GENERAL

This chapter contains a functional description of the modem.

CONTROLS AND INDICATORS

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

LED DESCRIPTIONS

The LEDs display modem status during various operations.

Request to Send

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

Clear to Send

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

Quality Monitor

QM - lights when poor signal quality produces a bit error rate of 1 x 10⁴ or greater. This signal is output on EIA-232 pin 11.

Carrier Detect

CD - lights when the received audio carrier signal is detected or, if enabled, when V.42 negotiation is complete. This signal is output on EIA-232 pin 8.

Received Data

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

Transmit Data

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

TALK (on the "L" model)

TALK - lights to indicate the unit is in talk mode; it is only on the model without the LCD.

POWERUP

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

Quick Startup Procedure

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

• Ensure the modem is installed according to the instructions in Chapter 2.

• Turn on the computer and the modem.

Manual Dialing

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

• Press TALK/DATA. The display will show V.32 9600 TALK.

• If the remote modem is set for autoanswer a high pitched tone (2100 Hz answer back tone) is heard.

• Pick up the handset and dial the phone number of the remote modem.

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

The display shows TRAINING as the modems negotiate a connection and then ONLINE when the connection is made.

Manual Answering

The modem will autoanswer in both TALK or IDLE mode. To manually answer the phone for conversation, set the front panel to TALK and the autoanswer

register (S0) to a ring count value high enough to allow answering the call before autoanswer does.

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

Autodial (Front Panel)

• Starting at the V.32 9600 IDLE display, press NO. The display advances to DIAL STORED NUMBER?

• Respond to the prompts until you reach the desired number to dial.

• Press YES. The modem will proceed through the dial sequence and establish a connection.

• You can follow this sequence of events by observing the LCD and listening to the speaker.

AT Command Dialing

• Starting from V.32 IDLE or TALK and using a computer in terminal mode, enter ATD and the telephone number to dial or ATDS and the memory location to dial. When the enter key is pressed the dial sequence starts. You can follow the status of the dial sequence by observing the monitor screen and listening to the speaker.

Software Communication Packages

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

ERROR CONTROL

The modem provides error detection and automatic retransmission of data upon detection of an error. The retransmission buffer is 2048 bytes long and can accommodate a maximum of eight frames. Microcom Networking Protocol (MNP) levels 2, 3, 4, and 5 are supported. Level 2 is the asynchronous link version, level 3 is the synchronous link version, level

4 is synchronous with optimized headers for increased efficiency, and level 5 implements data compression for increased data throughput. When making a call in dial mode, the modem negotiates the highest protocol common to both modems. If the connection cannot be established the modem continues through successive protocols until all are tried or a connection is made.

FLOW CONTROL

Flow control adjusts for differences in speed between the modem and DTE. The DTE can operate at a constant speed independent of the bit rate of the modem.

Flow control works in both directions. The modem can start and stop the DTE transmitter and the DTE can start and stop the modem transmitter. Both inband and out-of-band flow control are implemented. Inband methods employ the characters DC1/DC3 (11 hex / 13 hex). Out-of-band flow control is accomplished with the CTS and RTS interface leads.

AUTOBAUD

Autobaud is accomplished by sending the AT to the modem. The protocol processor allows the modem to automatically detect DTE speed and adjust to communicate with the DTE at that rate (autobaud). The protocol processor will default to 9600 bps. Autobaud also detects the character size and parity used by the DTE.

> *Note: Autobaud overrides the LCD selection for DTE speed, character length, and parity.*

4-WIRE OPERATION

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

> *Note: One modem must be configured for forced answer and MNP options must be the same on both ends of a 4-wire leased line for the connection to be successful.*

> *Note: 4-wire leased line mode supports 4800 and 9600 rates only and incorporates a CCITT V.33-like training sequence. The modem will not connect with a 4-wire leased line modem using a CCITT V.32 type training sequence.*

2-WIRE OPERATION

When configured for 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 is used to connect a 2-wire PSTN line for dial backup. The leased line connects the local and remote modems directly and dialing is not necessary. One of the modems must be configured for FORCED ANSWER. When connected via leased line the modems will train and begin communicating with each other.

2-Wire Dial-Up Operation

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

Connection to the telephone network is through the DIAL jack. A standard telephone connects to the TELSET / LEASED LINE jack.

REMOTE CONFIGURATION

This mode of operation allows the user to view or modify the option set of a remote modem. Remote configuration is initiated by the local (master) modem through a routine incorporating remote digital loopback, a security code, and an acknowledgment from the remote (slave) unit to be modified. The security code is user programmable and provides protection from unauthorized entry. Refer to Remote Configuration in Chapter 5.

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

The correct code must be received by the remote modem before remote configuration can be established. Once established, the local DTE becomes a virtual terminal and can serve both local and remote modems. Upon initiation of remote configuration, the local DTE is serving the remote modem.

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

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

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

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

SECURE OPERATION

Secure operation provides password protection against unauthorized dial-up access. The security feature can be enabled with AT commands when operating on a dial-up system and requires the secure modem to be set for MNP or buffered mode.

Security may be enabled or disabled. TXD and RXD are suppressed to the host DTE before and during security validation; all other signals (CTS, DSR, RI, etc.) operate as optioned. After the password has been validated, the modem operates like a standard V.32 unit. Security has no front panel operation except for the RESET SECURITY? prompt located in the FACTORY OPTIONS submenu. Resetting security clears both passwords and turns security off.

Operating Without Security

The modem operates like a standard V.32 except several additional AT commands are available to access security. With these commands, any user can set the passwords and turn security on when the modem is not already secure.

Operating With Security

A secure modem will not allow data transfer with 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 the primary reason for security is to prevent unauthorized dial-up access.

Remote Operation

The remote modem must pass security validation before the secure modem will allow data transfer. If accessing a secure remote modem, once communication has been established, the remote modem prompts the originator with

PLEASE ENTER YOUR PASSWORD ==>

To   Respond to the password prompt

Enter $ as a lead-in character followed by the password.

After receiving the $ the modem collects up to ten characters until the user presses the carriage return. Entering more than ten characters is illegal and causes the secure modem to disconnect. After receiving a valid password the secure modem sends PW ACCEPTED to the originating modem.

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. The EIA-232 signals to the DTE are not affected by security.

Passwords

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

sign, a comma, and a space. Passwords are case sensitive.

The passwords have the same priority level and may be substituted for each other. This can be helpful in some situations, such as when the user forgets one of the passwords.

LCD Indication of Security

The front panel LCD indicates whether security is enabled or not. If disabled, screens referring to security do not appear on the LCD. If enabled, main #1 consists of the following display:

```
SECURE 9600
XXXX
```

Security Reset

The only security operation available through the front panel menu is RESET SECURITY. If the user forgets both passwords this option will reset security to its initial state (off and with no passwords stored) and can be thought of as a restore-factory-options command. This option is located under the LOAD FACTORY OPTIONS menu:

```
RESET
SECURITY?
```

PUSHBUTTON ACTION

YES -   Advances to ERASE ALL SECURITY INFO?

NO, TALK/DATA -   Returns to submenu LOAD OR STORE OPTION SET?

Security Commands

The following AT commands operate security:

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

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

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

AT$E=x — Enables security where x is either password.

AT$E? — Displays the current status of security (on or off).

AT$D=x — Disables security where x is either password.

**AT$D?** — Displays the current status of security (on or off). Same as AT$E?

AT$DR — This command resets security to its initial state (off with no passwords stored).

x and y indicate passwords

Restrictions in Security Operation

The following conditions will cause the modem to disconnect.

- Caller is 300 bps
- Caller is synchronous
- Secure modem has protocol or buffers disabled
- Caller gives wrong password

These restrictions apply only when security is enabled.

DIAL BACKUP*

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

- Automatic - backup due to extended loss of carrier or 4 unsuccessful retrains in 3 minutes
- Manual - user determined using front panel controls or *LB or *LD commands.

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

Both methods will cause the modem to dial the prestored autodial number. The originate modem will go to idle mode for 5 seconds and then initiate the call. The answer modem will remain idle while looking for a ring. The modems then connect 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 from the front panel or AT command. 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 will terminate when the modem performs a leased line lookback.

* Not supported in V.22 mode.

PLACING A CALL

Direct Connect with a Standard Telephone

• Lift the telephone receiver. Set the LCD to with a TALK. Wait for the dial tone.

• Dial the number of the remote site.

• When the answer back tone is heard, immediately press the TALK/DATA button. The originating modem goes off hook and normal operation will begin within 30 seconds. If not, hang up and return to the first step.

• After the link is established, hang up the telephone.

Direct Connect with an Exclusion Key Telephone

• Place the LCD in IDLE mode and the telephone in voice mode (pull the exclusion key button up). Wait for a dial tone.

• Dial the number of the remote site.

• The remote modem answers with a 2100 Hz answer back tone. If the remote modem does not answer, hang up and return to the first step.

• When the answer back tone is heard, place the telephone in data mode (push the exclusion key button down).

• The originating modem goes off hook and normal operation begins within 30 seconds. If a successful connection is not established, return to the first step.

Autodial From Front Panel

• Advance the LCD to main #6, DIAL STORED NUMBER.

• Select number to dial and press YES to dial. Operation begins in 30 seconds. If not, press the TALK/DATA button and return to the first step.

Autodial with the AT Command Set

- To dial a number, for example 555-1212, type ATD 555-1212 carriage return.

- To dial a stored number type ATD Sn (n=1-9) and a carriage return.

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

Refer to the Dial Commands section in Chapter 5 for additional dialing commands.

ANSWERING A CALL

Autoanswer

Autoanswer by the modem is the normal configuration. Pressing TALK/DATA switches between IDLE and TALK. The modem will answer an incoming call in either mode. If TALK is selected, a telephone plugged into the telset jack will also ring.

| V.32 9600 IDLE | or | V.32 9600 TALK |

Manual Answer

On ring detection the modem front panel displays:

| V.32 9600 RINGING |

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

CALL TERMINATION

The following conditions cause call termination:

- Abort Disconnect (No answer, busy signal, no modem, etc.)   Default 30 sec. Selectable 1 to 30 sec.

- ATH   Disconnect command.

- Loss of Carrier Disconnect   Selectable 100 ms to 25.5 sec.

- Receive Long Space Disconnect   Selectable for disable or 2 sec.

- DTR Disconnect   Selectable for disabled or 10 ms to 2.55 sec.

- LCD Display   When TALK/DATA is pressed LCD displays DO YOU WANT TO GO TO TALK? When YES is pressed modem hangs up if no telset is connected or if the connected telset is not off hook. Pressing NO displays DO YOU WANT TO DISCONNECT? Pressing YES then disconnects.

- Protocol Link Establishment Failure   Reliable mode only. Failure to establish reliable link.

- Protocol Inactivity Timeout   Default (0) disabled. Software selectable for disabled or 1 to 255 minutes.

- Protocol Retry Limit Exceeded   12 retransmissions of the frame.

- Signal Quality   Leased line operation with dial backup enabled. Extended loss of carrier or 4 unsuccessful retrains in 3 minutes.

- Modem power is turned off.

V.32 Cleardown

V.32 cleardown is a method of call termination specified in the CCITT recommendation. The cleardown method incorporates a training sequence which ends with a command to disconnect. If long space disconnect is disabled, the cleardown sequence is activated by the ATH2 command.