 1 enter:

      AT$P1=pw$pw

Record the passwords in your personal records.

IMPORTANT: Systems administrator functions cannot be accessed without it. If you forget the superuser password, contact Technical Support. Refer to the "Calling Technical Support" section on page 12-2.

Set Security Levels — $Ln=m

The System Administrator (superuser) assigns each user with a security level by entering the $Ln=m command where n is the user number and m is the security level.

Set User Callback Number — $Cn=m

The callback number, used with level 2 or 3 security, is dialed by the modem after a user has successfully called in from a remote location and entered his password.

Level 1 security does not require a callback number; however, if the security level is changed to level 2 or 3 a callback number will be required.

The callback number should be programmed initially using the `$Cn=m` command. Where n is the user number and m is the callback number.

Extended Features — $W

$W1
A regular user can change his password and callback number if the local superuser has enabled the `$W1` option.

$W2
A remote regular user can gain superuser privilege once the local superuser has enabled the `$W2` command.

$W0
The extended feature options can be cleared by a local superuser by entering the `$W0` command.

Display Extended Feature Status — $W?

Enter the `$W?` command to display the status of the user changes and remote superuser options.

Display/Reset Illegal Access Attempt Counters — $M, $Mn, $M*

These commands inform the superuser of any illegal attempts to gain superuser status and the users current status. The status will either be "normal," indicating the user is still able to logon to the secure V.3600, or "suspended," indicating that the user made more than seven illegal attempts to gain superuser status and has been automatically suspended.

When the superuser logs on, the secure V.3600 automatically displays any illegal attempts since the last superuser logon. If it is not reset, the illegal attempt count will remain and the superuser will not be reminded unless more illegal attempts occur. To manually request this same information enter

> **AT$M**

The V.3600 responds by scrolling any illegal attempt information onto the screen as in the following example:

> USER NUMBER: 01, ILLEGAL ATTEMPTS: 1,
> STATUS: NORMAL
>
> USER NUMBER: 14, ILLEGAL ATTEMPTS: 7,
> STATUS: SUSPENDED
>
> OK

Enter the $Mn command (where n equals user number) to reset a specific user's illegal attempt count.

Enter the $M* command to reset all of the user's illegal attempt counts.

Factory Reset — $F=pw$pw

To reinitialize the security feature enter the $F=pw$pw command (where pw is the "current" superuser password). This command deletes all user information and reinstates factory default passwords. User information cannot be recalled.

Removing a User — $Rn

This superuser command removes a user from active status without deleting all of the user's information. The user can be restored to active status by setting the password with the corresponding user number as previously mentioned. To remove a user, enter

> **AT$Rn**

where n is the user numbers 2-50.

The superuser or user with ID #1 cannot be deleted from the user list.

Security Status — $E?

System security status can be verified using the $E? command.

Display User Status — $S?

Enter the $S? command to indicate whether or not the current user has superuser status.

The V.3600 responds with one of the following responses:

        SUPERUSER STATUS
        NORMAL STATUS

Verify User Information — $In, $IBn

Security level and callback number can be displayed using either the $In or $IBn command. To display the assigned security level and callback number for a single user enter

        AT$In

where n is the user number. A regular user can only check his own information. A user with superuser privileges can check any user's information.

A user with superuser privileges can also display the assigned security level and callback number for each valid user within a block of ten consecutive user numbers by entering:

        AT$IBn

where n is the first user number.

Request Superuser Privilege — $S=pw

Once logged on as a user, superuser privilege can be requested by entering the $S=pw command, where pw is the superuser password.

When the correct password has been entered, the V.3600 responds with

        SUPERUSER STATUS
        OK

Local Logon Command — $n=pw

Enter the $n=pw command to logon locally to the secure V.3600 where n is the user number and pw is the password.

Local Logoff Command — $$

To logoff after a local session enter

        AT$$

Remote Logon Procedure — $n=pw

The remote logon procedure is required to access a secure V.3600. When calling into the secure V.3600 from a remote location the user is prompted to enter a password. The password must be entered as

$n=pw

where n is the user number and pw is the user's password.

If the password entry is incorrect, the password entry field will be cleared and the remote user will be allowed further entries until the number of invalid attempts matches the lockout threshold stored in S77. At this point the secure V.3600 drops the call.

If the password entry is correct the secure modem sends the PASSWORD ACCEPTED message to the remote site. Depending on the assigned security level, the user is given

• Immediate access to the DTE connected to the secure modem,
• A callback sequence, or
• A callback with password reentry.

When the call is terminated from either end the secure V.3600 automatically resets itself to the secure mode for the next remote or local user.

While a remote caller is initiating a call to the secure V.3600, all status messages and control leads which would notify the local DTE of the incoming call are suppressed. The secure V.3600 uses the value stored in S0 to determine the number of rings on which to autoanswer. If S0 is set to 0 incoming calls will not be answered.

If a local user is logged on during an incoming call, a RING message is displayed but the call will not be answered until the local user logs off, issues an A command, or presses the TALK/DATA button.

If the local user logs off, the call will be answered and the remote user must follow the normal password procedure. If the local user enters A or presses TALK/DATA the call to the remote user connects normally.

Chapter 9
Fax Operation

The V.3600 can send and receive fax documents at speeds up to 14,400 bps, with the appropriate software. As a fax modem, the modem conforms to EIA-578, which defines a standard interface between a PC with fax software and the DCE as a fax modem.

When used with a Class 1 fax software package, V.3600 is CCITT Group 3 compatible and can send and receive documents at 2400, 4800, 7200, 9600, 12,000, or 14,400 bps with any Group 3 fax machine or PC with a fax modem.

Service Class selection configures the modem for Class 0 data mode or Class 1 fax mode. The LCD display indicates when fax mode is enabled. The V.3600 default configuration is for data mode; Service Class is normally only changed by the software as necessary.

Previous chapters in this manual contain information about the modem that should be understood prior to fax operation.

Read the fax software manual before attempting fax communications.

Fax Operation

The user's manual for the Class 1 fax software package should provide most information necessary to configure the software and send and receive faxes.

The information in Chapter 2 of this manual should be considered as well, and the "Modem Initialization" section on page 9-2 provides important information for proper fax communications.

Modem Initialization

For fax operation, most fax software packages are equipped with a fax initialization command string. Entering this command sets the active profile for fax operation. In some cases certain options should be modified for particular requirements. The fax software manual provides information about requirements.

Fax Defaults

Factory defaults, along with the initialization command, support fax operation. Some initialization commands include the default command &F and will reissue it for each fax operation. Some fax software packages do not include the default command, or only issue the default command when the fax software is first loaded. Subsequent fax operations may not reset the fax profile and, if a fax required option has been changed, fax operation will not work.

An example of a fax initialization command is

>   **AT&F V E S0=0**

This can be interpreted as:

AT&F	Reset the active profile to the factory default.
V	Set response messages to digit code.
E	Disable local echo (off).
S0=0	Disable autoanswer (off).

Fax Autoanswer

Some fax software takes control of autoanswer, disables autoanswer for the modem, and answers the phone as internally programmed. Other programs do not control autoanswer at all and require the modem to have autoanswer enabled. You must check the software manual for the particular requirements and refer to Chapter 4 for manual/autoanswer and TALK/DATA selection. Select the necessary options for fax operation.

Fax Associated Options

A number of options can be changed without any effect on fax operation. These include items like speaker volume and pause for carrier. Appendix E lists the AT commands. These commands can be incorporated by personal preference into the initialization command. Compare fax operation requirements with Appendix A and if necessary generate an initialization command string compatible with the software and the modem.

Stored Fax Profile

Another alternative is to develop a fax initialization command and store it in one of the user defined profiles. Fax initialization would include the command that recalls that profile for fax operation. Keep track of option changes between fax transmissions and if required reset the fax profile for the next fax transmission.

Class 1 Details

Operation as a fax modem complies with EIA-578; details of Class 1 operation and compatibility are found in that standard. There is no need to be familiar with these details since they are handled by the Class 1 software package, but this section briefly summarizes some of them.

As a Service Class 1 facsimile DCE, the V.3600 provides the basic services required to support Group 3 facsimile operation. Support from a Class 1 facsimile DTE is required to implement the CCITT T.30 recommendations for fax document transmission and the CCITT T.4 recommendations for encoding fax images. Using software control, the modem can:

- Connect calls
- Generate messages
- Detect waiting and silence
- Transmit and receive data
- Provide HDLC data framing, transparency, and error detection

The modem also filters data streams to and from the DTE in accordance with the Class 1 specification.

The Class 1 standard assumes a serial asynchronous DTE-DCE connection using EIA-232D (or CCITT V.24) circuits. EIA-232D circuits AB (signal ground), BA (transmitted data), and BB (received data) are required for fax operation, while additional circuits are optional. Refer to Chapter 2 for hardware installation and EIA-232D data interface information.

The modem uses inband unidirectional DC1/DC3 (XON/XOFF) flow control to match the DTE-DCE data rate to the line signaling rate (hardware RTS/CTS is optional). Since 1200 bps is the minimum rate needed to support T.30 Phase C data transfer using V.29 9600 bps, a serial port data rate of at least 19,200 bps should be used with the modem. Since flow control is used, this rate should not be changed during fax operation. The modem detects the DTE-DCE data rate from the AT command prefix as described in Chapter 5.

Class 1 Commands

The commands in this section are normally issued by the fax software and not by the user. They are provided here for reference. While only the lower order 7 bits of each character are used for commands and parameters, T.30 Phase C data transmission or reception requires all 8 data bits. Therefore, a data format which uses 8 data bits should be used for fax mode.

Dial Command — D
The dial command D, described in Chapter 5, tells the modem to go off hook, dial, and begin call origination. For fax operation, set the modem for Service Class 1 operation before the dial command is issued; use the +FCLASS=1 command.

The dial modifiers, except R, can also be used in fax mode. Depending on the X option selected, the modem will return the BUSY and NO DIALTONE result codes as appropriate. If the modem is in the on-line command state when a dial command is issued (e.g., a connection has already been established), the modem returns an ERROR result code. The NO CARRIER result code indicates that a connection could not be established (no carrier detected) within the number of seconds specified in status register S7, or the dial command has been aborted due to a character sent from the DTE.

AT Responses to the ATD Command

The function of this command is country-specific. The AT responses to the ATD command are as follows:

NUMBER LIST FULL

Call failure; the delayed number list cannot store any more numbers.

DELAYED NUMBER WAIT xx MINUTES

Call failure; the number is on the delayed list and the call is delayed xx minutes.

After dialing the specified number in fax mode, the modem generates 1100 Hz CNG tones in accordance with T.30 while trying to detect either CED (answer back tone) or the HDLC preamble of the first T.30 frame. The CNG tones cease after detecting either of these two signals. To allow proper interaction with manually answered fax stations, detection of CED is not required. After detecting 1650 Hz (i.e., the HDLC preamble of the first frame), the modem enters V.21 Channel 2 receive state with HDLC framing and returns a CONNECT result code. This is because dialing in fax mode (+FCLASS=1) implies an initial +FRH=3 command described in the "Fax Transmit and Receive Modes" section on page 9-7.

Answer Command — A

The A command instructs the modem to answer the call. For fax operation, set the modem for Service Class 1 operation before the A command is issued; use the +FCLASS=1 command.

If the modem is in the on-line command state when an answer command is issued (e.g., a connection is already established), the modem returns an ERROR result code. Otherwise, it answers the call and generates a 2100 Hz CED (answer back) tone in accordance with T.30. The modem then enters V.21 Channel 2 transmit state with HDLC framing and returns a CONNECT result code. This is because answering a call in fax mode (+FCLASS=1) implies an initial +FTH=3 command described in the "Fax Transmit and Receive Modes" section on page 9-7. To allow proper interaction with a manually originated fax call (in accordance with T.30), the modem does not require detection of CNG before generating CED or entering HDLC transmit mode.

If the DTE sends a character while executing the answer command and before CED is completed, the call is released and the modem will send the NO CARRIER result code.

On Hook — H
In fax mode, the H command instructs the modem to stop any transmission and terminate the call by going on hook.

Off Hook — H1
The H1 command instructs the modem to go off hook. In fax mode, this might be used when the user has used manual dialing to place a fax call. In this case, no CNG tones are generated and the initial +FRH=3 is not implied; it must be explicitly issued by the software.

Class 0 Operation — +FCLASS=0
Setting the Service Class to 0 with the +FCLASS=0 command sets the modem in data mode. This default setting is normally only changed by software if needed.

Class 1 Operation — +FCLASS=1
Setting the Service Class to 1 with the +FCLASS=1 command configures the modem as a Class 1 fax modem. This command is normally only issued by the fax software if needed. When set, the LCD displays FAX CLASS 1 MODE.

Service Class Indication — +FCLASS?
The current Service Class setting can be determined with the +FCLASS? command. A 0 response indicates the modem is configured for data mode while a 1 indicates it is set for fax mode. This information text is preceded and followed by <CR><LF> in addition to being followed by an appropriate result code response.

Service Class Capabilities — +FCLASS=?
The available Service Classes can be revealed by the +FCLASS=? command. The modem responds with the information text 0, 1 (preceded and followed by <CR><LF>), indicating that the modem supports both data communication and Class 1 fax operation.

Transmit Silence — +FTS=(Time)

The command +FTS=(Time) causes the modem to wait in silence for the specified amount of time and then send the OK result code to the DTE. The (Time) value is in 10 ms increments from 0 to 2.55 seconds. The modem aborts the command and sends an OK result code if the DTE sends an additional character, which is discarded, during the command execution. This command returns an ERROR result code if issued while the modem is on hook.

Receive Silence — +FRS=(Time)

The command +FRS= causes the modem to listen for silence and report back an OK result code when the line has been silent for the specified amount of time. The (Time) value is in 10 ms increments from 0 to 2.55 seconds.

The modem aborts the command and sends an OK result code if the DTE sends an additional character, which is discarded, during the command execution. This command returns an ERROR result code if issued while the modem is on hook.

Fax Transmit and Receive Modes

The following commands instruct the modem to transmit or receive facsimile data with the designated modulation. Flow control, data buffering, and data filtering are used as appropriate, in accordance with the Class 1 specification. Each of these commands must be the last command on the command line.

Command	Operation
+FTM=(MOD)	Transmit data with (MOD) carrier
+FRM=(MOD)	Receive data with (MOD) carrier
+FTH=(MOD)	Transmit HDLC data with (MOD) carrier
+FRH=(MOD)	Receive HDLC data with (MOD) carrier

The modem accepts one of the values listed in Table 9-1.

Table 9-1. Values for Fax Modulation

Value	Modulation	Speed
3	V.21 channel 2	300 bps
*with short train		

Table 9-1. Values for Fax Modulation (Continued)

Value	Modulation	Speed
24	V.27 ter	2400 bps
48	V.27 ter	4800 bps
72	V.29	7200 bps
73	V.17	7200 bps
74	V.17	7200 bps *
96	V.29	9600 bps
97	V.17	9600 bps
98	V.17	9600 bps *
121	V.17	12000 bps
122	V.17	12000 bps *
145	V.17	14400 bps
146	V.17	14400 bps*
*with short train		

The V.3600 returns an ERROR result code if any of the above commands are issued while the modem is on hook.

Facsimile Transmit — +FTM=(Mod)

+FTM=(Mod) causes the modem to transmit data using the modulation and speed selected with the (Mod) parameter. For V.27 ter, V.29, and V.17 modulations, the modem first transmits the required training sequence (with echo protector tone). After it is appropriately configured for transmission, the modem returns the CONNECT result code and transmits constant 1 bits until data is received from the DTE. For additional information, consult the Class 1 specification.

Facsimile Receive — +FRM=(Mod)

+FRM=(Mod) causes the modem to receive data using the modulation and speed selected with the (Mod) parameter. If the selected carrier is detected, a CONNECT result code is sent to the DTE; if a different signal is detected, the modem sends a +FCERROR (CONNECT ERROR) result code and returns to command mode. This command is aborted if the DTE sends any character to the modem other than DC1 or DC3 during this mode. For additional information, consult the Class 1 specification.

HDLC Transmit — +FTH=(Mod)

+FTH=(Mod) causes the modem to transmit HDLC framed data using the modulation and speed selected with the (Mod) parameter. For V.27 ter, V.29, and V.17 modulations, the modem will first transmit the required training sequence (with echo protector tone). Configured for HDLC transmission, the modem transmits HDLC flags and returns the CONNECT result code. HDLC flags will continue to be sent until the first byte of data is received from the DTE or until 5 seconds elapses with no data. For more information, refer to the Class 1 specification.

HDLC Receive — +FRH=(Mod)

The command +FRH=(Mod) causes the modem to receive HDLC framed data using the modulation and speed selected with the (Mod) parameter. If the selected carrier is detected, a CONNECT result code is sent to the DTE; if a different signal is detected, the modem sends a +FCERROR (CONNECT ERROR) result code and returns to command mode. This command will be aborted if the DTE sends any character to the modem other than DC1 or DC3 during this mode. For additional information, consult the Class 1 specification.

Test Supported Range of Values — +FTx=?, +FRx=?

The supported range of values for any of the fax transmit or receive commands can be determined with the +FTx=? or +FRx=? command where x is M, H, or S. The normal transmit and receive capabilities are interrogated with +FTM=? and +FRM=?, while the HDLC transmit and receive capabilities are interrogated with +FTH=? and +FRH=?. Since the modem can send and receive normal data or HDLC data at all valid speeds up to 14,400 bps, the modem returns the information text 3, 24, 48, 72, 73, 74, 96, 97, 98, 121, 122, 145, 146 for any of these four commands if x is M or H. For the commands +FTS=? or +FRS=? the modem returns the information text 0-255, indicating an allowed time interval from 0 to 2.55 seconds. The appropriate information text is always preceded and followed by <CR><LF> and followed by an appropriate result code response.

Class 1 Result Code — +FCERROR

If the modem detects any carrier or tone that differs from that specified in a +FRM or +FRH command, it sends the **+FCERROR** result code and returns to command state, allowing the DTE to attempt a recovery. The numeric form of this response is **+F4**.

Fax Autoanswer — +FAA=

The modem can be set up to automatically detect if a fax or data call is being answered. The command +FAA=1 enables this function and +FAA=0 disables it. This feature requires special support by the fax software package.

Command	Description
+FAA=0	Disable fax autoanswer
+FAA=1	Enable fax autoanswer

DTE Autobaud for Fax Autoanswer — *FR

Set the fax autoanswer feature to autobaud at 19.2 kbps or greater, if desired.

Command	Description
*FR	Forced to > = 19,200 bps
*FR1	Forced to = 19,200 bps
*FR?	Display this option's current status

Binary File Transfer

Some Class 1 software packages may provide an option for transferring files between computers with fax modems, using a Binary File Transfer (BFT) standard. Although the received file is not a fax image, transmitting the file is similar to sending a fax. Since the modem allows T.30 error correction mode (with HDLC framing up to 9600 bps), fax mode can also be used for BFT if supported by the Class 1 software package. The Binary File Transfer is an option in the fax software package, not a separate mode of operation.

Chapter 10
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.

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

Generally, the user should not directly alter S-register values. However, the user has the option of entering S-registers via ATS commands and directly altering the register value. This is called "writing" to an S-register.

📖 Note

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 a similar activity.

Some S-registers cannot be altered by the ATS command series. These are called "read only" S-registers. In addition to the definitions in this chapter, Appendix E contains a quick list of S-registers and indicates if they are read only or read and write.

Figure 10-1 shows how the inputs to an S-register (`S22` in this example) 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 10-2 shows the difference between decimal calculation and hexadecimal calculation.
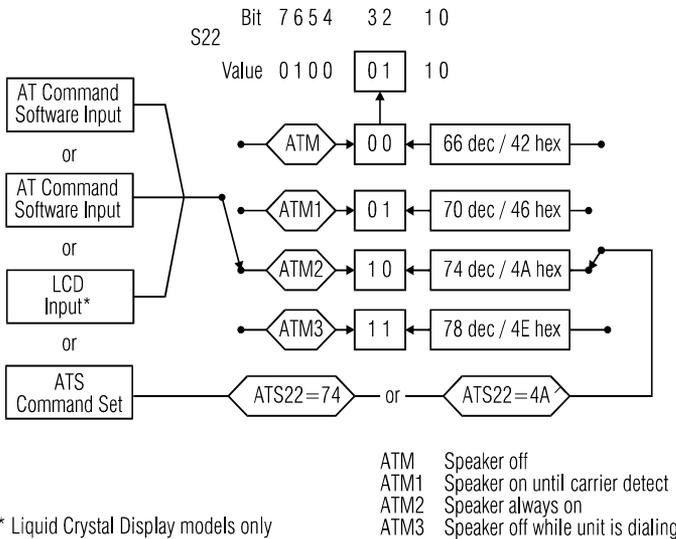
Figure 10-1. Changing S-Register Values

Bit	7	6	5	4		3	2	1	0	
Decimal Value	128	64	32	16		8	4	2	1	
S22 Value	0	1	0	0		0	1	1	0	
Decimal Total		64			+		4 + 2			=70 dec
Hexidecimal Value	8	4	2	1		8	4	2	1	
S22 Value	0	1	0	0		0	1	1	0	
Hexidecimal Total		4		and			4 + 2			=46 hex

Figure 10-2. Calculating S-Register Values

S-Register Operation — Sn?, Sn?^

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.

📖 **Note**

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 — Sn . # =v" section on page 10-4.

To change a register value, enter

> **ATSn=v**

where n = register number and v = decimal value, or enter

> **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

Some 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, and v = bit value 1 or 0.

For 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

This register turns the autoanswer 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

This register contains the ring count for a current incoming call and should not be changed. If you are developing communications software, the program can read the register to determine the ring total.

Escape Character — S2

The standard escape character is a + sign (ASCII value of 43). To change the character, set S2 to the desired ASCII value (0-127). To disable the escape command, set S2 to any value greater than 127 (128-255).

End-of-Line Character — S3

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

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

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

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

If ringback is not 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 carrier is not 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

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

S9 contains the amount of time (0-255) in 0.1 second increments that 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

S10 contains the amount of time (0-255) in 0.1 second increments that the 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

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, 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 15 and 255 may be used for S12.

S13

Not used

Bit Mapped — S14

📖 **Note**

In the tables for bit mapped S-registers, **bold text** indicates bit value defaults.

📖 **Note**

When bit-mapped S-registers have parallel AT commands, the commands are listed in the register tables as a cross reference. If a command does not exist for the option, the column is left blank.

Bit	Value	Command	Description
0	--	--	Reserved
1	0	E	Local character echo off
	1	**E1**	**Local character echo on**
2	**0**	**Q**	**Response messages on**
	1	Q1	Response messages off
3	0	V	Response messages as digit codes
	1	**V1**	**Response messages as words**
4	**0**		**Ignore**
	1	Q2	Response messages in originate mode only
5	**0**	**T**	**Tone dial**
	1	P	Pulse dial
6	**0**	**H2**	**Allow cleardown**
	1	H3	Disallow cleardown
7	0	*OR1	Forced answer
	1	***OR**	**Normal originate**

S15

Reserved

System Tests — S16

This register contains the status of system test options.

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	--	Remote digital loopback requested by other modem inactive Remote digital loopback requested by other modem 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

Test timeout is the amount of time, in 1 second increments, that a diagnostic test will run and 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

Bit	Value	Command	Description
6,	**00**	**&S**	**DSR forced on**
0	10	&S1	DSR on when online
	01	&S2	DSR off 5 seconds after disconnect
	11	&S3	DSR follows off hook (OH)
5,	00	&C	DCD always on
1	**10**	**&C1**	**DCD on while carrier present**
	01	&C2	DCD on except for 5 seconds after disconnect
	11	&C3	DCD follows RTS on remote modem; not valid in reliable mode
2	0	&R	CTS follows RTS by S26 delay
	1	**&R1**	**CTS always on**
4,	00	&D	Modem ignores DTR
3	01	&D1	Modem assumes command mode when DTR turns off
	10	**&D2**	**Modem hangs up when DTR turns off**
	11	&D3	Modem resets when DTR turns off
7	0	Y	Long space disconnect disabled
	1	**Y1**	**Long space disconnect enabled**

Bit Mapped — S22

Bit	Value	Command	Description
1,	00	L	Speaker volume low
0	01	L1	Speaker volume low
	10	**L2**	**Speaker volume low**
	11	L3	Speaker volume high
3,	00	M	Speaker off
2	**01**	**M1**	**Speaker on until carrier detect**
	10	M2	Speaker always on
	11	M3	Speaker off when modem is dialing
6–4	000	X	CONNECT message only, blind dials, no busy detect
	001	X1	CONNECT / appropriate code for rate, blind dials, no busy detect
	010	X2	CONNECT / appropriate code for rate, waits for dial tone, no busy detect
	011	X3	CONNECT / appropriate code for rate, blind dials, reports BUSY
	100	**X4**	**CONNECT / appropriate code for rate, waits for dial tone, reports BUSY**

Bit	Value	Command	Description
7	**0**	**&P**	**Make / break ratio (US) 39/61**
	1	&P1	Make / break ratio (UK) 33/67

Bit Mapped — S23

Bit	Value	Command	Description
0	0	&T5	Remote digital loop request denied
	1	**&T4**	**Remote digital loop request granted**
5-1	---	---	Reserved
7,	**00**	**&G**	**No guard tones**
6	01	&G1	550 Hz guard tone
	10	&G2	1800 Hz guard tone
	11	--	Not used

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

Bit	Value	Command	Description
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 11	**&X** &X1 &X2 --	**Internal clock** External clock Receive clock Not used
6	1 **0**	--	Enable async DTR dialer **Disable async DTR dialer**
7	--	--	Reserved

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. A zero will disable automatic lookback to leased line. The default value is 15 minutes.

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

Bit Mapped — S29

Bit	Value	Command	Description
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

Bit	Value	Command	Description
6, 3	--	--	Reserved
7	**0** 1	***FB** *FB1	**DTE fallback disabled** DTE fallback enabled

Bit Mapped — S30

Bit	Value	Command	Description
0	--	--	Reserved
1	**0** 1	--	**V.25 ASCII** V.25 EBCDIC
2	**0** 1	--	**V.25 VAL enabled** V.25 VAL disabled
4, 3	--	--	Reserved
5	**0** 1	--	**NRZ V.25** NRZI V.25
7, 6	**00** 01 10 11	**&M** &M4 &M5 &M6	**V.25 disabled** V.25 bisync enabled V.25 SDLC enabled V.25 Async enabled

S31
Reserved

Bit Mapped — S32

Bit	Value	Command	Description
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

S33
Reserved

Bit Mapped — S34

Bit	Value	Command	Description
0	--	--	Reserved
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

DTR / Dial Backup Number to Dial — S35
Select the number to automatically dial (1-9 of stored numbers) for the modem to dial in DTR dialing or autodial backup.

S36-S40
Reserved

Remote Configuration Escape Character — S41
Select the remote configuration escape character (1-255). The default is ASCII 61 (=).

Remote Configuration Guard Time — S42

Select the remote configuration guard time (0-255) in 20 ms intervals. The default is 50 (1 sec).

S43

Reserved

XON Character from DTE — S44

Select the XON character (0-127) to be sent from the DTE. The default value is ASCII 17.

XOFF Character from DTE — S45

Select the XOFF character (0-127) to be sent from the DTE. The default value is ASCII 19.

S46-48

Reserved

XON Character to DTE — S49

Select the XON character (0-127) to be sent to the DTE. The default value is ASCII 17.

XOFF Character to DTE — S50

Select the XOFF character (0-127) to be sent to the DTE. The default value is ASCII 19.

Dial Line Transmit Level — S51

The S51 register selects dial line transmit level from -9 to -30 dBm in 1 dBm increments. The default value is 10.

Bit	Value	Command	Description
4-0	0 to 30	*TDn (n=9 to 30)	Transmit level in dBm (-9 through -30 dBm)
7-5	--	--	Reserved

Leased Line Transmit Level — S52

The S52 register selects leased line transmit level from 0 to -30 dBm in 1 dBm increments. The default value is 0.

Bit	Value	Command	Description
4–0	0 to 30	*TLn (n=0-30)	Transmit level in dBm (0 through -30 dBm)
7–5	--	--	Reserved

Automatic Rate Adaption Threshold — S53

Bit	Value	Command	Description
0	**0**	--	**Disable rate renegotiation above initial connect**
	1		Enable rate renegotiation above initial connect
1	--	--	Reserved
3, 2	**00**	**%R**	**Automatic rate adaption threshold disabled** Low BER
	01	%R1	Medium BER
	10	%R2	High BER
	11	%R3	
4	--	--	Reserved
5	**0**		**Protocol negotiation status disabled**
	1		Protocol negotiation status enabled
6	--	--	Reserved
7	0	***DR**	**Disable distinctive ring detection**
	1	*DR=1	Enable distinctive ring detection

Flow Control — S54

The S54 register selects the flow control options.

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

6,	00	\Q4	Disable flow control from DCE
5	01	\Q5	Enable XON/XOFF flow control
	10	\Q6	Enable CTS flow control to the DTE
	11	\Q7	Enable CTS flow control to the DTE
7	--	--	Reserved

S55
Reserved

V.42 Compression Control — S56

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

Bit Mapped — S57

Bit	Value	Command	Description
0	**0**	***RC**	**Standard number codes**
			— 15 - 4800 bps
			— 18 - 9600 bps
	1	*RC1	Alternate number codes
			— 11 - 4800 bps
			— 12 - 9600 bps
4-1	--	--	Reserved
5	**0**		**Busy out disabled**
	1		Busy out enabled during LAL test mode (for private PBX use only)
7, 6	--	--	Reserved

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. Issue the \Tn command to load inactivity timer, n=0-255 minutes.

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

Break Control — S59

The S59 register determines the action taken when a break is encountered. Refer to the "Break Control — \Kn" section on page 6-9 for further information.

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

Bit Mapped — S60

Bit	Value	Command	Description
0	0	%E	Disable auto retrain
	1	**%E1**	**Enable auto retrain**
1	0		MNP compression disabled
	1		**MNP compression enabled**
2	**0**	**\C**	**Disable auto-reliable data buffer**
	1	\C1	Buffer data for 4 seconds or 200 characters
5–3	--	--	Reserved

6	0	\R	RI blinks for ring and remains on for duration of call
	1	**\R1**	**RI blinks for ring and turns off when call is answered**
7	**0**	**\V**	**Disable protocol response messages**
	1	\V1	Enable protocol response messages

DTE Options — S61

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

Bit	Value	Command	Description
2–0	--	--	Reserved
3	0	--	7 bit word length
	1		8 bit word length
5, 4	00	--	Mark parity
	01		No parity
	10		Odd parity
	11		Even parity
7, 6	--	--	Reserved

Disconnect Buffer Delay — S62

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

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

Maximum Transmit Block Size — S63

The S63 register sets the maximum transmit block size.

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

Auto-Reliable Fallback Character — S64

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

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

S65-66

Reserved

Link Speed Status — S67

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

Bit	Value	Command	Description
4-0	00000	--	N/A
	00001		300 bps
	00010		Reserved
	00011		1200 bps
	00100		2400 bps
	00101		4800 bps
	00110		7200 bps
	00111		9600 bps uncoded
	01000		9600 bps trellis
	01001		12000 bps
	01010		14400 bps
	01011		16800 bps
	01100		19200 bps
	01101		21600 bps
	01110		24000 bps
	01111		26400 bps
	10000		28800 bps
	10001		31200 bps
	10010		33600 bps
7-5	--	--	Reserved

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 14,400 bps is determined by S80. When S69 is
non-zero, the maximum originate connect rate is determined by S69.

Bit	Value	Command	Description
4-0	00000	%B	Use rate indicated by S80
	00001	%B1	300 bps
	00011	%B2	1200 bps
	00100	%B3	2400 bps
	00101	%B4	4800 bps
	00111	%B5	9600 bps uncoded
	01000	%B6	9600 bps trellis
	00110	%B7	7200 bps
	01001	%B8	12,000 bps
	01010	%B9	14,400 bps
	00010	%B10	Reserved
	01011	%B11	16,800 bps
	01100	%B12	19,200 bps
	01101	%B13	21,600 bps
	01110	%B14	24,000 bps
	01111	%B15	26,400 bps
	10000	%B16	28,800 bps
	10001	%B17	31,200 bps
	10010	**%B18**	**33,600 bps**
7-5	--	--	Reserved

Operating Mode — S70

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

Example: With \N7 selected the modem tries an 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.

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 native (auto-reliable)**
3	0	\M	Disable V.42 fast detect
	1	**\M1**	**Enable V.42 fast detect**
7–4	--	--	Reserved

Operating Mode Status — S71

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

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

Bit Mapped — S72

Bit	Value	Command	Description
0	**0**	**\J**	**Disable slaved DTE/DCE (constant speed DTE on)**
	1	\J1	Disable slaved DTE/DCE (constant speed DTE on)
2, 1	--	--	Reserved
3	0	&R9	CTS does not follow DCD
	1	&R2	CTS follows DCD
6-4	--	--	Reserved
7	**0**	--	**Disable autocallback**
	1		Enable autocallback

Password Timeout — S73

S73 sets the length of time the remote user has to enter a password before the secure V.3600 drops the call. The default is 0.

Bit	Value	Command	Description
7-0	0-255	--	Time in seconds (0 = disable)

Callback Delay — S74

The length of time the secure modem waits to place the callback call after the remote user correctly enters a password and the call is dropped. The default is 15 seconds.

Bit	Value	Command	Description
7-0	0-255	--	Time in seconds (0 = disable)

Callback Retry — S75

The number of times the modem will attempt to place the callback call to a remote user if the first attempt is unsuccessful. The default is 0.

Bit	Value	Command	Description
7-0	0-255	--	Number of attempts to place the call

Callback Retry Delay — S76

The length of time that the modem waits, after an unsuccessful attempt to connect to the remote unit at the programmed callback number, before trying to place the call again. The default is 15 seconds.

Bit	Value	Command	Description
7-0	0-255	--	Time in seconds (0 = disable)

Lockout Threshold — S77

Set the number of incorrect remote user password attempts that can be made before the call is dropped. The default is 0. When remote configuration is active, the lockout occurs after seven attempts.

Bit	Value	Command	Description
7-0	0-255	--	Number of incorrect password attempts (0 = disable)

Autocallback Timer — S78

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

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. The range is from 1-255 in 20 ms increments. The default is 35 (700 ms).

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

Serial Port or DTE Speed — S80

The S80 register indicates the serial port speed.

Bit	Value	Command	Description
4-0	00001	--	300 bps
	00010		600 bps
	00011		1200 bps
	00100		2400 bps
	00101		4800 bps
	00110		7200 bps
	00111		9600 bps
	01000		12,000 bps
	01001		14,400 bps
	01010		16,800 bps
	01011		19,200 bps
	01100		21,600 bps
	01101		24,000 bps
	01110		26,400 bps
	01111		28,800 bps
	10000		31,200 bps
	10001		33,600 bps
	10010		38,400 bps
	10011		57,600 bps
	10100		11,5200 bps

Minimum DCE Speed — S81

Bit	Value	Command	Description
4–0	00000	%L	Disabled
	00001	**%L1**	**Disabled**
	00011	%L2	1200 bps
	00100	%L3	2400 bps
	00101	%L4	4800 bps
	00111	%L5	9600 bps uncoded
	01000	%L6	9600 bps trellis
	00110	%L7	7200 bps
	01001	%L8	12,000 bps
	01010	%L9	14,400 bps
	00010	%L10	600 bps
	01011	%L11	16,800 bps
	01100	%L12	19,200 bps
	01101	%L13	21,600 bps
	01110	%L14	24,000 bps
	01111	%L15	26,400 bps
	10000	%L16	28,800 bps
	10001	%L17	31,200 bps
	10010	%L18	33,600 bps
7–3	--	--	Reserved

Negotiation Status — S82

Bit	Value	Command	Description
1–0	--	--	Reserved
3–2	00	W	Disable negotiation status
	01	**W1**	**Enable negotiation status**
	10	W2	No negotiation status; indicates DCE link rates
7–4	--	--	Reserved

S83
Reserved

Bit Mapped — S84

Bit	Value	Command	Description
0	**0**	--	**Enable any key abort**
	1		Disable any key abort
7–1	--	--	Reserved

S85-S87

Reserved

Modulation Type S88

Bit	Value	Command	Description
3–0	0000	--	Auto mode
	0001		V.21
	0010		B103
	0011		Reserved
	0100		B212A
	0101		V.22 bis
	0110		V.27 (lease line only)
	0111		Reserved
	1000		V.29 (lease line only)
	1001		Reserved
	1010		V.33 (lease line only)
	1011		V.32 bis
	1100		V.34
7–4			Reserved

S89-S90

Reserved

Current Modulation S91

The S91 register is for reference only.

Bit	Value	Command	Description
3–0	0000	--	Auto mode
	0001		V.21
	0010		B103
	0011		Reserved
	0100		B212A
	0101		V.22 bis
	0110		V.27 (lease line only)
	0111		Reserved
	1000		V.29 (lease line only)
	1001		Reserved
	1010		V.33 (lease line only)
	1011		V.32 bis
	1100		V.34
7–4	--	--	Reserved

S92 - S94
Reserved

V.34 Settings — S95

Bit	Value	Command	Description
0	0 **1**	--	Disable V.8 for non-V.34 answer **Enable V.8 for non-V.34 answer**
3–1	--	--	Reserved
4	0 **1**	--	Disable non-linear encoding **Enable non-linear encoding**
5	0 **1**	--	Disable pre-emphasis **Enable pre-emphasis**
6	0 **1**	--	Disable constellation shaping **Enable constellation shaping**
7	0 **1**	--	Precoding disabled **Precoding enabled**

V.34 Asymmetric Settings — S96

Bit	Value	Command	Description
4–0	--	--	Reserved
5	0 **1**	--	Disable asymmetric bit rates **Enable asymmetric bit rates**
6	--	--	Reserved
7	0 **1**	--	Disable TX power control **Enable TX power control**

Bit Mapped — S97

Bit	Value	Command	Description

1–0	00
	01
	10
		`*TH`
		`*TH1`
		`*TH2`
			V.34 rate threshold low (10^{-6} BER)
			Medium V.34 threshold (10^{-4} BER)
			High V.34 threshold (10^{-2} BER)

7–2	**--**	--	Reserved

S98- S100
Reserved

Chapter 11
V.25 bis Autodialer

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 (refer to the "Asynchronous / Synchronous Mode Selection — &M" section on page 5-25).

If using the LCD,

1) Scroll through the menu to Main Menu 5, MODIFY CONFIGURATION.
2) Advance to and enter the DTE PARAMETERS submenu.
3) Select SYNC DATA.
4) Advance to DIAL METHOD.
5) Select one of V.25 BISYNC DIALER, 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 parameters 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.

Software Guidelines

- 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 by V.25 bis conventions. For example, a dial command with *intermediate call progress* enabled (BISYNC mode ASCII/EBCDIC character set) is:

From computer   *To computer*
<sy><sy><stx>CRN<sp>(205)555-0124<etx>   <sy><sy><stx>VAL<etb>

- V.25 bis commands can be in one of these data formats:
    ASYNC
    BISYNC
    SDLC   NRZ
    SDLC   NRZI
  in ASCII or EBCDIC

Access these formats using:

&M   Asynchronous dial/asynchronous data

&M1   Asynchronous dial/synchronous data

&M2   Dials stored number when DTR off/on transition is detected/sync data

&M3   Manual dial/sync data

&M4   V.25 bis dialer/BISYNC protocol/sync data (ASCII)

&M5   V.25 bis dialer/SDLC protocol/sync data (NRZ)

&M6   V.25 bis async dial/sync data

&M7   V.25 bis async dial/async data

&M8   V.25 bis dialer w/BISYNC protocol/sync data (EBCDIC)

&M9   V.25 bis dialer w/SDLC protocol/sync data (EBCDIC) (NRZ)

&M10   V.25 bis dialer w/SDLC protocol/sync data (ASCII) (NRZI)

&M11   V.25 bis dialer w/SDLC protocol/sync data (EBCDIC) (NRZI)

- Separator fields depend on the data format.

  for ASYNC {sep} = command <CR>
       BISYNC {sep} = <sy><sy><stx> command <etx>
       SDLC {sep} = <Flags><Addr><ctl> command

  <FCS> *where:*
  <sy> = 16 hexadecimal
  <stx> = 02 hex
  <etx> = 03 hex
  <etb> = 17 hex
  <Flag> = 7E hex
  <Addr> = FF hex
  <ctl> = 13 hex (last frame), 03 hex (not last frame)
  <FCS> = Frame Check Sequence
  <CR> = Carriage Return

Invalid Responses

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

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

INVMS   This message has one of three possible meanings:

   1) Receiving too many characters for any command.

   2) Any command followed by a semicolon *;*

INVPS   This message has one of three possible meanings:

1) 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
   - entered with parameters that does not require parameters
2) Any parameter containing too many characters.

INVPV   This message has one of three meanings:

1) Any parameter set containing invalid characters
2) Any parameter or parameter set containing no valid (only ignored) characters
3) Any parameter set containing an out-of-range parameter

Dial Parameters

Table 11-1 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 11-1. Dial Parameters

Parameters	Function
0 thru 9	DTMF and pulse digit
* and #	DTMF digit
W	Wait for 2nd type of dial tone
>	Pause for 1 second
=	Pause for 3 seconds
<	Pause for programmed delay time
P	Pulse dialing
T	Tone dialing
&	Flash (go on hook) for ½ second
;	PARM separator
Space, dash, parenthesis, period	Parameters inserted for readability

V.25 bis Commands and Responses

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.

CFINT   Call failure - no answer back tone.

CFIDT   Call failure - no dial tone.

CFIAB   Call failure - ABT detected but no carrier.

INC   Incoming ring detected.

CFICB   Call failure - delayed number list is full.

DLC;xxx Call failure - number is on delayed list and the call is delayed for xxx minutes.

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 31 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, except for call progress responses.

Intermediate Call Progress Response

The following response is given only if enabled. See Option Definition 002 below.

   CNX@nnnnnBPS

where nnnnn is the line speed. 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 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

        LSNa;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:

Same as for the `DIC` command.

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 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 addresses 01-09 are defined

CFILD   Call failure - no connection from link list.

Request List of Delayed Numbers — RLD
This command instructs the modem to send a list of delayed numbers to the DTE.

The modem cannot dial a number that is on the delayed call list until the prescribed time, or until power to the modem is turned off and then on again. A example list of delayed numbers is as follows:

RLD
LSD 1;5551212;D02001
LSD 2;5551414;D04059

If there is no response to the RLD command, there are no numbers on the delayed call list.

For numbers on the delayed call list, the response structure is as follows: LSD a;bbbbbbb;Dxxyyy

Where:

a = delayed number list order
bbbbbbb = delayed telephone number
D = Delayed
xx = the number of failed call attempts made to the number
yyy = the number of minutes that calls to the number are delayed

Request List of Linked Numbers — RLL

The request list of linked numbers command is 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 for BISYNC 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

        LSLa;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>Sbbbbbbb00sccppddr / comment field

where bbbbbbb is the board number, s is the series number, cc is the controller code revision, pp is the data pump code revision, dd is the board dash number, and r is the printed circuit board revision followed by a comment field.

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). The "Options" section on page 11-15 lists 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.
         Example: `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
     INVPV012 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 INVPV013 message
     Options 10 through 12 would still be changed as commanded;
     options 13 and 14 would be unchanged.

Save Current Settings — PRK

`PRK` saves the current option settings.

Responses:

VAL   Valid command received. Transmitted on receiving an error-
        free command with no transmission error such as a parity
        error. 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 on page 11-15 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} for BISYNC is an

        <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

        LSOxxx;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

        LSO000;000

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

        LSOxxx;ooo

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

        LSOxxx;ooo{sep}xxx;ooo...

Options

You can change the options for the V.25 bis autodialer using the PRO command or list them using the RLO command. Options are listed in Table 11-2.

Table 11-2. V.25 Autodialer Options

Option	Definition	Settings	Default
002:	Intermediate call progress messages	0 - Disable 1 - Enable	0
003:	Blind dial	0 - Disable 1 - Enable	0
007:	Long space disconnect	0 - Disable 1 - Enable	1

Table 11-2. V.25 Autodialer Options (Continued)

Option	Definition	Settings	Default
051:	Primary transmit / receive rate	007: 1200 bps 008: 2400 bps 034: 4800 bps 035: 9600 bps uncoded 036: 9600 bps 046: 7200 bps 047: 12,000 bps 048: 14,400 bps 049: 16,800 bps 050: 19,200 bps 051: 21,600 bps 052: 24,000 bps 053: 26,400 bps 054: 28,800 bps 055: 31,200 bps 056: 33,600 bps	54 (28800 bps)
055:	Transmit clock	0 - Internal 1 - External 2 - Receive (slave)	0
063:	Autoanswer	0 - Disable 1 - Enable (answer after 1 to 255 rings)	0
064:	Line current disconnect	0 - Off 1 - Short (8 ms) 2 - Long (90 ms)	2
076:	Speaker control	0 - Off 1 - On 4 - On until CD 6 - Off when dialing	4
077:	Speaker volume	0 - Low 1 - Medium 2 - High	1
085:	Constant carrier RTS/CTS delay	0 to 250 ms 10 ms increments	0
087:	DTR dropout timer DTR must turn off for this length of time to be recognized.	0 to 255 in 10 ms increments	5 (50 ms)
089:	Pause in dial string	0 - Invalid 1 to 255 seconds	2
090:	Carriage return character	ASCII or EBCDIC character range	13 dec

Table 11-2. V.25 Autodialer Options (Continued)

Option	Definition	Settings	Default
091:	Line feed character	ASCII or EBCDIC character range	10 dec ASCII; 37 dec EBCDIC
092:	Guard tone	0 = None 1 = 550 Hz 2 = 1800 Hz	0
093:	Carrier detect delay	0 - Off; 1 to 255 10 ms increments	6 (60 ms)
094:	Loss of carrier disconnect	0 - Off 1 to 255 100 ms increments	14 (1.4 sec)
095:	DTR dial address - Stored telephone number address to dial on DTR off-to-on transition		1
096:	DTR dial	0 - Disable 1 - Enable	0
098:	Call timeout	0 - Off 1-255 sec	30 sec
103:	Signal quality retrain	0 - Disable 1 - Send training sequence on poor quality	1
111:	Modulation mode	000: Automode 001: V.21 002: B103 005: V.22 006: V.22 bis 007: V.27 ter 009: V.29 012: V.32 bis 013: V.34	
112	V.34 Select Threshold	000: Low 001: Medium 002: High	
113	V.34 Asymmetric bit rates	000: Disabled 001: Enabled	

Table 11-2. V.25 Autodialer Options (Continued)

Option	Definition	Settings	Default
903:	Bilateral loop - If enabled and a test is commanded, bilateral loop is defined as follows: **Test Bilateral CommandedLoop** Loop 1 Loop 2 Loop 2 Loop 1 Loop 3 Loop 4 Loop 4 Loop 3 Loop definitions per CCITT V.54.	0 - Disabled 1 - Enabled	0
904:	Computer commanded remote digital loopback	0 - Disable 1 - Enable	0
905:	Computer commanded local analog loopback	0 - Disable 1 - Enable	0
906:	Remote commanded test	0 - Disable 1 - Enable	1
907:	Test timer	0 - Until DTR drops TTT - 1 to 255 sec	0

Chapter 12
Maintenance

Warning

Disconnect power before performing maintenance. Although dangerous voltage levels are not exposed, disconnecting power ensures that no electric shock hazard is 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 Replacement

Warning

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

Maintenance

The modem provides maintenance-free service. Periodically it is advisable to remove dust that has collected on internal components. If attempting to clean the modem, remove dust with a soft bristle brush and low pressure air or vacuum.

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

Calling Technical Support

The Service and Support page at the back of this User's Guide contains several phone and faxback numbers and the Web address. If calling Technical Support, please call from a location near the computer with the modem. It helps expedite the call to have the following information available:

- Type of modem -- V.3600
- Modem serial number
- Date code
- Purchase date
- Type and version of software, including data communications, fax, and browser/reader software
- Type and version of other software running at the same time

Note
Do not return the modem to the manufacturer without prior authorization.

If the unit appears faulty, contact Motorola Technical Support at 1-800-544-0062 (USA) for service and assistance.

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)
Front Panel	32 ASCII character LCD

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 Requirements

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

- 115 VAC ±10%; 50-60 Hz
- 230 VAC ±10%; 50–60 Hz
- 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

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

Fax Rates

14400, 12000, 9600, 7200, 4800, and 2400

Modulations

V.34, V.32, V.22, V.21, V.27 bis, V.29, Bell 103, Bell 1200, V.17, V.33, V.22 bis, V.32 bis

Fax Modulation

Modulation	Speed
V.21 channel 2	300 bps
V.27 ter	2400 bps
V.27 ter	4800 bps
V.29	7200 bps
V.17	7200 bps
V.17	7200 bps with short train
V.29	9600 bps
V.17	9600 bps
V.17	9600 bps with short train
V.17	12000 bps
V.17	12000 bps with short train
V.17	14400 bps
V.17	14400 bps with short train

Internal Transmit Clock Frequency

Selected bit rate $\pm$ 0.01%

External Transmit Clock Frequency

Selected bit rate $\pm$ 0.01%

Transmit Output Level

0 to -30 dBm, selectable.

Operation

4-wire, full-duplex, leased (private) line
2-wire, full-duplex, leased (private) line or PSTN

Carrier Detect Level
Dynamic to -43 dBm

Telco Connection
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 90 ± 2 ms, user selectable in 10 ms increments
(The default is 0 ms.)

Link Layer Protocols
V.42/V.42 bis error correction and compression protocol
MNP levels 2-5 error correction and compression protocol

Appendix B
Phone Jack Descriptions

DIAL Pin Functions

The DIAL jack connects to the PSTN dial-up lines. Pin functions are as follows:

Pin	Function
1, 2, 3	Not used
4 R	Ring side of telephone line
5 T	Tip side of telephone line
6, 7, 8	Not used

TELSET/LEASED LINE Pin Functions

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

Pin	Function
1, 2	Transmit pair - 4-wire leased line or Tx and Rx for 2-wire leased line
4, 5	Ring and tip (respectively) of telephone line for a telephone
7, 8	Receive pair - 4-wire leased line

Appendix C
Hardware Options

Jumper Option Selection

Modem configuration is controlled by front panel pushbuttons and the
LCD, AT or V.25 bis commands, and one hardware option jumper located
on the PC board. Normally, jumpers do not have to be changed. If a
change is required, remove the modem cover. The jumper diagrams on the
following pages indicate the factory settings.

Removing the Cover

Warning

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

1) Place the unit on its side on a flat surface.
2) To disengage the cover's locks from the base of the modem, insert a
   medium size flat screwdriver blade in one of the slots as illustrated
   in Figure C-1. DO NOT PUSH the screwdriver, but pry the lock
   open by applying pressure toward the unit.
3) Assist removal by pushing the cover from the base.
4) Repeat this procedure with the remaining three slots.

Bottom of
the modem

Slots - Open the two slots
on one side of the modem
first. Then open the two on
the other side.
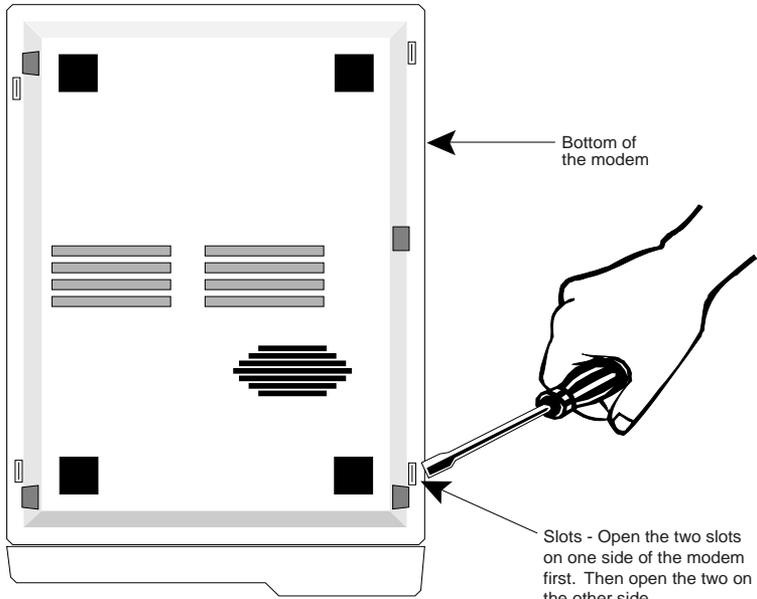
Figure C-1. Cover Removal

Figure C-2 shows the jumper location.

CH ■■■ SIG
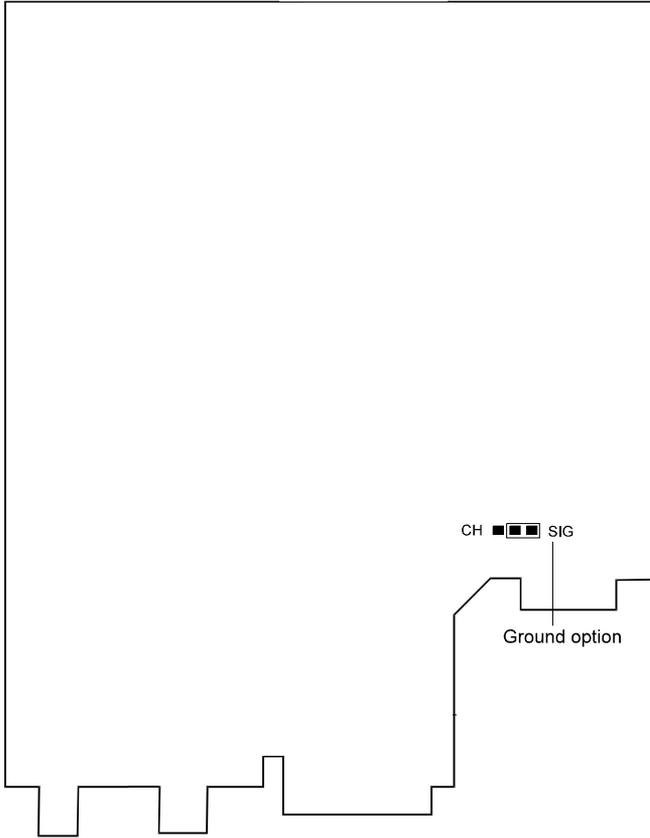
Ground option

Figure C-2. Jumper Location for Ground Option

Figure C-3 shows a typical jumper configuration.
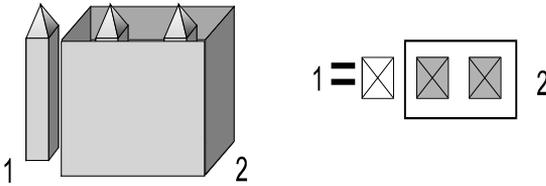
Figure C-3. Typical Jumper Configuration

Ground Option Jumper

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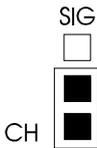
*Signal ground connected to chassis ground selected

∗ *factory setting*

Replacing the Cover

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.

Appendix D
Fault Isolation Procedure

Fault Isolation Procedure

This diagnostic test procedure and the indicator lights built into the modem allow a rapid check of the terminals, modems, and telephone line interface. 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 loops 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
1) Connect the modem to the dial-in line by the LINE jack on the back panel.
2) If the dial line is installed with a standard data jack, connect a standard telephone to the TELSET/LEASED LINE jack on the back panel of the modem and use the standard telephone procedure.

Standard Phone
1) Configure the modem to V.34 33600 IDLE mode by pressing the TALK/ DATA button, and then lift the receiver. No dial tone is heard. Press the TALK/DATA button to display V.34 IDLE and wait for dial tone.
2) Dial out; the phone should operate normally.

Modem and Telephone Line Check

Part I

1) Configure the modem for LOCAL ANALOG LOOP WITH TEST PATTERN. This terminates the local modem telephone lines into 600 ohms and connects the local modem transmit output amplifier back to its own receiver through the AGC. Transmit input data from the terminal is inhibited and is substituted with a V.52 test pattern.

2) 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.

3) When random errors are present, the TEST PATTERN ERRORS display counts receive errors.

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

```
┌─────────────────────────────────────┐
│                                       │
│    TR   CS   RS   CD   RD   TD        │
│   ███  ███  ███  ███  ☐  ◢          │
│                                       │
└─────────────────────────────────────┘
```
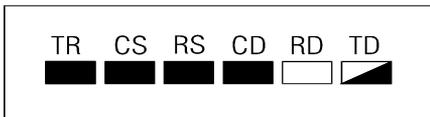
5) Configure the modem for LOCAL ANALOG LOOP to switch the transmitter back to its normal data input.

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

7) 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.

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

9) If the preceding tests were not successful, call Technical Services. Refer to the "Calling Technical Support" section on page 12-2.

Part II

This part 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 operation.

1) 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 the digital bilateral loop is enabled at the remote, the remote DTE is looped back to itself.

2) 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.

3) The TEST PATTERN ERRORS display will count received errors.

4) At the local modem, the indicators should be as follows:
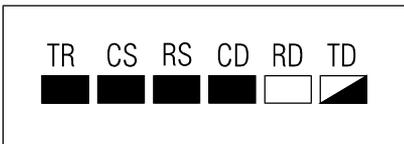
5) To further test the modem and communications link, reverse the system loopback. First exit the existing loopback test. Reverse the roles of the local and remote modems and repeat step two.

Note

If the bilateral digital loop is enabled at the local modem, the DTE interface is looped to itself and permits the DTE to check the interface circuitry as well as itself.

Appendix E
Command Index and Defaults

General

This reference guide provides asynchronous command characters and their descriptions. The pages listed provide initial information on the commands. The S-registers listed are cross references (see the "Status Registers" section on page E-17).

📖 **Note**
   Bold text indicates command parameter defaults.

Table E-1. Synchronous Command Reference

Command	Page	S-Reg	Description
AT	5-3	--	Attention code - command prefix
A/	5-4	--	Repeat last command
+ + +	5-22	S2, S12	Escape sequence (pause, + + +, pause)
A	5-17	--	Answer
D	5-13, 9-4	--	Dial
Dial Modifiers:			
T	5-14	**S14**	**Tone dial**
P		S14	Pulse dial
,		S8	Long pause (2 sec or S8 value)
W	5-15	S7	Wait for 2nd dial tone (S7 value)
!		--	Flash switchboard
R		--	Switch to answer mode after dialing
;		--	Return to command mode after dialing
@	5-16	--	Wait for 5 seconds of silence
Sn		--	Dial stored command line
E	5-22	S14	Local character echo off
E1		**S14**	**Local character echo on**
† *cannot be executed from remote configuration mode*			

Table E-1. Synchronous Command Reference (Continued)

Command	Page	S-Reg	Description
H	5-23	--	Hang up †
H1		--	Forces modem off hook †
H2		**S14**	**Set H command to V.32 †**
H3		S14	Set H command to fast †
I	5-24	--	Request product code
I1		--	Request EPROM CRC value
I3		--	Request product version
I4		--	Returns Motorola V.3600
I5		--	Disconnect reason
L, L1, **L2**	5-24	S22	**Speaker volume low**
L3		S22	Speaker volume high
M	5-24	S22	Speaker off
M1		S22	**Speaker off when carrier is present**
M2		S22	Speaker always on
M3		S22	Speaker off when dialing and carrier is present
O	5-25	--	Restore data mode (after escape) †
O1		--	Retrain and restores data mode (after escape) †
Q	5-6	**S14**	**Response displays on**
Q1		S14	Response displays off
Q2		S14	Response displays on in originate mode only
Sn?	10-3	--	Read value in register n (decimal)
Sn?^		--	Read value in register n (hexadecimal)
Sn=v		--	Set v (value) in register n (decimal)
Sn=v^	10-3	--	Set v (value) in register n (hexadecimal)
Sn.#=v	10-4	--	Set single bit value in register n , #= bit position 0-7, v = bit value 1 or 0
V	5-6	S14	Response codes
V1		**S14**	**Response messages**
† cannot be executed from remote configuration mode			

Table E-1. Synchronous Command Reference (Continued)

Command	Page	S-Reg	Description
W	5-6	S82	Negotiation display disabled
W1		**S82**	**Negotiation display enabled**
W2		S82	Displays DCE link rate
X		S22	CONNECT (code 1), for all speeds, no dial tone or busy signal detection
X1		S22	Appropriate connect codes for rate, no dial tone detection
X2		S22	Wait for dial tone (appropriate connect codes)
X3		S22	Detect busy signal (appropriate connect codes)
X4		**S22**	**Wait for dial tone, detect busy signal (appropriate connect codes)**
Y	5-25	S21	Long space disconnect disabled
Y1		**S21**	**Long space disconnect enabled**
Z	5-39	--	Reset to user option set #1 †
Z1		--	Reset to user option set #2 †
&C	5-19	S21	DCD always on
&C1		**S21**	**DCD on while carrier is present**
&C2		S21	DCD off 5 seconds after disconnect
&C3		S21	DCD follows remote RTS
&D	5-20	S21	DTR ignored
&D1		S21	DTR recalls command mode
&D2		**S21**	**DTR disconnects**
&D3	5-20	S21	DTR disconnects and resets modem to stored configuration
&F or **&F1**	5-39	--	**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 †
&G	5-25	**S23**	**No guard tone**
&G1		S23	550 Hz tone
&G2		S23	1800 Hz tone
† cannot be executed from remote configuration mode			

Table E-1. Synchronous Command Reference (Continued)

Command	Page	S-Reg	Description
`&L`	5-36	`S27`	**Dial line †**
`&L1`		S27, S32	Leased line 2-wire †
`&L2`		S27, S32	Leased line 4-wire †
`&M`	5-25	**S27, S30**	**Asynchronous dial / asynchronous data**
`&M1`		S27	Asynchronous dial / synchronous data
`&M2`		S27	Dials stored number when DTR off / on transition is detected / sync data
`&M3`		S27	Manual dial / sync data
`&M4`		S30	V.25 bis autodialer with BISYNC protocol / sync data
`&M5`		S30	V.25 bis autodialer with SDLC protocol /sync data
`&M6`		S30	V.25 bis async dialer / sync data
`&M7`		--	V.25 bis async dialer / async data
`&M8`	5-25	--	V.25 bis async dialer / BISYNC protocol / sync data (EBCDIC)
`&M9`		--	V.25 bis async dialer / SDLC protocol/ sync data (EBCDIC, NRZ)
`&M10`		--	V.25 bis async dialer / SDLC protocol/ sync data (ASCII, NRZ1)
`&M11`		--	V.25 bis async dialer / sync data (EBCDIC, NRZ1)
`&P`	5-26	`S22`	**39/61 pulse make / break ratio**
`&P1`		S22	33/67 pulse make / break ratio
`&R`	5-21	S21	CTS normal operating state
`&R1`		`S21`	**CTS forced on**
`&R2`		S72	CTS follows DCD
`&R9`		S72	CTS equals RTS
`&S`	5-20	`S21`	**DSR always on**
`&S1`		S21	DSR on when ready to accept data
`&S2`		S21	DSR off for 5 seconds after disconnect
`&S3`		S21	DSR follows off hook (OH)
`&T`	7-2	--	Terminate current test †
`&T1`	7-3	--	Initiate analog loopback †
`&T3`	7-5	--	Initiate digital loopback †
† cannot be executed from remote configuration mode			

Table E-1. Synchronous Command Reference (Continued)

Command	Page	S-Reg	Description
&T4	7-5	**S23**	**Grant remote commanded digital loopback †**
&T5		S23	Denies remote commanded digital loopback †
&T6		--	Initiate remote digital loopback †
&T7	7-6	--	Initiate self test remote digital loopback †
&T8	7-4	--	Initiate self test analog loopback †
&V	5-40	**--**	**View configuration profiles**
&V1	5-40	--	Display received signal status
&V2		--	Display active profile
&W	5-38	**--**	**Store current configuration to user option set #1**
&W1		--	Store current configuration to user option set #2
&X	5-27	**S27**	**Internal clock**
&X1		S27	External clock
&X2		S27	Receive clock
&Y	5-38	--	**Powerup with user option set #1**
&Y1		--	Powerup with user option set #2
&Y?		--	Display powerup option set
&Zn=x	5-40	--	Store dial string x to location n (n=0-9)
%A	6-6	**S64**	**Disable auto-reliable fallback character**
%An		S64	Set auto-reliable fallback character to n (n = ASCII 1-127) †
%B	5-28	S69	Use DTE speed/maximum DCE speed
%B1		S69	300 bps max
%B2		S69	1200 bps max
%B3		S69	2400 bps max
%B4		S69	4800 bps max
%B5		S69	9600 bps uncoded max
%B6		S69	9600 bps max
%B7		S69	7200 bps max
%B8		S69	12000 bps max
%B9		S69	14400 bps max
%B10		S69	600 bps
%B11		S69	16800 bps max
%B12		S69	19200 bps max
† cannot be executed from remote configuration mode			

Table E-1. Synchronous Command Reference (Continued)

Command	Page	S-Reg	Description
%B13	5-28	S69	21600 bps max
%B14		S69	24000 bps max
%B15		S69	26400 bps max
%B16		S69	28800 bps max
%B17		S69	31200 bps max
%B18		**S69**	**33600 bps max**
%C	6-11	S56	Compression disabled
%C1		**S56**	**Compression enabled on transmit and receive data**
%C2		S56	Compression enabled on transmit data only
%C3		S56	Compression enabled on receive data only
%D	6-4	**S62**	**Disable disconnect buffer delay**
%Dn		S62	Set disconnect buffer delay in seconds n (n = 1-255)
%E	5-30	S60	Disable auto retrain
%E1		**S60**	**Enable auto retrain**
%L	5-29	S81	Disabled minimum DCE speed
%L1		**S81**	**Disabled**
%L2		S81	1200 bps min
%L3		S81	2400 bps min
%L4		S81	4800 bps min
%L5		S81	9600 bps uncoded min
%L6		S81	9600 bps min
%L7		S81	7200 bps min
%L8		S81	12000 bps min
%L9		S81	14400 bps min
%L10		S81	600 bps
%L11		S81	16800 bps min
%L12		S81	19200 bps min
%L13		S81	21600 bps min
%L14	5-29	S81	24000 bps min
%L15		S81	26400 bps min
%L16		S81	28800 bps min
%L17		S81	31200 bps min
%L18		S81	33600 bps min
%P1=pw	5-41	--	Set software download password
%P1=D		--	Disable software download
%P1?		--	Display software download password
† cannot be executed from remote configuration mode			

Table E-1. Synchronous Command Reference (Continued)

Command	Page	S-Reg	Description
%R	5-30	**S53**	**Disable automatic rate adaption**
%R1		S53	Enable automatic rate adaption low BER
%R2		S53	Enable automatic rate adaption medium BER
%R3		S53	Enable automatic rate adaption using high BER
%T	7-7	--	Transmit test pattern †
%T=	5-43	--	Followed by a remote configuration security code, establishes remote configuration †
%V	5-31	--	Display product revision level
\A	6-10	S63	Maximum block size of 64 characters
\A1		S63	Maximum block size of 128 characters
\A2		S63	Maximum block size of 192 characters
\A3		**S63**	**Maximum block size of 256 characters**
\B	6-11	**S79**	**Transmit a break signal**
\Bn		S79	Sets break length in 20 ms increments, n=1-255, default is 35 (700 ms)
\C	6-11	**S60**	**Disable auto-reliable buffer**
\C1		S60	Buffer data for 4 seconds or 200 characters
\G	6-8	**S54**	**Disable modem port flow control**
\G1		S54	Enable modem port XON/XOFF flow control
\J	6-4	**S72**	**Disable slaved DTE/DCE speed (constant speed DTE on)**
\J1		S72	Enable slaved DTE/DCE speed (constant speed DTE off)
\J2		--	Enable 230.4 kbps DTE speed
\J3		--	Disable 230.4 kbps DTE speed

📖 **Note**

The 230.4 kbps DTE speed is available, but the DTE will not autobaud to 230.4 kbps. With the modem set for 115.2 kbps, enter AT\J2 to enable the speed, and reset the DTE for 230.4 kbps. When the modem is set for 230.4 kbps, enter AT\J3 to disable it if needed. Reset the DTE for 115.2 kbps.

† *cannot be executed from remote configuration mode*

Table E-1. Synchronous Command Reference (Continued)

Command	Page	S-Reg	Description
\Kn	6-9	S59	Selects action when encountering a break
\K		S59	Break option 0
\K1		S59	Break option 1
\K2		S59	Break option 2
\K3		S59	Break option 3
\K4		S59	Break option 4
\K5		**S59**	**Break option 5**
\M	6-5	S70	V.42 fast detect data sequence disabled
\M1		**S70**	**V.42 fast detect data sequence enabled**
\N	6-5	S70	Normal mode
\N1		S70	Direct mode
\N2	6-5	S70	MNP only
\N3		S70	MNP or normal
\N4		S70	LAPM only
\N5		S70	LAPM with normal fallback
\N6		S70	LAPM with MNP fallback
\N7		**S70**	**LAPM with MNP and normal fallback**
\Q	6-7	S54	Disable DTE flow control
\Q1		S54	Enable DTE XON/XOFF flow control
\Q2		S54	Enable CTS flow control to the DTE
\Q3		**S54**	**Enables bilateral CTS/RTS flow control**
\Q4		S54	Disable DCE flow control
\Q5		S54	Enable DCE XON/XOFF flow control
\Q6		S54	Enable CTS flow control to the DTE
\Q7		S54	Enable CTS flow control to the DTE
\R	10-18	S60	Ring indicate, blinks for ring and remains on for duration of call
\R1		**S60**	**Ring indicate, blinks for ring and turns off when call is answered**
\T	6-10	**S58**	**Disable inactivity timer**
\Tn		S58	Set inactivity timer to n (n = 1-255 minutes)
† *cannot be executed from remote configuration mode*			

Table E-1. Synchronous Command Reference (Continued)

Command	Page	S-Reg	Description
\V	10-18	**S60**	**Disable protocol result codes**
\V1		S60	Enable protocol result codes
\V2	--	--	Connect DCE rate
\V3	--	--	Connect DCE rate/protocol
\V4	--	--	Connect DCE rx rate/DCE tx rate/ modulation mode/protocol
\X	6-8	**S54**	**No XON/XOFF characters to remote DCE**
\X1		S54	Pass XON/XOFF characters to remote DCE
*AS	5-27	--	Disable V.34 asymmetric bit rate
*AS1		--	Enable V.34 asymmetric bit rate
*AUn	5-16	--	Dial number stored at location n upon transition of DTR in command mode (n = 1-9)
*CNx,n	5-40	--	Store phone number n in location x (x = 1-9)
*DA	5-32	**--**	**Switches modem to talk mode †**
*DA1		--	Switches modem to data mode †
*DB	5-36	**S32**	**Manual dial backup operation**
*DB1		S32	Automatic dial backup operation
*DG	7-7	**S34**	**Disables bilateral digital loop**
*DG1		S34	Enables bilateral digital loop
*FB	5-22	**S29**	**Ignore pin 23**
*FB1		S29	Pin 23 transition causes DTE speed fallback
*FT	5-32	**S29**	**Disable fast train**
*FT1		S29	Enable fast train
*IC		--	Disregard incoming call
*LA	7-8	**S34**	**Ignore pin 18**
*LA1		S34	DTE commanded LAL enabled
*LB	5-36	--	Return to leased line from dial backup†
*LC	5-32	S32	Line current disconnect disabled
*LC1		S32	Short (8 ms) line current disconnect
*LC2		**S32**	**Long (90 ms) line current disconnect**
*LD	5-36	--	Manual dial backup
† *cannot be executed from remote configuration mode*			

Table E-1. Synchronous Command Reference (Continued)

Command	Page	S-Reg	Description
*MM	5-27	**--**	**Automode (modulation)**
*MM1		--	V.21
*MM2		--	Bell 103J
*MM3		--	Reserved
*MM4		--	Bell 212A
*MM5		--	V.22 bis
*MM6		--	V.27 bis 4-wire leased only
*MM7	5-27	--	Reserved
*MM8		--	V.29 4-wire leased only
*MM9		--	Reserved
*MM10		--	V.33 4-wire leased only
*MM11		--	V.32 bis
*MM12		--	V.34
*ND	5-40	--	Displays the nine stored numbers
*NT	5-33	S29	AT command set disabled
*NT1		**S29**	**AT command set enabled**
*OR	5-36	**S14**	**Originate**
*OR1		S14	Forced answer
*RC	5-8	**S57**	**15 - 4800 bps, 18 - 9600 bps**
*RC1		S57	11 - 4800 bps, 12 - 9600 bps
*RD	7-8	**S34**	**Ignore pin 21**
*RD1		S34	DTE commanded RDL enabled
*RO	5-41	**S29**	**Retain options at disconnect**
*RO1		S29	Restore options at disconnect
*RR	5-31	--	Rate negotiate to 2400 †
*RR1		--	Rate negotiate to 4800 †
*RR2		--	Rate negotiate to 7200 †
*RR3		--	Rate negotiate to 9600 †
*RR4		--	Rate negotiate to 12000 †
*RR5		--	Rate negotiate to 14400 †
*RR6		--	Rate negotiate to 16800 †
*RR7		--	Rate negotiate to 19200 †
*RR8		--	Rate negotiate to 21600 †
*RR9		--	Rate negotiate to 24000 †
*RR10		--	Rate negotiate to 26400 †
*RR11		--	Rate negotiate to 28800 †
*RR12		--	Rate negotiate to 31200 †
*RR13	5-31	--	Rate negotiate to 33600 †
† cannot be executed from remote configuration mode			

Table E-1. Synchronous Command Reference (Continued)

Command	Page	S-Reg	Description
`*TDn`	5-33	`S51`	Sets dial transmit level -10 to -30 dBm
`*TH`	5-27	`S97`	Low V.34 rate selection threshold (10^{-6} BER)
`*TH1`		`S97`	Medium V.34 rate selection threshold (10^{-4} BER)
`*TH2`		**`S97`**	**High rate selection threshold (10^{-2} BER)**
`*TLn`	5-36	`S52`	Sets leased line transmit level to n where n is a number between 0 and 30 corresponding to 0 to -30 db †
`$H`	5-32	--	Online quick reference
`$H= string`		--	Online quick reference for *string*
`$V`		--	Display product serial number
`$Y`	5-41	--	Enable soft download flash
† *cannot be executed from remote configuration mode*			

Caller ID Commands

Command	Page	S-Reg	Description
*ID	5-17	--	**Disable Caller ID**
*ID1		--	Enable Caller ID

Distinctive Ring Commands

Command	Page	S-Reg	Description
*DR	5-18	**S53**	**Disable Distinctive Ring**
*DR=1		S53	Enable Distinctive Ring

Fax Commands

Fax Command	Page	Description
+FCLASS=0	9-6	**Service Class 0 (data modem) †**
+FCLASS=1		Service Class 1 (fax modem) †
+FCLASS?		Display current Service Class setting †
+FCLASS=?		Display available Service Class settings †
+FAA=	9-10	Enables fax auto answer function
*FR		Fax auto answer DTE autobaud forced to >=19200
*FR1		Fax auto answer DTE autobaud forced to =19200
*FR?		Display option status

† *Cannot executed from remote configuration*

Class 1 Commands Valid in Only Fax Mode

Command	Page	Description
+FTH=(MOD)	9-9	Transmit HDLC data with (MOD) carrier *
+FRH=(MOD)	9-9	Receive HDLC data with (MOD) carrier *
+FRM=(MOD)	9-8	Receive data with (MOD) carrier *
+FRS=(Time)	9-7	Waits for silence (10 ms intervals, 0-255) *
+FTM=(MOD)	9-8	Transmit data with (MOD) carrier *
+FTS=(Time)	9-7	Stop transmission and pause (10 ms intervals, 0-255) *

* *cannot be executed from remote configuration*

Command	Page	Description
NOTE: The (MOD) parameter can be one of the following values: 0 or		
Value	**Modulation**	**Speed**
3	V.21 channel	300 bps
24	V.27 ter	2400 bps
38	V.27 ter	4800 bps
72	V.29	7200 bps
73	V.17	7200 bps
74	V.17	7200 bps with short train
96	V.29	9600 bps
97	V.17	9600 bps
98	V.17	9600 bps with short train
121	V.17	12000 bps
122	V.17	12000 bps with short train
145	V.17	14400 bps
146	V.17	14400 bps with short train
+FTx=? +FRx=?	9-9	Check range for values supported where *x* may be M, S, or H. If *x* is M or H, the modem returns 3, 24, 48, 72, 73, 96, 97, 98, 121, 122, 145, 146. If *x* is S, the modem returns 0-255.
+FCERROR		Carrier different from specified in +FRM or +FRH

Security Commands

Command	Page	Description
Low Security		
`$S=x`	8-4	Sets an empty password location to `x`
`$C=x,y`		Changes either password where `x` represents the old password and `y` is the new one
`$C=x,-`		Deletes password `x` from memory
`$DR`		Reset security
`$D=x`		Disables security where `x` is either password
`$D?` or `$E?`		Displays the current status of security
`$E=x`		Enables security where `x` is either password
High Security		
`$Cn=m`	8-9	Set user callback number. `n` = user number and `m` = the callback number
`$D`	8-8	**Disable security**
`$E?` or `$D?`	8-10	Display current security status
`$EH=pw`	8-7	Enable security (`pw` = superuser password) †
`$F= pw$pw`	8-10	**Reinitialize security**
`$IBn`	8-11	Display user information for a block of up to ten valid users (`n` = first user number)
`$In`		Display user information (`n` = user number)
`$Ln=m`	8-8	Set security level for the user specified by `n` (`m` = security level)
`$M`		Display illegal attempts information
`$M*`		Reset illegal attempts registers/restore suspended users to normal status
`$Mn`		Reset illegal attempts registers and restore suspended user `n` to normal status
`$Pn= pw$pw`	8-8	Set user password; `n` = user number and new password (`n` = 0 for superuser *pw* = password)
`$Rn`	8-10	Remove a user (`n` = user number)
`$S?`	8-11	Display current user status (superuser / user)
†*cannot be executed from remote configuration mode*		

`$W0`	8-9	Disable user changes (password and callback number) †
`$W1`		Enable user changes (password and callback number) †
`$W2`		Enable remote superuser †
`$W?`		Display user changes remote superuser option status
`$$`	8-11	Local logoff
`$n=pw`	8-11 8-12	Local logon (n = user number and `pw` = password)
`$S=pw`	8-11	Request to enter superuser status (`pw` = password)
†*cannot be executed from remote configuration mode*		

Remote Configuration Commands

Command	Page	Description
`%P=n`	5-42	Set remote configuration security code to value n (0 to 99999999)
`%P?`		Display local modem remote configuration security code
`%P=` `(blank)`		Clear security code
`*RA`	5-44	Disable remote configuration
`*RA1`		**Enable remote configuration**
`*RB`		Remote configuration DTE speed = 300 bps
`*RB1`		Remote configuration DTE speed = 600 bps
`*RB2`		Remote configuration DTE speed = 1200 bps
`*RB3`		Remote configuration DTE speed = 2400 bps
`*RB4`		Remote configuration DTE speed = 4800 bps
`*RB5`		Remote configuration DTE speed = 7200 bps
`*RB6`		Remote configuration DTE speed = 9600 bps
`*RB7`	5-44	Remote configuration DTE speed = 12000 bps
`*RB8`		Remote configuration DTE speed = 14400 bps
`*RB9`		Remote configuration DTE speed = 16800 bps
`*RB10`		Remote configuration DTE speed = 19200 bps
`*RB11`		Remote configuration DTE speed = 21600 bps
`*RB12`		Remote configuration DTE speed = 24000 bps
`*RB13`		Remote configuration DTE speed = 26400 bps
`*RB14`		Remote configuration DTE speed = 28800 bps
`*RB15`		Remote configuration DTE speed = 28400 bps
`*RB16`		Remote configuration DTE speed = 57600 bps
`*RB17`		Remote configuration DTE speed = 115200 bps
`*RF`	5-44	7 data bits, mark parity, 1 stop bit
`*RF1`		7 data bits, no parity, 2 stop bits
`*RF2`		7 data bits, odd parity, 1 stop bit
`*RF3`		7 data bits, even parity, 1 stop bit
`*RF4`		8 data bits, mark parity, 1 stop bit
`*RF5`		8 data bits, no parity, 1 stop bit
`*RF6`		8 data bits, odd parity, 1 stop bit
`*RF7`		8 data bits, even parity, 1 stop bit
`*RQ`	5-45	Exit remote configuration, save new configuration
`*RQ1`		Exit remote configuration, discard new configuration

Status Registers

S-Reg	RO/ RW	Page	Function	Default Factory Set #1
S0	RW	10-5	Ring to answer	1
S1	RO		Ring count	0
S2	RW		Escape sequence character	43 (+)
S3	RW		End-of-line character	13 (CR)
S4	RW		Line-feed character	10 (LF)
S5	RW	10-5	Backspace character	8 (BS)
S6	RW		Pause before blind dialing	2 (2 sec)
S7	RW		Pause for carrier	30 (30 sec)
S8	RW		Pause for comma	2 (2 sec)
S9	RW		Carrier validation	6 (0.6 sec)
S10	RW		Loss carrier delay time	14 (1.4 sec)
S11	RO	10-6	DTMF tone duration	80 ms
S12	RW		Escape sequence pause	50 (1 sec)
S14	RW	10-8	Bit mapped	8A hex
S16	RO	10-9	System tests	0
S18	RW		Test timer	0
S21	RW	10-10	Bit mapped	B4 hex
S22	RW	10-10	Bit mapped	46 hex
S23	RW		Bit mapped	01 hex
S25	RW	10-11	DTR recognition time	5 (0.5 sec)
S26	RW		RTS/CTS delay	0
S27	RW		Bit mapped	0
S28	RW		Lookback timer	15 min
S29	RW	10-12	Bit mapped	0
S30	RW		V.25 mode selection	0
S32	RW	10-14	Bit mapped	06 hex
S34	RW		Bit mapped	60 hex
S35	RW		Default dial number	1
RO=Read only RW=Read or write				

S-Reg	RO/ RW	Page	Function	Default Factory Set #1
S41	RW	10-14	Remote configuration escape character	3d hex
S42	RW		Remote configuration guard time	32 hex
S44	RW		DTE XON character	11 hex
S45	RW		DTE XOFF character	13 hex
S49	RW		DCE XON character	11 hex
S50	RW		DCE XOFF character	13 hex
S51	RW		Dial transmit level	10
S52	RW	10-16	Lease transmit level	0
S53	RW		Bit mapped	0
S54	RW	10-16	Bit mapped	63 hex
S56	RW	10-17	V.42 compression	03 hex
S57	RW		Bit mapped	0
S58	RW		Inactivity timer	0
S59	RW	10-18	MNP break control	5
S60	RW		Bit mapped	5b hex
S61	RO	10-19	DTE word length, parity	18 hex
S62	RW		Disconnect buffer delay	0
S63	RW		Maximum protocol block size	255
S64	RW	10-20	Auto-reliable character	0
S67	RO		Link speed status	0
S69	RW	10-21	Maximum DCE speed	18
S70	RW	10-22	Protocol operating mode	0f hex
S71	RO		Protocol operating mode status	0
S72	RW	10-23	Bit mapped	0
S73	RW		Password timeout security	0
S74	RW		Callback delay	15
S75	RW		Callback retry	0
S76	RW	10-24	Callback retry delay	15
S77	RW		Lockout threshold	0
S78	RW		Autocallback timer	30
S79	RW		Break length	35
S80	RO	10-25	Serial port speed	20
S81	RW	10-26	Minimum DCE rate	1
S82	RW		Bit mapped	0 hex
S84	RO	10-26	Negotiation status	0
S88	RW		Modulation type	0
RO=Read only RW=Read or write				

S-Reg	RO/ RW	Page	Function	Default Factory Set #1
S91	RW	10-27	Current modulation	0
S95	RW		V.34 settings	f3 hex
S96	RW	10-28	V.34 settings	a0 hex
S97	RW		Bit mapped	06 hex
RO=Read only RW=Read or write				

V.25 bis Dialer Commands

Synchronous Command	Page	Description
CIC	11-8	Connect incoming call command
CRN nn...n	11-5	Dial command (nn...n = number to be dialed)
0 – 9		DTMF and pulse digit
* #		DTMF digit
W		Wait for second type of dial tone
>		Pause for 1 second
=		Pause for 3 seconds
<		Pause for programmed delay time
P		Pulse dial
T		Tone dial
&		Flash (go on hook) for 1/2 second
;		Parameter separator
Space, dash, parentheses, period	11-4	Clarity characters
CRRn	11-8	Redial the last number a maximum of n times
CRSa	11-6	Dial stored number command (a = address)
DIC	11-7	Disregard incoming call command
PRK	11-13	Save current option settings
PRLa;b	11-8	Link number at address a with number at address b
PRNa; nn...n	11-6	Program number command (nn...n = number to be dialed, a = address)
PROxxx;yy;0 ;0...	11-11	Program options command (xxx = register address, yy = option count)
PRPn	11-13	Restores current option settings to the factory defaults in default bank n (1-9)
RLD	11-9	Request list of delayed numbers command (country-specific)
RLL	11-10	Request list of linked numbers command
RLN	11-7	Request list of stored numbers command
RLOxxx;yy	11-14	Request list of stored options command (xxx = register address, yy = option count)
RLV	11-11	Request list of version information command

V.25 Response Messages

Response Message	Meaning
CFIAB	Call failure - answer back tone but no connection
CFICB	Call failure - the delayed call list cannot store any more numbers
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 @ 33600 bps	Intermediate call progress - connection made at 33600
CNX @ 31200 bps	Intermediate call progress - connection made at 31200
CNX @ 28800 bps	Intermediate call progress - connection made at 28800
CNX @ 26400 bps	Intermediate call progress - connection made at 26400
CNX @ 24000 bps	Intermediate call progress - connection made at 24000
CNX @ 21600 bps	Intermediate call progress - connection made at 21600
CNX @ 19200 bps	Intermediate call progress - connection made at 19200
CNX @ 16800 bps	Intermediate call progress - connection made at 16800
CNX @ 14400 bps	Intermediate call progress - connection made at 14400
CNX @ 12000 bps	Intermediate call progress - connection made at 12000
CNX @ 9600 bps	Intermediate call progress - connection made at 9600
CNX @ 7200 bps	Intermediate call progress - connection made at 7200
CNX @ 4800 bps	Intermediate call progress - connection made at 4800
CNX @ 2400 bps	Intermediate call progress - connection made at 2400
CNX @ 1200 bps	Intermediate call progress - connection made at 1200

Response Message	Meaning
DLC;xxx	Delayed call - call attempt to number is delayed for xxx minutes
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 - 33600
Modulation automode
V.34 rate threshold high
V.34 asymmetric rate enabled
Normal originate
Fast train disabled
Auto retrain enabled
SQ auto rate disabled
Transmit clock internal
Dial line
Jack type RJ11
Line current disconnect long
Long space disconnect enabled
V.22 guard tone disabled

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

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
Autocallback disabled

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

DTE OPTIONS
Async data
DTE rate - 115200
8 bit, no parity
Async controlled dialer
AT command set enabled
DTR disconnects
DSR forced high
DCD normal
CTS forced high
DTE fallback disabled
Options retained at disconnect

SPEAKER OPTIONS
Volume low
On until carrier detect

Factory Option Set # 2
(Asynchronous Dial-up without V.42 bis Protocol) (AT&F2)

MODEM OPTIONS
DCE rate - 33600
Modulation automode
V.34 rate threshold low *
V.34 asymmetric rate enabled
Normal originate
Fast train disabled
Auto retrain enabled
SQ auto rate disabled
Transmit clock internal
Dial line
Jack type RJ11
Line current disconnect long
Long space disconnect enabled
V.22 guard tone disabled

PROTOCOL OPTIONS
LAPM protocol disabled *
MNP protocol disabled *
Normal buffer mode *
Constant DTE speed
DTE flow control disabled *
DCE flow control disabled *
XON/XOFF pass through disabled *
Inactivity timer off
Break control 0 *
V.42 fast detect disabled *

SPEAKER OPTIONS
Volume low
On until carrier detect

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

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
Autocallback disabled

DTE OPTIONS
Async data
DTE rate - 115200
8 bit, no parity
Async controlled dialer
AT command set enabled
DTR disconnects
DSR forced high
DCD normal
CTS forced high
DTE fallback disabled
Options retained at disconnect

＊Indicates variation from factory option set #1

Factory Option Set #3
(Synchronous Dial-up) (AT&F3)

MODEM OPTIONS
DCE rate - 33600
Modulation automode
V.34 rate threshold low *
V.34 asymmetric rate disabled *
Normal originate
Fast train disabled
Auto retrain enabled
SQ auto rate disabled
Transmit clock internal
Dial line
Jack type RJ11
Line current disconnect long
Long space disconnect disabled *
V.22 guard tone disabled

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

SPEAKER OPTIONS
Volume low
On until carrier detect

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

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
Autocallback disabled

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

*Indicates variation from factory option set #1

Factory Option Set # 4
(Synchronous 4-wire Leased Line) (AT&F4)

MODEM OPTIONS
DCE rate - 33600
V.34 modulation *
V.34 rate threshold low *
V.34 asymmetric rate disabled *
Normal originate
Fast train disabled
Auto retrain enabled
SQ auto rate disabled
Transmit clock internal
Leased line *
4-wire *
Transmit level - 0 dBm *
Dial backup manual *
Lookback timer - 15 min *
Jack type RJ11
Line current disconnect long
Long space disconnect enabled
V.22 guard tone disabled

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

SPEAKER OPTIONS
Volume low
On until carrier detect

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

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
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

*Indicates variation from factory option set #1

Factory Option Set #5

(Asynchronous 4-wire Leased Line with V.42bis Protocol) (AT&F5)

MODEM OPTIONS
DCE rate - 33600
V.34 modulation *
V.34 rate threshold high
V.34 asymmetric rate enabled
Normal originate
Fast train disabled
Auto retrain enabled
SQ auto rate disabled
Transmit clock internal
Leased line, 4-wire *
Transmit level - 0 dBm *
Dial backup manual *
Lookback timer - 15 min *
Jack type RJ11
Line current disconnect long
Long space disconnect enabled
V.22 guard tone disabled

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

SPEAKER OPTIONS
Volume low
On until carrier detect

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

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
Autocallback disabled

DTE OPTIONS
Async data
DTE rate - 115200
8 bit, no parity
AT command set enabled
Ignores DTR *
DSR forced high
DCD normal
CTS forced high
DTE fallback disabled
Options retained at disconnect

*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 - 33600
V.34 modulation *
V.34 rate threshold low *
V.34 asymmetric rate enabled
Normal originate
Fast train disabled
Auto retrain enabled
SQ auto rate disabled
Transmit clock internal
Leased line, 4-wire *
Transmit level - 0 dBm *
Dial backup manual *
Lookback timer - 15 min *
Jack type RJ11
Line current disconnect long
Long space disconnect enabled
V.22 guard tone disabled

PROTOCOL OPTIONS
LAPM protocol disabled *
MNP protocol disabled *
Normal buffer mode
Constant DTE speed
DTE flow control disabled *
DCE flow control disabled *
XON/XOFF pass through disabled
Inactivity timer off
Break control 0 *
V.42 fast detect disabled *

SPEAKER OPTIONS
Volume low
On until carrier detect

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

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
Autocallback disabled

DTE OPTIONS
Async data
DTE rate - 115200
8 bit, no parity
AT command set enabled
Ignores DTR *
DSR forced high
DCD normal
CTS forced high
DTE fallback disabled
Options retained at disconnect

*Indicates variation from factory option set #1

Factory Option Set # 7
(Synchronous 2-wire Leased Line Normal Originate) (AT&F7)

MODEM OPTIONS
DCE rate - 33600
V.34 modulation *
V.34 rate threshold low *
V.34 asymmetric rate disabled *
Normal originate
Fast train disabled
Auto retrain enabled
SQ auto rate disabled
Transmit clock internal
Leased line, 2-wire *
Transmit level - 0 dBm *
Dial backup manual *
Lookback timer - 15 min *
Jack type RJ11
Line current disconnect long
Long space disconnect disabled *
V.22 guard tone disabled

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

SPEAKER OPTIONS
Volume low
On until carrier detect

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

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
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

∗Indicates variation from factory option set #1

Factory Option Set # 8
(Synchronous 2-wire Leased Line Forced Answer) (AT&F8)

MODEM OPTIONS
DCE rate - 33600
V.34 modulation *
V.34 rate threshold low *
V.34 asymmetric rate disabled *
Forced answer *
Fast train disabled
Auto retrain enabled
SQ auto rate disabled
Transmit clock internal
Leased line, 2-wire *
Transmit level - 0 dBm*
Dial backup manual *
Lookback timer - 15 min *
Jack type RJ11
Line current disconnect long
Long space disconnect enabled
V.22 guard tone disabled

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 control 0 *
V.42 fast detect disabled *

SPEAKER OPTIONS
Volume low
On until carrier detect

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

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
Autocallback disabled

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

*Indicates variation from factory option set #1

Factory Option Set #9

(Synchronous V.25bis Dialer) (AT&F9)

MODEM OPTIONS
DCE rate - 33600
Modulation automode
V.34 rate threshold low *
V.34 asymmetric rate disabled *
Normal originate
Fast train disabled
Auto retrain enabled
SQ auto rate disabled
Transmit clock internal
Dial line
Jack type RJ11
Line current disconnect long
Long space disconnect disabled
V.22 guard tone disabled

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 control 0 *
V.42 fast detect disabled *

SPEAKER OPTIONS
Volume low
On until carrier detect

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

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
Autocallback disabled

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

∗Indicates variation from factory option set #1

Appendix F
ASCII and EBCDIC Characters

Hexadecimal equivalents of binary and decimal numbers are as follows.

Binary	Decimal	Hexadecimal
0000	0	0
0001	1	1
0010	2	2
0011	3	3
0100	4	4
0101	5	5
0110	6	6
0111	7	7
1000	8	8
1001	9	9
1010	10	A
1011	11	B
1100	12	C
1101	13	D
1110	14	E
1111	15	F

Hexadecimal Examples:

0101	1011	=5B hex
1001	1101	=9D hex
1110	0010	=E2 hex

The following table lists ASCII decimal, hexadecimal, and equivalent character values, and EBCDIC characters. The table shows only available keyboard symbols. Control keys are shown in the right column of the first table.

ASCII Symbol	Decimal	Hex	EBCDIC	Control Key
(NUL)	0	00	NU (null)	@
(SOH)	1	01	SH (start of header)	A
(STX)	2	02	SX (start of text)	B
(ETX)	3	03	EX (end of text)	C
(EOT)	4	04	PF	D
(ENQ)	5	05	HT (horizontal tab)	E
(ACK)	6	06	LC (lower case)	F
(BEL)	7	07	delete	G
(BS)	8	08	--	H
(HT)	9	09	--	I
(LF)	10	0A	(SMM)	J
(VT)	11	0B	VT (vertical tab)	K
(FF)	12	0C	FF (form feed)	L
(CR)	13	0D	CR (carriage return)	M
(SO)	14	0E	SO (shift out)	N
(SI)	15	0F	SI (shift in)	O
(DLE)	16	10	DL (data link escape)	P
(DC1)	17	11	D1 (device control 1)	Q
(DC2)	18	12	D2 (device control 2)	R
(DC3)	19	13	D3 (device control 3)	S
(DC4)	20	14	RE (restore)	T
(NAK)	21	15	NL (new line)	U
(SYN)	22	16	BS (back space)	V
(ETB)	23	17	IL (light)	W
(CAN)	24	18	CN (cancel)	X
(EM)	25	29	EM (end of message)	Y
(SUB)	26	1A	CC	Z
(ESC)	27	1B	C1 (CU1)	[
(FS)	28	1C	FS (form separator)	\
(GS)	29	1D	GS (group separator)	]
(RS)	30	1E	RS (record separator)	^
(US)	31	1F	US (unit separator)	DEL
(SP)	32	20	DS	--

ASCII Symbol	Decimal	Hex	EBCDIC	Control Key
!	33	21	SS (SOS)	--
"	34	22	--	--
#	35	23	--	--

ASCII Symbol	Decimal	Hex	EBCDIC
$	36	24	CP (bypass)
%	37	25	LF (line feed)
&	38	26	EB (end of block)
'	39	27	EC (escape)
(	40	28	--
)	41	29	--
*	42	2A	SM
+	43	2B	C2 (CU2)
,	44	2C	--
-	45	2D	EQ (enquiry)
.	46	2E	AK (acknowledgment)
/	47	2F	BL (bell)
0	48	30	--
1	49	31	--
2	50	32	SY (sync)
3	51	33	--
4	52	34	PN
5	53	35	--
6	54	36	UC (uppercase)
7	55	37	ET (end of transmission)
8	56	38	--
9	57	39	--
:	58	3A	--
;	59	3B	C3 (CU3)
<	60	3C	D4 (device control 4)
=	61	3D	NK (no acknowledgment)
>	62	3E	--
?	63	3F	SB (substitute)
@	64	40	space
A	65	41	--
B	66	42	--

ASCII Symbol	Decimal	Hex	EBCDIC
C	67	43	--
D	68	44	--
E	69	45	--
F	70	46	--
G	71	47	--
H	72	48	--
I	73	49	¢ (cent)
J	74	4A	. (period)
K	75	4B	< (less than)
L	76	4C	((open parenthesis)
M	77	4D	+ (plus)
N	78	4E	--
O	79	4F	& (ampersand)
P	80	50	--
Q	81	51	--
R	82	52	--
S	83	53	--
T	84	54	(leading pad)
U	85	55	--
V	86	56	--
W	87	57	--
X	88	58	--
Y	89	59	! (exclamation)
Z	90	5A	$ (dollar sign)
[	91	5B	* (asterisk)
\	92	5C	) (close parenthesis)
]	93	5D	; (semicolon)
^	94	5E	^ (caret or ¬)
_	95	5F	--
`	96	60	/ (ACK1)
a	97	61	--
b	98	62	--
c	99	63	--
d	100	64	--
e	101	65	--
f	102	66	--
g	103	67	--
h	104	68	--
i	105	69	--

ASCII Symbol	Decimal	Hex	EBCDIC
j	106	6A	|
k	107	6B	,
l	108	6C	%
m	109	6D	_
n	110	6E	>
o	111	6F	?
p	112	70	ACK0
q	113	71	--
r	114	72	--
s	115	73	--
t	116	74	--
u	117	75	--
v	118	76	--
w	119	77	--
x	120	78	--
y	121	79	' (single quote)
z	122	7A	: (colon)
{	123	7B	# (pound)
|	124	7C	@ (at)
}	125	7D	' (apostrophe)
~	126	7E	= (equal)
DEL	127	7F	" (double quote)
--	128	80	--
--	129	81	a
--	130	82	b
--	131	83	c
--	132	84	d
--	133	85	e
--	134	86	f
--	135	87	g
--	136	88	h
--	137	89	i
--	138	8A	--
--	139	8B	--
--	140	8C	≤ (less than or equal)
--	141	8D	(
--	142	8E	+

ASCII Symbol	Decimal	Hex	EBCDIC
--	143	8F	--
--	144	90	--
--	145	91	j

Decimal	Hex	EBCDIC
146		
147	93	l
148	94	m
149	95	n
150	96	o
151	97	p
152	98	q
153	99	r
154	9A	--
155	9B	--
156	9C	x
157	9D	)
158	9E	±
159	9F	--
160	A0	--
161	A1	~
162	A2	s
163	A3	t
164	A4	u
165	A5	v
166	A6	w
167	A7	x
168	A8	y
169	A9	z
170	AA	--
171	AB	Î
172	AC	È
173	AD	[
174	AE	Š
175	AF	•
176	B0	S0 (SM0)
177	B1	S1 (SM1)

Decimal	Hex	EBCDIC
178	B2	S2 (SM2)
179	B3	S3 (SM3)
180	B4	S4 (SM4)
181	B5	S5 (SM5)
182	B6	S6 (SM6)
183	B7	S7 (SM7)
184	B8	
185	B9	S9 (SM9)
186	BA	--
187	BB	°
188	BC	
189	BD	] (close bracket)
190	BE	≠ (not equal)
191	BF	--
192	C0	{ (open brace)
193	C1	A
194	C2	B
195	C3	C
196	C4	D
197	C5	E
198	C6	F
199	C7	G
200	C8	H
201	C9	I
202	CA	--
203	CB	--
204	CC	(unprintable character)
205	CD	--
206	CE	(unprintable character)
207	CF	} (close bracket)
208	D0	J
209	D1	K
210	D2	L
211	D3	M
212	D4	N
213	D5	O
214	D6	P
215	D7	Q
216	D8	R
217	D9	--

Decimal	Hex	EBCDIC
218	DA	--
219	DB	--
220	DC	--
221	DD	--
222	DE	--
223	DF	--
224	E0	\ (back slash)
225	E1	--
226	E2	S
227	E3	T
228	E4	U
229	E5	V
230	E6	W
231	E7	X
232	E8	Y
233	E9	Z
234	EA	--
235	EB	--
236	EC	(unprintable character)
237	ED	--
238	EE	--
239	EF	--
240	F0	0
241	F1	1
242	F2	2
243	F3	3
244	F4	4
245	F5	5
246	F6	6
247	F7	7
248	F8	8
249	F9	9
250	FA		
251	FB	--
252	FC	--
253	FD	--
254	FE	--
255	FF	(trailing pad)

A

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

B

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

C

C	Celsius
CA	Circuit Assurance
CC	Carrier Control
CCITT	International Consultative Committee for Telegraph and Telephone
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

CO	Central Office
COS	Call Originate Status
CR	Carriage Return
CRC	Cyclic Redundancy Check
CRQ	Call Request
CTRL	Control Field
CTS, CS	Clear to Send

D

DAA	Data Access Arrangement (AT&T)
dB, db	Decibel
dc	Direct Current
DCE	Data Communications Equipment (modem)
DCD	Data Carrier Detect
DCPSK	Differentially Coherent Phase-Shift Keying
DIC	Disregard Incoming Call
DIS, DS	Disable
DLE	Data Link Escape
DLO	Data Line Occupied
DMS	Digital Multiplexer System
DOS	Disk Operating System
DPR	Digit Present
DSR	Data Set Ready
DTE	Data Terminal Equipment
DTMF	Dual Tone Multi Frequency
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

FB	Fallback
FCC	Federal Communications Commission
FF	Form Feed
FGND	Frame Ground
FL	Flag
FLL	Fixed loss loop
FM	Frequency Modulation
Fox message	Test message
FSK	Frequency-Shift Keying

H

HDLC	High Level Data Link Control
Hz	Hertz (cycles per second)

I

INC	Incoming Call
IC	Industry Canada
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

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	Loopback Options
LCD	Liquid Crystal Display OR Line Current Disconnect
LDL	Local Digital Loopback
LED	Light Emitting Diode
LF	Line Feed
LL	Local Loopback
LO	Line Occupancy
LRC	Longitudinal Redundancy Check
LSD	Long Space Disconnect
LSO	List of Stored Options
LSV	List Version

M

mA	Milliamps
MHz	MegaHertz
Modem	Modulator/Demodulator
MR	Modem Ready
ms	Millisecond

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,	Programmable PR
PROM	Programmable - Read Only Memory
PSK	Phase Shift Keying
PSTN	Public Service Telephone Network
PWI	Power Indication

Q

QAM	Quadrature Amplitude Modulation

R

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
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

SD	Send Data

SDLC	Synchronous Data Link Control (IBM)
SGND, SG	Signal Ground
SH	Switch Hook
SNR	Signal / Noise Ratio
SPID	Service Profile Identifier
SQ	Signal Quality
SQM	Signal Quality Monitor
SS	Systems Status
STX	Start of Text
SYN	Synchronization Character

T

TC	Transmit Clock
TD	Transmit Data
TE	Terminal Equipment
TEI	Terminal Endpoint Identifier
TELCO	Telephone Company
TELSET	Telephone Set
TM	Test Mode
TP	Test Pattern
TR	Terminal Ready
TST	Test
TX	Transmit

U

UART	Universal Asynchronous Receiver/Transmitter
USOC	Universal Service Ordering Code

V

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

X

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

Appendix H
Flash Upgrade

Update your V.3600 modem easily using this flash upgrade procedure.

What You Need

- A data communications software package that supports a 57.6 kbps DTE rate and "X modem CRC" protocol
- Flash upgrade file

Look for modem software upgrades on the Web at this address:

> http://www.mot.com/MIMS/ISG/Service_Support/software.html

Steps For Downloading

IMPORTANT: Do not abort this process, once started!

1) Activate your data communications software package, and set up your DTE for 57.6 kbps.
2) Enter AT.
   You should receive an OK response message.
3) Enter AT%P1=*password (8 digits)*
   > For example: AT%P1=12345678
   This entry sets a soft download password. (See the AT command set for further information on the %P commands if needed.)
   You should receive an OK response message.
4) Enter
   AT$Y=password (8 digits)
   For example:
   AT$Y=123456768
   You should receive this response message:
   SOFTLOAD XM86-1
   READY

   This means that your modem is ready to be upgraded.

5) From your terminal software package, send the "flash upgrade file" to the modem. You know the download is working because the LCD displays:
   FLASH UPGRADE
   IN PROGRESS

📖 **Note**
   Be sure you use the "X modem CRC" protocol.

The modem automatically resets after the upgrade is complete. The process can take several minutes.

One of two messages returns.

> DOWNLOAD OK

indicates a successful upgrade.

> DOWNLOAD ERROR

indicates a problem with the download.

Enter ATI3 if you want to verify the latest software update.

Troubleshooting

1) You did not choose the correct download protocol.
   > <u>Response:</u> Repeat the process.

2) The upgrade flash file is corrupted.
   > <u>Response:</u> Get a clean file and redo the steps.

3) If all else fails:
   > <u>Response:</u> See the "Calling Technical Support" section on page 12-2

Appendix I
Country-Specific Parameters

Modems are pre-configured for a country or region of operation. These default options vary by country.

The tables that follow show, for countries or regions with changes, the default parameter option, the available options, and any other country-specific information.

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India

Command	Command Name	Default Option	Available Options
ATS0	Ring Count to Answer On	0	0 - 255
ATS6	Blind Dial	4	4
L	Call Time-Out	30	1 - 60
ATS10	DCD Loss Disconnect	14	0 - 255
ATP or ATT	Dial Type	0	0, 1
AT*TD or ATS51	Dial Transmit (Tx) Level	10	0 - 15
	Dial Wait	8	
ATS11	DTMF Tone Length	80	50 - 255
AT&G	Guard Tone	0	0, 1, 2
ATH1	LAL Busy Out	Allowed	
AT*TL or ATS52	Leased-Line Transmit (Tx) Level	0	0 - 15
ATS8	Pause Delay	4	4 - 12
AT&P	Pulse Dial Cycle	0	0, 1
AT\T or ATS58	Terminal Inactivity Timer	0	0 - 255
Other country-specific restrictions:			
(None)			
The characters **AT** or **at** precede all commands except: **+++**, **#####**, and **A/**			

Japan

Command	Command Name	Default Option	Available Options
ATS0	Ring Count to Answer On	0	0 - 255
ATS6	Blind Dial	4	4 - 255
L	Call Time-Out	45	1 - 110
ATS10	DCD Loss Disconnect	14	0 - 255
ATP or ATT	Dial Type	0	0, 1
AT*TD or ATS51	Dial Transmit (Tx) Level	15	1 - 15
	Dial Wait	10	
ATS11	DTMF Tone Length	80	50 - 255
AT&G	Guard Tone	0	0, 1, 2
ATH1	LAL Busy Out	Allowed	
AT*TL or ATS52	Leased-Line Transmit (Tx) Level	1	1 - 15
ATS8	Pause Delay	2	2
AT&P	Pulse Dial Cycle	0	0, 1
AT\T or ATS58	Terminal Inactivity Timer	0	0 - 255
Other country-specific restrictions:			
The following dial modifiers are not permitted: , = < >			
The characters **AT** or **at** precede all commands except: **+++**, **#####**, and **A/**			

Malaysia

Command	Command Name	Default Option	Available Options
ATS0	Ring Count to Answer On	0	0 - 255
ATS6	Blind Dial	2	0 - 255
ATS7	Call Time-Out	30	0 - 255
ATS10	DCD Loss Disconnect	14	0 - 255
ATP or ATT	Dial Type	0	0, 1
AT*TD or ATS51	Dial Transmit (Tx) Level	10	0 - 15
	Dial Wait	10	
ATS11	DTMF Tone Length	80	50 - 255
AT&G	Guard Tone	0	0, 1, 2
ATH1	LAL Busy Out	Allowed	
AT*TL or ATS52	Leased-Line Transmit (Tx) Level	0	0 - 15
ATS8	Pause Delay	2	0 - 255
AT&P	Pulse Dial Cycle	0	0, 1
AT\T or ATS58	Terminal Inactivity Timer	0	0 - 255
Other country-specific restrictions:			
(None)			
The characters **AT** or **at** precede all commands except: **+++**, **#####**, and **A/**			

Universal/International

Command	*Command Name*	*Default Option*	*Available Options*
ATS0	Ring Count to Answer On	0	0 - 255
ATS6	Blind Dial	3	1 - 255
ATS7	Call Time-Out	60	0 - 255
ATS10	DCD Loss Disconnect	15	0 - 255
ATP or ATT	Dial Type	0	0, 1
AT*TD or ATS51	Dial Transmit (Tx) Level	9	0 - 20
	Dial Wait	2	
ATS11	DTMF Tone Length	72	50 - 255
AT&G	Guard Tone	0	0, 1, 2
ATH1	LAL Busy Out	Allowed	
AT*TL or ATS52	Leased-Line Transmit (Tx) Level	0	0 - 20
ATS8	Pause Delay	3	0 - 255
AT&P	Pulse Dial Cycle	1	0, 1
AT\T or ATS58	Terminal Inactivity Timer	0	0 - 255
Other country-specific restrictions:			
(None)			
The characters **AT** or **at** precede all commands except: **+++**, **#####**, and **A/**			

U. S. A.

Command	Command Name	Default Option	Available Options
ATS0	Ring Count to Answer On	1	0 - 255
ATS6	Blind Dial	2	1 - 255
ATS7	Call Time-Out	30	0 - 255
ATS10	DCD Loss Disconnect	14	0 - 255
ATP or ATT	Dial Type	0	0, 1
AT*TD or ATS51	Dial Transmit (Tx) Level	10	9 - 30
	Dial Wait	10	
ATS11	DTMF Tone Length	80	50 - 255
AT&G	Guard Tone	0	0, 1, 2
ATH1	LAL Busy Out	Allowed	
AT*TL or ATS52	Leased-Line Transmit (Tx) Level	0	0 - 30
ATS8	Pause Delay	2	0 - 255
AT&P	Pulse Dial Cycle	0	0, 1
AT\T or ATS58	Terminal Inactivity Timer	0	0 - 255
Other country-specific restrictions:			
(None)			
The characters **AT** or **at** precede all commands except: +++, #####, and **A/**			

Service and Support

Introduction

U.S.A. customers who have questions about Motorola Internet and Networking Group products or services should refer to the following sections. Non-U.S.A. customers should contact their local Motorola ING subsidiary office or distributor.

Questions About Product Shipment or Technical Assistance

Please call the nearest Motorola Internet and Networking Group representative, or Customer Administration at (800) 544-0062.

To Access the Motorola ING Internet Web Pages

Additional company and product information can be found on our Internet Web site: **http://www.mot.com/ING/**

Sales-Related Issues

Call your local Motorola Internet and Networking Group sales office, authorized distributor, or the Sales Assistance Center at (800) 446-0144.

Information on Product Training

For information on classroom training, or customized on-site training, or to order self-study training materials, call the Sales Assistance Center at (800) 446-0144.

Questions About Billing

If you have a question about billing, call 1-800-446-0144 and select option 2.

Comments About the Guide

To help us improve our product documentation, please complete and return the prepaid comment card in this guide.

To Order Additional Motorola ING User Documentation

To order additional copies of Motorola Internet and Networking Group user documentation, call (508) 261-5933.

Motorola Limited Hardware Warranty

Two Year Limited Hardware Warranty

Motorola, Inc. warrants this product against defects in hardware material and workmanship under normal use for two (2) years from the date of original retail purchase. Motorola, at its option, will, at no charge, either repair the product (with new or reconditioned parts), or replace it (with a new or reconditioned product), or refund the purchase price of the product during the warranty period. Repaired/replacement products are warranted for either 90 days or the remainder of the original warranty period, whichever is longer. This warranty extends to the original end-user only.

What This Warranty Does Not Cover

This warranty does not cover: (a) software; (b) installation or service of the product; (c) conditions resulting from consumer damage such as improper maintenance or misuse, abuse, accident or alteration; (d) all plastic surfaces (including screens) and all other exposed parts that are scratched or damaged due to normal use; (e) the operation of our products with equipment not supplied by Motorola; (f) products which have had the serial number removed or made illegible; or (g) products rented to others.

This warranty applies only to hardware products manufactured by or for Motorola and identified by the Motorola trademark, trade name or product identification logo affixed to them.

Refer to the Service and Support section of the User's Guide for service after the warranty expires. No warranty is made as to coverage availability or grade of service provided by the carrier.

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HOW TO USE MOTOROLA'S LIMITED WARRANTY SERVICE

To take advantage of this warranty, you must do the following:

If you are having trouble with your modem, contact Motorola using the appropriate number from the Service and Support section of the User's Guide. If it is determined that your product requires service, you will be issued a Return Materials Authorization ("RMA") number.

- Pack the defective product securely for shipping. Include only the Motorola product or products that are defective.
- This warranty is void if the product is damaged in transit. Insure your shipment.
- Ship the defective product, proof of date of purchase, and the RMA number to the address specified in the Return Materials Authorization.
- Display your RMA number prominently on the outside of the shipping box.
- To ensure prompt service, please include a letter indicating the specific cause for returning the product.

Motorola ING
20 Cabot Boulevard
Mansfield, Massachusetts 02048

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