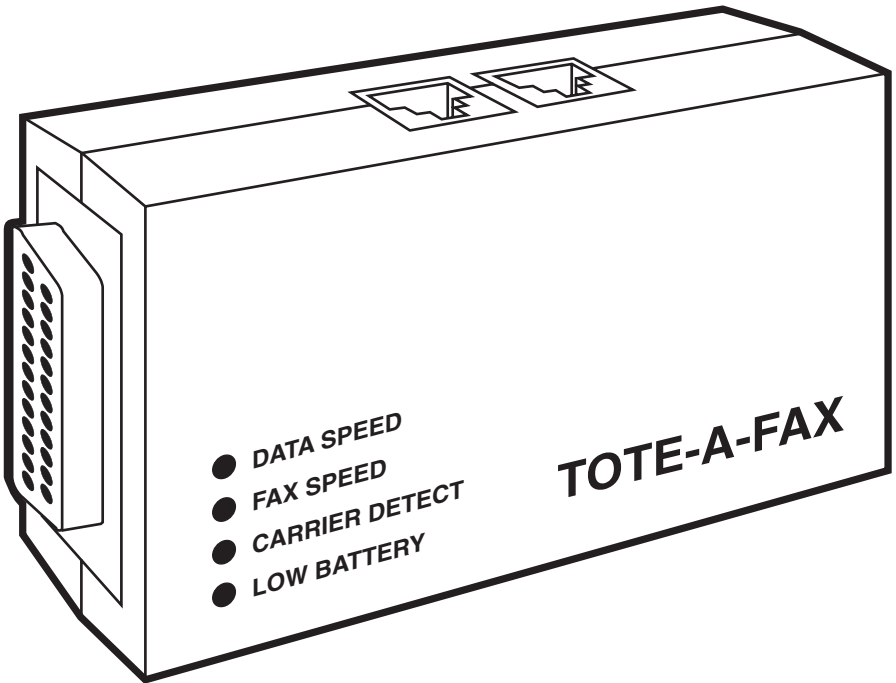




Tote-A-Fax



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**FEDERAL COMMUNICATIONS COMMISSION
RADIO FREQUENCY INTERFERENCE STATEMENT**

Class B Digital Device. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. This equipment has been tested and found to comply with the limits for a Class B computing device pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or telephone reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and the receiver.
- Connect the equipment to an outlet on a circuit different from that to which the receiver is connected.
- Consult an experienced radio/TV technician for help.

CAUTION!

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

To meet FCC requirements, shielded cables and power cords are required to connect this device to a personal computer or other Class B certified device.

This digital apparatus does not exceed the Class B limits for Radio noise emission from digital apparatus set out in the Radio Interference Regulation of Industry Canada

Le présent appareil numérique n'émet pas de bruits radioélectriques dépassant les limites applicables aux appareils numériques de la Classe B prescrites dans le Règlement sur le brouillage radioélectrique édicté par Industrie Canada.

1. Specifications

Standards — Data: Bell 103, 212A; CCITT V.21, V.22, V.22bis

Speed — Data: 300, 1200, or 2400 bps (with acoustic coupler, 300 or 1200 bps)

Format — Serial, binary, synchronous, asynchronous

Operation — Full- or half-duplex, dialup; compatible with acoustic coupler

Automatic Operations — Auto-answer; autodial; automatic rate selection; automatic detection of data call

Command Support: — Compatible with the standard AT Command Set for 2400 bps, plus Extended AT Command Set for fax operation; special “ATI4” command for online help

Interface — DCE: EIA RS-232C and CCITT V.24 (DTE must support DTR, DCD, and CTS); Telephone: 2-wire balanced, direct-connect; Acoustic coupler: Special adapter included for direct connection to Radio Shack model 26-3813, 26-3805A, or equivalent

Connectors — (1) DB25 female, (2) RJ-11C female

Dialing — Tone (DTMF) and Pulse (Bell or CCITT)

Call Progress — Dial-tone and Busy-tone detection

Audio Monitoring — Speaker

Indicators — Data/Speed, Carrier Detect (CD), Low Battery

Memory — Nonvolatile RAM allows storage of two (2) configuration profiles and four (4) telephone numbers

Transmit Level — -9 dbm

Power — 9 VDC @ 200 MA minimum: from alkaline battery. (battery life 3-4 hours), external adapter, or Pin 9 of DCE (DB25) connector; Standard miniature phone jack (3.5-mm); tip positive 9-12 VDC, sleeve ground

Diagnostics — Local digital and analog loopback, remote digital loopback

Size — 4.9" L x 2.8"W x 1" H (12.4 x 7.0 x 2.5 cm)

Weight: — 0.3 lb. (0.1 kg) without power supply or cables; 0.7 lb. (0.3 kg) with power supply

Operating Environment — 32° to 104° F (0° to 40° C); up to 95% relative humidity, non-condensing

2. Introduction

The portable Tote-A-Fax modem gives you the power to communicate with facsimile machines as well as other modems. It combines a 9600-bps Group III facsimile modem with a full-featured 2400-bps data modem. Because it's so small, and because it's battery-powered, the Tote-A-Fax is ideal for use with PC-compatible portable and laptop computers.

2.1 What's in the Package

Your Tote-A-Fax modem package includes the following:

- Tote-A-Fax modem
- 9-volt battery
- 7-foot modular telephone cord
- Acoustic Cup Adapter Cable (for use with Acoustic Cups)
- External AC Adapter
- This Installation and Operation Manual
- Tote-A-Fax Fax/Data Software and Manual
- Cable for connection to 25- or 9-pin computer serial port

2.2 Features and Functions of the Tote-A-Fax

1. Fax/Speed LED. *On* indicates that a fax transmission is taking place at 9600 bps. *Flashing* indicates fax transmission at 4800. *Off* indicates that no fax transmission taking place.
2. Data/Speed LED for Data Connections. *On* indicates that the modem is operating (in Data Mode) at 2400, bps; *flashing*, at 1200; *off*, at 300.
3. Carrier Detect-Data Mode LED. *On* indicates that a transmit carrier signal from the remote modem is present, and thus that the two modems are ready to communicate.
4. Low-Battery LED. *On* indicates that the battery needs to be charged.
5. RS-232C (DB25) Connector. Attaches the modem to the serial port of your computer, either directly or through an interface cable (DB25 or DB9-to-DB25).
6. Telephone Interface Jacks. The modular telephone cord fits into these jacks for direct connection to the telephone line. The jacks are identical; you can plug the phone line into

either one and a telephone (if you wish) into the other.

7. Acoustic Coupler Interface. Two-jack connection for the Acoustic Adapter Cable, which attaches to acoustic cups for connecting a handset to the phone line.
8. External AC Adapter Jack. Accepts the modem end of the External AC Adapter (connect the other end to the power source). (Since the AC adapter uses one of the same jacks as the Acoustic Coupler Interface, you cannot use an AC adapter and

the Acoustic Coupler Interface at the same time.)

9. Battery Compartment. Holds the 9-volt battery that powers the modem.
10. Registration/Serial Number Label. Shows the ID, registration number, and serial number of the modem.
11. DIP Switch (under the battery-compartment door).

Figures 2-1, 2-2, and 2-3 show you where you'll find all these features on your Tote-A-Fax.

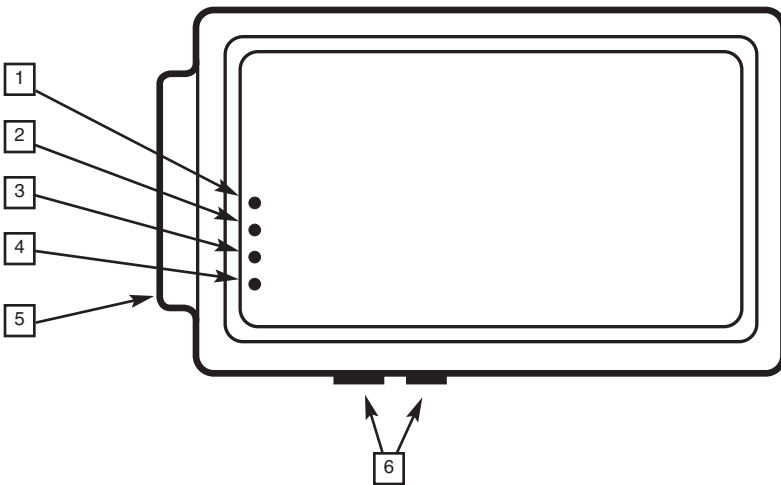


Fig. 2-1. Top View of the Tote-A-Fax.

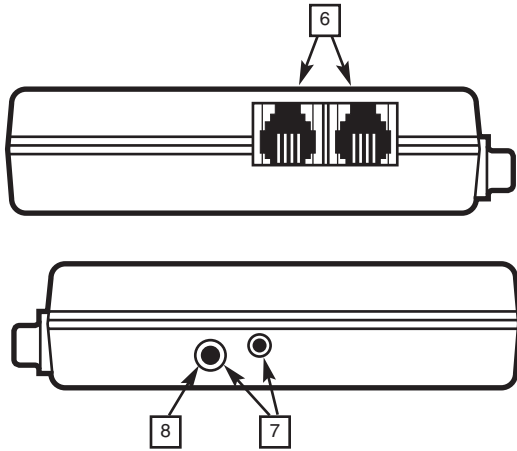


Fig. 2-2. Side Views of the Tote-A-Fax.

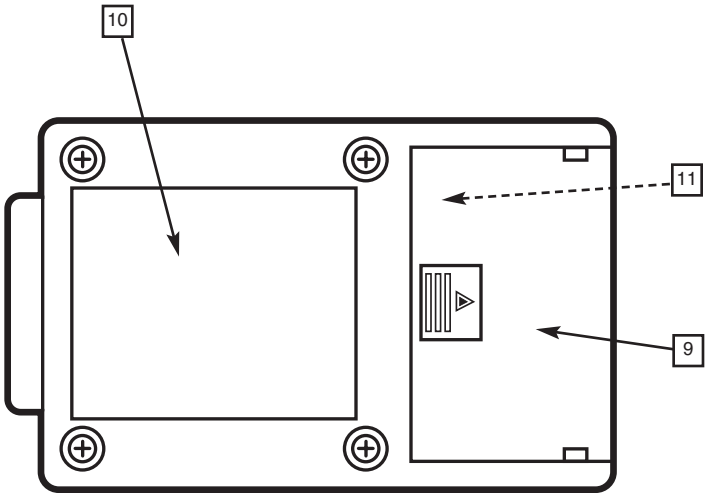


Fig. 2-3. Bottom View of the Tote-A-Fax.

2.3 Complying with Regulations

The use and application of the Tote-A-Fax are subject to government regulations. Different regulations apply, depending on the country or countries where you will be using it. Please refer to the **Appendix** for the information you must provide your telephone company, and for other government regulations that apply when you use the modem in the United States and internationally.

2.4 Conventions Used in This Manual

This manual uses the following conventions:

- **Bold** text represents what you, the user, enter through your computer keyboard.
- “[**CR**]” means that you press the RETURN or ENTER key (“Carriage Return”) on your keyboard.
- “Computer” and “DTE” are used interchangeably. Technically, DTE (Data Terminal Equipment) can be any equipment to which the modem is connected, but most users will probably be connecting the Tote-A-Fax to a computer.

3. Getting Connected

3.1 Powering Your Modem

Your Tote-A-Fax modem can be powered by one of three sources:

- An internal 9-volt battery
- An external AC Adapter
- Pin 9 of certain computers' DB25 connector

3.1.1 BATTERY OPERATION

Your Tote-A-Fax can run for about three or four hours on its internal 9-volt battery. (If you run the battery down too far when you're communicating, you risk losing your connection. Keep an eye on the Low Battery indicator, and use the AC adapter if you can't replace the battery promptly.)

In battery operation, the modem is turned on and off by signals received over one of two pins on the RS-232C connector. Which pin depends on the setting of Internal Jumper J1:

*Off:*Data Terminal Ready (DTR)—
Pin 20

*On:*Receive Transmission (RX)—Pin
2

3.1.2 DTE-SENSED BATTERY ON/OFF (DEFAULT)

The computer's RS-232 port uses a signal line called Data Terminal Ready (DTR)—pin 20 on your modem—to tell the modem that the computer is ready to communicate. The signal must be "high" for the two to communicate.

The computer changes the status of DTR to high when you load your communications software, or when you instruct the computer to enter Terminal Mode. The computer changes DTR to low when you exit your communications program or Terminal Mode.

If Jumper J1 is set to OFF, your modem will monitor DTR for a high signal. When DTR goes high, the modem turns on. After DTR goes low, the modem turns off.

3.1.3 RX-SENSED BATTERY ON/OFF

NOTE: This option should be used only if your computer does not support DTR—or if your Tote-A-Fax appears unable to dial a call under battery power, yet works with the AC adapter.

Your modem's Receive Transmission (RX) pin, Pin 2, receives data from your computer's Send Transmission (TX) pin, its Pin 2. If you set Jumper J1 to ON, the modem will look for negative voltage on RX as the sign to turn on.

In most cases, this means that the modem will turn on when you turn your computer on. The modem will turn off after the RX signal goes off, which requires that you either turn off the computer or disconnect the modem from the computer to save battery life.

NOTE: Because you are not using DTR to control the power, you should also command the modem to ignore DTR during operation. Send the command AT&D&W (see Section 3.4 for details).

3.1.4 INSTALLING THE BATTERY

Use only NEDA 1604A or equivalent alkaline battery. Rechargeable batteries are not recommended, because their life is about one-third that of alkaline batteries.

1. Hold the modem upside-down, with the DB25 connector facing you.
2. Place your thumb on the arrow of the battery cover.
3. Pressing down with your thumb, push the battery cover away from you.
4. Install the battery.
5. Replace the battery cover by aligning it on both sides of the compartment and sliding it towards you until it snaps shut.

3.1.5 USING AN EXTERNAL AC ADAPTER

An AC adapter may be used to power the modem where AC power is readily available.

When the external AC adapter is plugged in, the modem turns on and automatically disconnects the internal battery (if one is installed). This is the best way to power your modem if you are using it for extended periods of time or if you want to have the modem auto-answer incoming calls. You can leave the Tote-A-Fax turned on at all times without inhibiting its performance or decreasing its operating life.

The adapter connects to the modem via the AC Adapter jack (see Fig. 3-1).

NOTE: Remember, one of the jacks used by the Acoustic Coupler interface is the same jack occupied by the AC adapter cable. Thus, if you use an external adapter to power the modem, you will have to use the telephone interface jack to connect to the telephone line.

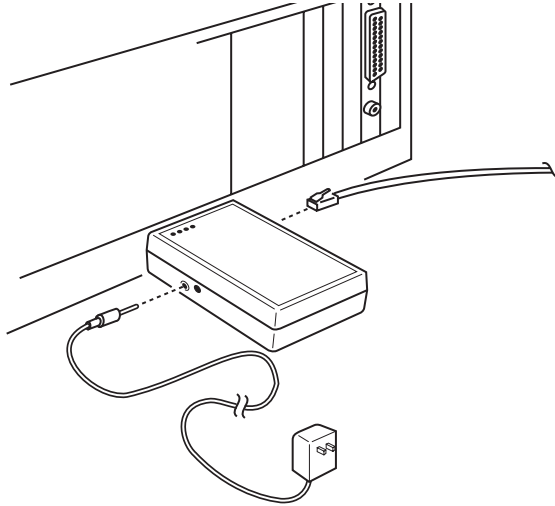


Fig. 3-1. Connecting the external AC adapter.

3.1.6 TAKING POWER FROM THE DB25 CONNECTOR

Some computers provide +12 volts on Pin 9 of the DB25 connector, allowing you to power your Tote-A-Fax directly from the computer.

NOTE: Most IBM personal computers and compatibles do NOT provide power on Pin 9. So don't use this method unless you are familiar with the technical specifications of your machine's RS-232C port.

When +12 volts are present on pin 9, the internal battery (if any) disconnects automatically and the modem turns on.

Setting the modem for DB25 powering is a technical matter that should be not undertaken except by

a qualified technician. Call Black Box for technical support.

3.2 Connecting Your Modem

Your Tote-A-Fax connects to the computer on one side and the telephone line on the other. This section explains how to make those connections.

3.2.1 CONNECTING TO THE COMPUTER

There are two ways to connect your modem to your computer:

- Directly, by plugging the modem into the RS-232C port of the computer.
- Indirectly, by using a cable to connect to the serial port.

Connecting directly to the computer:

The DB25 connector on your Tote-A-Fax “mates” with the DB25 (serial) connector on your computer. (You can find the serial port on your computer by its physical appearance or perhaps by a label.)

Because of its light weight, the modem does not need locking screws or strain-relief devices to ensure reliable connection to the computer. Just make sure the two connectors are pressed firmly together.

Connecting to the computer through a cable:

Because there are many different connector sizes, you might have to connect your modem with a cable. The two most commonly used cables are DB25-to-DB25 and DB9-to-DB9.

1. *DB25-to-DB25 Cable.* Table 3-1 shows the wiring for a cable that has a DB25 connector at each end.

Table 3-1. DB25 to DB25 Pin Assignments

Pin	ID	Direction	Description
1	GRD	N/A	Protective ground
2	TX*	to modem	Transmit data
3	RX*	from modem	Receive data
4	RTS	to modem	Request to Send
5	CTS*	from modem	Clear to Send
6	DSR	from modem	Data Set Ready
7	GND*	N/A	Signal ground
8	CD	from modem	Carrier Detect
20	DTR*	to modem	Data Terminal Ready
22	RI	from modem	Ring Indicator

* Required by the modem.

2. *DB9-to-DB25 Cable.* Many computers now use a 9-pin “D” connector (DB9) for their serial ports. Most of these DB9 connectors

conform to the IBM® AT® wiring configuration. Table 3-2 shows the pin assignments for a DB9-to-DB25 cable.

Table 3-2. DB9 to DB25 Pin Assignments

DB9 Pin	DB25 Pin	ID	Description
1	8	CD	Carrier Detect
2	3*	RX	Receive data
3	2*	TX	Transmit data
4	20*	DTR	Data Terminal Ready
5	7*	GND	Signal Ground
6	6	DSR	Data Set Ready
7	4	RTS	Request to Send
8	5*	CTS	Clear to Send
9	22	RI	Ring Indicator

*Required by the modem

3.2.3 CONNECTING TO THE TELEPHONE LINE

There are two ways to connect to telephone lines:

- Directly, through an RJ-11 modular cable.
- Indirectly, through an acoustic-cable interface with the telephone handset.

Connecting directly to the phone line:

The most efficient way to connect your Tote-A-Fax to the telephone line is through direct electrical connection: One end of a modular phone cable fits into the jack in the modem, and the other end fits into a wall jack (see Fig. 3-2).

NOTE: If you do not have a modular wall jack, you will either have to convert the wall jack or use a modular adapter. Consult your local phone company and your local electronics store about each of these options.

You might wish to connect both the modem and the phone to the same jack, either to use the same phone line for both voice and data communication or to dial the telephone manually. First, to connect the modem to the phone line, use a telephone cable to connect the phone outlet to one of the jacks on the Tote-A-Fax (see Fig. 3-2). Then use another telephone line to connect the phone to the second modem jack.

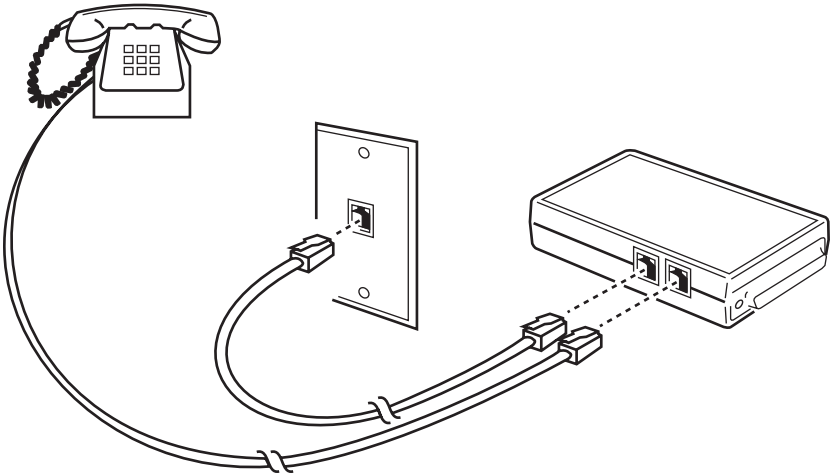


Figure 3-2. Connecting a Telephone to Your Modem.

Connecting acoustically via the handset:

If there is no modular wall jack available, you'll have to use an acoustic interface. An acoustic coupler converts the modem's

signals into the audible sounds the phone line carries and vice versa. Figure 3-3 shows how the modem connects to a Radio Shack or equivalent acoustic coupler.

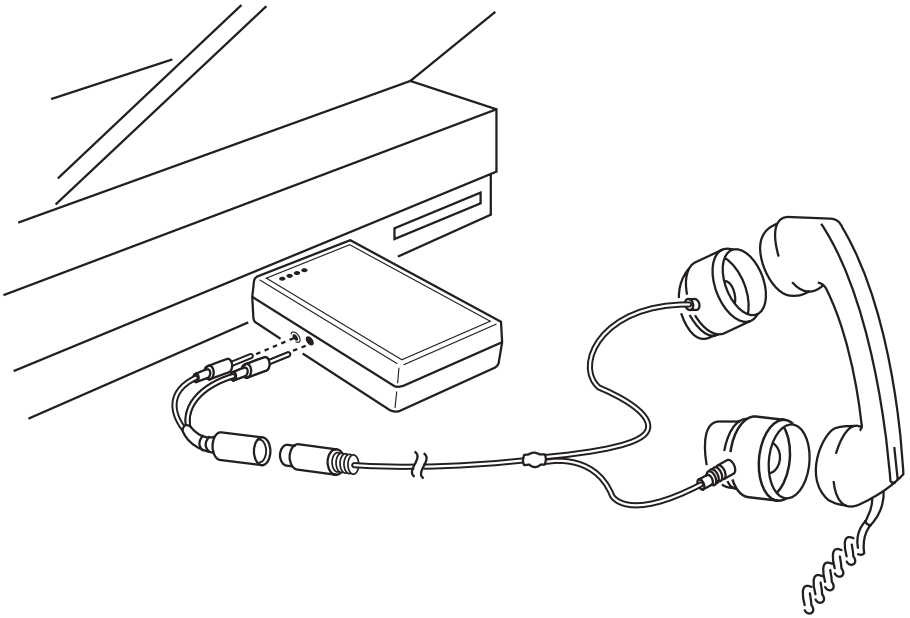


Figure 3-3. Connecting Your Modem to an Acoustic Coupler.

Acoustic couplers use sound to transmit and receive data. Errors may occur if the coupler picks up extraneous sounds or vibrations. To keep errors to a minimum:

1. Make sure the cups are firmly seated on the handset.
2. Make sure the surface on which the cups rest during transmission is quiet and vibration-free. (Tip: Since your body is an excellent muffler, try putting the cups on your shoulder while transmitting from a street-side telephone.)
3. Remember that, because of the nature of acoustic transmission, 2400-bps transmission is usually impossible. Transmission at 1200 bps is supported in many areas, and 300 bps is universally supported. If data errors occur at 1200 bps, reduce speed to 300 bps. If errors continue, try another phone to find out whether the phone you had been using was causing interface problems.

4. Using Your Tote-A-Fax

Now that your Tote-A-Fax modem is connected to your computer and to the telephone line, it's time to get on-line and begin communicating. This chapter will discuss the basics of initiating and receiving data communications.

NOTE: This chapter and the two that follow show you how to use your modem by giving it direct commands. The software that came with your Tote-A-Fax handles this part automatically. However, if you are using different software, refer to your software manual for information.

The five general steps in data communications, regardless of hardware/software system, are:

1. Setting communications parameters and loading communications software.
2. Dialing.
3. Connecting.
4. Interacting.
5. Hanging up.

You'll find instructions for the first step in the software manual. As for the rest:

4.1 Dialing

4.1.1 DIRECT CONNECTIONS AND "INTELLIGENT" DIALING

This section deals with how to dial if your modem is connected directly to your computer and by RJ-11 connector to the telephone line, and you use software to dial automatically.

Because there are so many different kinds of computers and communications software available, this manual can't discuss these procedures in detail. Before trying to communicate:

- Make sure you are familiar with your computer.
- Make sure you understand how your communications software works.
- Make sure your communications software has been installed to support a Hayes® compatible modem.

The instructions that follow assume you have set the hardware and communications parameters correctly. If you have problems getting on-line, see **Chapter 7** for troubleshooting suggestions.

1. Enter the telephone number you want to dial.
2. Execute the software's "dial" command.
3. When you are ready to hang up, execute the software's "Hang Up" command to disconnect automatically.
4. The modem responds "CONNECT" after the number has been dialed and a connection signal has been detected. You are now on line and able to interact with the host. (If no signal is detected within 30 seconds, the modem hangs up and returns to Command Mode, sending you the message "NO CARRIER.")

4.1.2 DIRECT CONNECTIONS AND "DUMB" DIALING

This section deals with how to dial if your modem is connected directly to your computer and by RJ-11 connector to the telephone line, and you use terminal-emulation software that can't dial automatically.

In this case the software will have a "Terminal" or "Local" mode from which you command the modem directly.

1. Enter Terminal Mode and set the speed and parameters.
2. Enter **ATZ [CR]** to reset the modem. The modem responds "OK." (If it does not, there's a problem; see **Chapter 8** for troubleshooting suggestions.)
3. Enter the dialing command **ATD {prefix} {phone number} [CR]**. The prefix is one or more modifiers affecting how the number is dialed—for example, **T** for tone-dialing or **P** for pulse-dialing. (**Section 5.2** lists all the dialing modifiers, and see **Section 4.1.4** for some samples of dialing commands.)

5. When you are ready to hang up, you have at least two options. You can use your communications software command to tell the modem to hang up. Or you can enter the Escape code (+++ is the default) and then enter the command **ATH [CR]** to tell the modem to hang up. The modem responds "OK."
6. Modem responds "OK" when it has completely disconnected.

4.1.3 ACOUSTIC CONNECTIONS AND MANUAL DIALING

If you're using acoustic couplers to connect to the telephone, your communications software cannot dial a telephone number at all. Instead, you must use the software's "Terminal" or "Local" mode to command the modem to prepare the line for you to dial.

1. Enter Terminal Mode. Set the parameters, and set the speed at either 300 or 1200 bps (remember, 2400 bps won't work in acoustic communication).

2. Enter **ATZ [CR]** to reset the modem. The modem responds “OK.”
3. Press the switchhook on the phone to get a dialtone. Then dial the number.
4. Enter the dialing command **ATDC [CR]**. This command tells the modem to wait up to 30 seconds for a carrier signal, and to watch for appropriate signals from the coupler. The modem responds “CONNECT” if a signal is detected. (If no signal is detected within 30 seconds, the modem hangs up and returns to Command Mode, sending you the message “NO CARRIER.”)
5. You are now on line and able to interact with the host.
6. When you are ready to hang up, disconnect the coupler and return the handset to its cradle.

4.1.4 EXAMPLES OF DIALING

Here are some examples of typical situations you might run into when you’re dialing the modem.

- *Dialing a Number.* These three basic dialing commands—

ATDT 213-555-1212
ATDT2135551212
ATDT(213)5551212

—are exactly equivalent tone-dialing commands. Spaces, parentheses, and dashes are simply ignored.

- *Pausing before Dialing.* Many times you’ll want to pause in the middle of dialing a number. For example, if you’re in a hotel where you have to dial 9 to get an outside line, you’ll need to wait for the second dialtone before dialing the rest of the number. The sign for a pause is a comma. Each comma included in the command signals the modem to wait for two seconds before continuing. For example—

ATDT9,5551212

—tells the modem to wait two seconds after it dials the 9.

- *Combining Commands.* You can combine several commands on one line. For example, to pulse-dial a long-distance carrier and then tone-dial the telephone number, you could enter:

ATDP5551212,,T1234,516-261-0423

This command pulse-dials the number of the long-distance carrier, pauses four seconds, tone-dials your identification code, pauses two seconds, and finally dials the long-distance number.

4.2 Answering

Even if your modem is connected to the telephone line and turned on, it will not answer an incoming phone call unless you tell it to answer. You must either command it to answer each time a call comes in, or command it once to answer automatically.

NOTE: The speed at which you send these commands determines the highest rate at which your modem can connect when answering. To allow answering at 300, 1200, and 2400 bps, send your commands at 2400 bps. See the manual for your communications software to find out how to set your PC's speed.

4.2.1 ANSWER ON COMMAND (ATTENDED ANSWERING)

When you hear the phone ringing (the notice RING displays on your computer screen, whether a telephone is attached to the modem or not), command the modem to answer the call by entering **ATA**.

NOTE: Don't command the modem to answer before the phone actually rings. If you do, the caller will detect a busy signal and will not be able to connect.

4.2.2 AUTOMATIC ANSWER (UNATTENDED ANSWERING)

You can set your Tote-A-Fax to answer an incoming call automatically. Send the command

ATS0=n

where:

- **S0** designates the "Auto-answer" Register S0
- **n** designates the number of the ring upon which the modem is to answer.

For example, the command **ATS0=2** tells the modem to answer on the second ring.

NOTE: The factory default setting is **S0=0**, which means your modem will NOT automatically answer incoming calls. When you turn off the modem, the S0 register is reset to zero unless you specifically command the modem to "memorize" the changed auto-answer setting. To save your auto-answer setting to nonvolatile memory, use the **&W** command, alone (**AT&W**) or as part of the auto-answer command line **ATS0=1&W**. (See the next chapter for more about the **&W** command.)

If you plan to use one line for both voice and data communication, setting "n" to a high number gives you a chance to answer the phone first. For example, if you set **S0=6**, you can answer the phone yourself before the sixth ring.

**4.2.3 UNATTENDED COMMUNICATION
(WITH ECHO AND RESULT CODES
DISABLED)**

Sometimes you might want to attach your modem to a computer and let it answer incoming calls without your having to intervene, and without getting its result codes relayed to your computer. The modem will return only data; you will not see messages like “RING” and “CONNECT.” In this case, you need to change certain factory settings, as follows:

1. Turn automatic answering on by sending the command **ATS0=n**, where “n” is the number of the ring on which the modem is to answer. (Remember, if you set **S0=0**, the modem will not answer at all.)
2. Disable echoing, by sending the command **ATE0**.
3. Disable result codes, by sending the command **ATQ1**.
4. Save these changes to non-volatile memory, by sending the command **AT&W**.

NOTE: Remember, you can send all the commands above as a single command—just type **ATE0Q1&W**.

To undo this configuration, use a multiple-code command string:

ATS0=0Q0E1&W.

NOTE: For a quick reset, you can send the command **AT&F&W** at any time. This command will return the modem to the factory-default settings and overwrite all settings stored in non-volatile memory, including auto-answering.

4.3 Matching Different Speeds and Protocols

Each time the Tote-A-Fax is turned on, the communications rate defaults to 2400 bps. Any of three events can alter this setting:

1. You send a new AT command to the Tote-A-Fax.
2. The Tote-A-Fax attempts to communicate with a remote modem set to a different speed.
3. You set up auto-answering at a different speed.

Each time the Tote-A-Fax receives a new AT command, the rate at which the command is given replaces the existing rate.

When your local modem attempts to establish a link with a remote modem set to a different speed, your modem will automatically attempt to adjust its rate setting so that a connection can be made. If a successful connection is made, your modem returns a “CONNECT” message identifying the rate at which it will be transmitting to the remote modem—for example, “CONNECT 1200.”

The Tote-A-Fax cannot adjust speed upward. When you call a remote modem, therefore, call at the highest rate you think is possible. If you can’t communicate at that rate, your Tote-A-Fax will fall back to the highest rate at which communication can take place.

Because the Tote-A-Fax may end up transmitting at a rate different from the one you started with, you may have to adjust the rate at which your local computer communicates with your Tote-A-Fax in order for it to recognize your commands.

For example, if you sent the dial command at 2400 bps, but the remote modem is set to 1200 bps, your modem will return the message "CONNECT 1200" after establishing a connection. After sending this message at 2400 bps, your modem immediately falls back to 1200 bps.

When that happens, you have two choices.

1. You may change the speed used by your computer software to 1200 bps. See the manual for your communications software.
2. You may use the **\J0** command to set the modem's data buffers to maintain a constant speed between the computer and the modem. **See Chapter 6** for information about the **\J** and **\N** commands and the Normal and Reliable modes.

5. The Modem Command Set

In general, all commands except **A/** (“repeat the previous command line”) and **+++** (the escape sequence) follow the format

AT{command}[CR]

where *AT* is the attention command alerting the modem that a command follows, and *[CR]* (Carriage Return) signifies the end of the command line. The command is case-sensitive: The modem will recognize **AT** or **at**, but not **At** or **aT**. The “command” may be a single command, like

ATS0=1 [CR]

or a sequence, like

ATS0=1&D2&W[CR]

The modem examines the command-line prefix to determine the communications settings of your computer (speed and parity) and adopts these settings automatically. They remain in effect until the modem receives another **AT** command.

Table 5-1 lists the asynchronous character formats that the Tote-A-Fax supports.

Table 5-1. Supported Asynchronous Character Formats

Start Data Bits	Data Bits	Parity	Stop Bits
1	7	Even or Odd	1 or more
1	7	None	2
1 more	7	Mark or Space	1 or more
1	8	None	1 or more

5.1 Getting Help

The first command you should learn is **ATI4**. This Tote-A-Fax command tells the modem to display a quick-reference list of basic modem commands. When you can't remember a command and don't have ready access to the manual, just type **ATI4**.

5.2 Dialing Commands

D is the basic dialing command. Like most other modem commands, it follows the prefix **AT**.

You can add any of the following “modifiers” to the dialing command by simply adding the modifier after **ATD**. For example, to tone-dial a number, send the command **ATDT**.

- C Dial with Coupler**—Sets the modem to prepare for manual dialing with an acoustic coupler, to watch for signal from the coupler, and to disconnect if no connection is made within 30 seconds after it receives the command.
- S Dial Stored Number**—Dials the number you've stored in the modem's memory at a particular location. The format of the modifier is S=n, where "n" is Location 0-3. For example, if you send the command **ATDS=2**, the modem will dial the string you stored in memory location 2. See the command **&Zn=x** at the end of Section 5.4.
- P Pulse dial (Default)**—Tells the modem to use pulse-dialing.
- T Tone dial**—Tells the modem to use tone-dialing.
- , Pause**—Tells the modem to pause 2 seconds. (The length of the pause may be changed by changing the contents of Register S8. Send the command **ATS8=n**, where n is the length of the pause you want.)
- W Wait for dialtone**—Tells the modem to wait for a second dialtone before proceeding. The tone must be of the right frequencies to be recognized. If the Tote-A-Fax doesn't recognize your dialtone, use commas to pause long enough for the second dialtone to appear.
- R Reverse Mode**—If you are calling an originate-only modem—a modem that answers calls only in "originate" frequency—end the dial command with R and your modem will use the answer frequency to communicate.
- ; Return to Command Mode After Dialing**—Normally, your modem would go on-line after dialing. This command can be useful in adding or stringing together very long or complicated dialing sequences and modem settings.
- / Wait for 1/8**—Tells your modem to pause for 1/8 second before proceeding.
- @ Wait for Silence**—Tells the modem to wait for silence before continuing to dial.
- ! Flash**—Makes the modem hang up very briefly, as if you pressed the switchhook quickly. (Some office systems require a flash to precede speed-dialed numbers.)
- Redialing.** If the number you call is busy, you can redial it by entering the Repeat command **A/**. (The Repeat command is not preceded by "AT" or terminated by a [CR].)

5.3 The Escape Sequence

The escape sequence is a special code used to take the modem off-line so it can recognize and execute your commands.

Once you've dialed a number or answered a call to begin communications, your modem is "on line." It passes any characters you type directly through to the remote modem.

If you want your modem to recognize any of those characters as commands, you must take it off-line by sending it the escape sequence.

So that the modem can tell the code apart from the rest of the characters it's receiving from you, the escape sequence is usually preceded and followed by a pause.

The default escape sequence is this:

{one-second pause} +++ {one-second pause}

You can adjust the length of the pause by setting Register S12 to another value, and you can change the escape code from +++ to something else by setting Register S2. See the **Sr=n** command in the next section for more on changing register values, and see **Section 5.8** for a complete list of the S-registers.

5.4 General Modem Commands

- AT** *The Attention command* tells the modem that a command will follow. It precedes all commands except the repeat command, **A/**, and the Escape sequence, **+++**.
- A/** *Repeat* the last “AT” command line sent to the modem. You’ll find this command especially useful for redialing telephone numbers. (**A/** is not preceded by “AT” or ended by [CR]).
- A** *Automatically answer* incoming calls. Set Register S0 to indicate how many rings the modem will wait before answering (range 0-255). The default is S0=0, meaning that the modem will *not* automatically answer.
- B** *300- and 1200-bps Protocol Compatibility*—Sets the modem to operate under either Bell (US) or CCITT (international) communications standards. B0 selects CCITT; B1 selects Bell (the default in US and Canada).
- D** *Dial*—See **Section 5.2** for details.
- E** *Echo Characters* controls echoing of characters from the local modem to the local DTE. (If your communications software provides local echo, set the modem to no echo.) E0 selects no echo; E1 selects echo (the default).
- H** *Hang up*. This command can be issued while on line only after you first use the escape sequence (see **Section 5.3**).
- I** *Information* tells the modem to display identification information about itself:
- I0** Product Code
 - I1** Firmware ROM checksum
 - I2** Do checksum on firmware ROM
 - I3** Our product and country version
 - I4** “AT” Command Summary Display

- M** *Speaker Mode* controls when the speaker is on.
- M0** off
 - M1** (default) on until carrier is detected
 - M2** always on
 - M3** on during connect “handshaking”
- O** *Go to On-Line Mode* tells the modem to go back on-line if the escape code has been used during a connection. You have two options:
- O0** Go on-line (default)
 - O1** Go on-line and execute an “equalizer retraining” with the remote modem. You may want to use this option in 2400-bps operation to eliminate data-transmission problems. But use it only with a modem that accepts a “Retrain Request” while on line.
- Q** *Result Codes Display* determines whether the modem’s response to a command is displayed.
- Q0** Displayed (default)
 - Q1** Not displayed
- Sr=n** *Set Register “r” to value “n.”* Changes the contents of a register, where “r” is the register’s number, from 0 to 27 and “n” is a whole number from 0 to 255.
- Sr?** *Read Register “r”* asks the contents of a register, where “r” is the register’s number, from 0 to 27. The modem responds with the value of that register, a number from 0 to 255.
- V** *Result Codes Form*—Sets whether short or long “result codes” are used. Result codes are either the modem’s response to your commands or its indication of communications activity. V0 selects the short form (numeric); V1 selects the long form (verbal, which is the default).

Short	Long
0	OK
1	CONNECT
2	RING
3	NO CARRIER
4	ERROR
5	CONNECT 1200
6	NO DIALTONE
7	BUSY
10	CONNECT 2400

See **Section 5.5** for a complete explanation of the result codes.

There are other result codes that apply to MNP connections. See the next chapter for information on what they mean and how to enable them.

- X** *Result Codes Set* specifies which set of result codes the modem uses. Enabling certain result codes also influences some of the modem's activities, because the modem will respond to the line conditions the result codes monitor.

For example, if an **X** command instructs the modem to look for the presence of a busy signal, the modem will disconnect when it detects one. If busy-signal detection is not enabled, the modem disconnects when the line is busy only because it doesn't detect a carrier within a certain period of time.

Setting	Codes enabled
X0	0-4
X1	0-5, 10
X2	0-6, 10
X3	0-5, 7, 10
X4	0-7, 10 (default)

- Y** *Long-space disconnect* specifies whether the modem will use a break signal—a “long space”—for disconnections. If you select **Y1**, the Tote-A-Fax hangs up when it receives a 1.6-second break signal. And when you command the Tote-A-Fax to hang up (with the command **ATH**), it sends a four-second break signal to the remote modem before disconnecting.
- Y0** Disabled (default)
Y1 Enabled
- Z** *Reset* the modem. If the modem is connected when it receives the command, it hangs up the line.
- Z0** Resets the modem to its factory-default settings.
Z1 Resets the modem’s settings and restores Stored Profile Number 1 (the settings you stored in the modem’s nonvolatile memory with the **&W** command).
- +++** *Escape Command*—Switches the modem from On-Line to Command Mode. See Section 5.3 for complete information.
- &C** *Data Carrier Detect (DCD) Monitoring* specifies whether the modem monitors the true state of the DCD signal on the line.
- &C0** The modem ignores the presence or absence of the DCD signal and assumes that it’s always on.
&C1 The modem responds to the true state of DCD.
- Some terminals work best with the **&C0** setting. Most PCs work best with the **&C1** setting.
- &D** *Data Terminal Ready (DTR) Impact* specifies how the Tote-A-Fax responds to the presence or absence of the DTR signal (Pin 20 of the RS-232 connector):
- &D0** The modem ignores DTR.
&D1 The modem goes into Command State when it detects a DTR transition from On to Off.
&D2 The modem hangs up and goes into Command State when it detects a DTR transition from On to Off (this is the default).
&D3 The modem re-initializes its RAM when it detects a DTR transition from on to off, as if you had sent an **ATZ** command. If the modem is connected, it hangs up.

&F *Fetch Factory Configuration* loads into memory and writes to nonvolatile RAM the factory-default settings.

&G *Guard Tone* specifies the frequency of guard tones used in some telephone systems (not in U.S.):

&G0 No tone (default)

&G1 550-Hz tone

&G2 1800-Hz tone

&L *Leased-Line Selection* specifies the line mode:

&L0 Normal dialup line (default)

&L1 Leased-Line Mode 1 (Retrain Mode)

&L2 Leased-Line Mode 2 (Handshake Mode).

Use Register S14 to select Originate/Answer mode.

&M *Asynchronous/Synchronous Mode Selection* selects standard asynchronous mode or one of three synchronous modes.

&M0 Standard asynchronous mode (default).

&M1 Synchronous Mode 1, for use with terminals that can support both synchronous and asynchronous operation. After the call is placed in asynchronous mode, the modem switches to synchronous mode. If there is an on-to-off transition of DTR, the modem returns to asynchronous mode.

&M2 Synchronous Mode 2, in which the stored number is dialed on an off-to-on transition of the DTR signal. The number must first have been stored in the modem's nonvolatile memory with the **&Z** command sent from an asynchronous terminal. If there is an on-to-off transition of DTR, the modem returns to asynchronous command state.

&M3 Synchronous Mode 3, which permits manual dialing. Dial the telephone number while DTR is off. After the number is dialed, change DTR to on and hang up the voice phone. The off-to-on transition must be recognized before you hang up the phone, or the connection will be lost.

&P *Pulse Dial make/break ratio* sets the modem for pulse-dialing either in the United States and Canada or internationally.

&P0 U.S. and Canada (default)

&P1 International

In technical terms, the **&P** command sets the “make/break ratio”—the ratio of off-hook (make) to on-hook (break). Most of the world besides the United States and Canada uses a ratio of 33/67 (set by the **&P1** command); the United States and Canada use a ratio of 39/61 (set by the **&P0** command).

&T *Modem Testing Options* initiate and terminate various tests. For more information see **Chapter 9**.

&T0 Terminates a test in progress.

&T1 Begins Local Analog Loopback Test.

&T3 Begins Local Digital Loopback Test.

&T4 Accepts a request from a remote modem for Remote Digital Loopback Test.

&T5 Rejects a request from a remote modem for Remote Digital Loopback Test.

&T6 Begins a Remote Digital Loopback Test.

&T7 Begins a Remote Digital Loopback with Self-Test.

&T8 Begins Local Analog Loopback with Self-Test.

&V *View Active Configuration and User Profiles* tells you how the modem is configured now, and displays any user profiles and any stored telephone numbers.

You should send the **AT&V** command on a line by itself, not in conjunction with other commands.

&W *Write Active Configuration Profile to Nonvolatile RAM* stores a user profile in one of two nonvolatile-memory locations, so that it can be recalled later with the **&Z** command.

&W0 writes the storable parameters of the active configuration to User Profile 0

&W1 writes the storable parameters of the active configuration to User Profile 1.

&Zn=x Stores up to four dialing strings in the modem's nonvolatile memory for later dialing. The format for the command is **&Zn={stored number}**, where "n" is the location 0-3 to which the number should be written. For example, the line **AT&Z2=5552368** writes 5552368 as the third of the four numbers in nonvolatile memory. The **&Zn=x** command can be used to store a number with as many as 36 characters.

Any dialing string can be saved except the **S** dialing modifier. (You can't tell a stored dialing string to dial another stored dialing string.) You can use the ";" modifier except when the modem is set to use Synchronous Mode 2.

5.5 The Result Codes

Table 5-1 shows the result codes the Tote-A-Fax sends, and explains what each of them means. See the next chapter for the special result codes

that relate to MNP, V.42, and V.42 bis communications. Some codes are always enabled; others can be enabled or disabled with the **X** command (see **Section 5.4**).

Table 5-1. Result Codes.

Long	Short	Meaning
OK	0	The modem has executed the command you sent, or it has received the Escape code you sent and returned to Command Mode. <i>Always enabled.</i>
CONNECT	1	The modem is connected to the remote computer system. (When X1 through X4 are in effect, CONNECT indicates a connection at 300 bps or less, since higher speeds return Result Codes 5 or 10). <i>Always enabled.</i>
RING	2	Your telephone line is ringing. <i>Always enabled.</i>
NO CARRIER	3	The modem is not receiving a carrier signal from the remote modem. The data connection has been broken and the modem has returned to Command Mode. <i>Always enabled.</i>
ERROR	4	The modem was not able to execute a command and remains in Command Mode. <i>Always enabled.</i>
CONNECT 1200	5	The modem has made a connection at 1200 bps. <i>Enabled by X1 through X4.</i>
NO DIALTONE	6	The modem has not detected a dialtone. <i>Enabled by X2 and X4.</i>
BUSY	7	The telephone number your modem called is busy. <i>Enabled by X2 and X4.</i>
CONNECT 2400	10	The modem has made connection at 2400 bps. <i>Enabled by X3 and X4.</i>

5.6 Modem Settings and Memory

Modem settings are stored in areas of the modem's memory called software registers, or S-registers. The modem uses the settings currently stored in these S-registers, but this memory is temporary. When the modem is turned off or receives a reset command, the current settings are erased and settings stored in permanent memory are loaded instead.

ROM is Read-Only Memory, which permanently stores the factory-default settings on a chip inside the modem. These settings are automatically loaded into RAM when the new Tote-A-Fax is first turned on. Modem commands can change the factory settings, but they remain stored in ROM and can be loaded into RAM with the **&F** command.

RAM, Random Access Memory, is the temporary memory that the modem uses while it's operating. The current settings are stored here, but disappear when the modem is turned off.

NVRAM, Nonvolatile RAM, is an area in the modem's memory where you can record your own custom settings permanently (or until you change them)—telephone numbers, for example, which you can store with the **&Z** command. These custom settings are loaded into RAM for the modem to use when it's turned on, and you can retrieve them at any time with the **Z** command. NVRAM will hold information for ten years or more.

5.7 Examples of Writing Configurations to NVRAM

Here are some examples of how to write your own custom settings to nonvolatile RAM.

- Setting Auto Answer for 3 rings without changing existing settings:

```
ATS0=3&W
```

- Setting Auto Answer for 3 rings while resetting everything to the factory-default configuration:

```
AT&FS0=3&W
```

- Setting phone number and multiple commands:

```
AT&ZT555-1212
```

```
AT&F&DX3S0=4V&W
```

Notice the difference between these last two examples. The first uses the **&Z** command to save the phone number only; it does not require **&W**. The last command example also shows how multiple commands may be incorporated into the same command line.

When you want to completely reset memory to the factory-default configuration, send the command

```
AT&F&W
```

The **Z** command (which resets the modem) reads only the appropriate information from NVRAM and ROM and loads it into RAM so it can be used.

5.8 The S-Registers

Software Registers (“S-Registers”) contain the information that controls the operation of your modem. For most purposes, the only register you might use regularly is S0, the register that determines whether the modem automatically answers calls. Other S-Registers hold information you’ll most likely change only indirectly through your communications software—for example, when you change the communications speed.

The S-registers are listed in numerical order below. Certain registers—and certain bits in bit-mapped registers—are omitted because they are not used.

- S0 *Auto-Answer*. Range: 0-255 rings. Default: 0. Specifies the ring on which the modem will automatically answer an incoming call.
- S1 *Ring Counter*. Range: 0-255 rings. Default: 0. Counts the number of rings that have occurred on an incoming call.
- S2 *Escape-Code Character*. Range: 0-127 ASCII. Default: 43. Specifies the decimal value (in ASCII) of the character that the modem will recognize as the escape code. The default, ASCII 43, is the + character.
- S3 *Carriage-Return Character*. Range: 0-127 ASCII. Default: 13. Specifies the character that the modem will recognize as a carriage return, which is the character that terminates modem command lines. The default, 13, is the normal carriage-return character.
- S4 *Line-Feed Character*. Range: 0-127 ASCII. Default: 10. Specifies the character that the modem will recognize as a line feed, which is the character that usually signals a terminal or printer to start a new line for subsequent characters. The default is 10, which is the normal ASCII line-feed character.
- S5 *Backspace Character*. Range: 0-32, 127 ASCII. Default: 8. Specifies the character that the modem will recognize as a backspace. The default, 8, is the standard ASCII backspace character.
- S6 *Dialtone Wait*. Range: 2255 seconds. Default: 2. Specifies how long your modem will wait for a dialtone before dialing. If it does not detect a dialtone before the time is up, it responds “NO DIALTONE.”
- S7 *Wait for Carrier Signal*. Range: 1-255 seconds. Default: 30. Specifies how long your modem will wait for a carrier signal after dialing or answering. If it does not detect a carrier signal before the time is up, it responds “NO CARRIER”.
- S8 *Pause Time for Comma*. Range: 0-255 seconds. Default: 2. Specifies how many seconds the modem will pause for each comma (,) it encounters in a Dial command. (The modem accepts values below 2, but two seconds is the actual minimum pause.)

- S9 *Carrier-Detect Response Time.* *Range: 1-255 tenths of a second. Default: 6.* Specifies how long the responding carrier signal must be present for your modem to recognize it. The default tells the modem to listen for 0.6 seconds. (Increasing the time reduces the chance your modem will mistake noise, such as a voice or a busy signal, for a carrier signal.)
- S10 *Carrier Loss Time.* *Range: 1-255 tenths of a second. Default: 14.* Sets the longest time a carrier signal can be undetected by the modem before it hangs up and returns the “NO CARRIER” result code. You may have to set a longer time if you’re using a noisy phone line, since line noise can interrupt the carrier signal.
- Do not set this value lower than the value of Register S9. If you do, the modem will assume the carrier is lost before it is detected, and so will always hang up.
- S11 *DTMF Tone.* *Range: 50-255 tenths of a second. Default: 75.* Sets the interval between tones during tone-dialing. On some phone systems that are slow to recognize the tones, you might have to add more time. On faster systems, you might be able to get away with a shorter interval (which would speed up dialing).
- S12 *Escape-Code Guard time.* *Range: 20-255 fiftieths of a second. Default: 50.* Sets the length of quiet time required before and after you enter the escape code for the modem to recognize the escape sequence. Be sure to set the guard time long enough so that the Escape can be recognized, given the rate at which you are transmitting. If you set S12=0, the modem will take any sequence of three + characters as the escape sequence, with no guard time required.
- S14 *Bit-Mapped Options:*
- Bit 1: Command Echo (see **E** command):
- 0=No echo
1=Echo (default)
- Bit 2: Result Code (see **Q** command):
- 0=Enabled (default)
1=Disabled
- Bit 3: Verbose mode (see **V** command and **Section 5.5**)
- 0=Short-form results codes
1=Full-word result codes (default)

Bit 5: Dial method (see **Section 5.2**)

0=Tone-dial
1=Pulse-dial (default)

Bit 7: Originate/answer

0=answer
1=originate (default)

S16 Modem Test Options (see **Chapter 7**):

Bit 0: Local Analog Loopback:

0=Disabled (default)
1=Enabled

Bit 2: Local Digital Loopback:

0=Disabled (default)
1=Enabled

Bit 3: Remote Digital Loopback Status (indicates that the modem is in Remote Digital Loopback initiated by the remote modem):

0=Loopback off
1=Loopback in progress

Bit 4: Remote Digital Loopback

0=Disabled (default)
1=Enabled

Bit 5: Remote Digital Loopback with Test and Error Count:

0=Disabled (default)
1=Enabled

Bit 6: Local Analog Loopback with Self-Test:

0=Disabled (default)
1=Enabled

S18 *Test Timer*. Range: 1-255 seconds. Default: 0. Sets duration of a modem diagnostic test.

S21 *Bit-Mapped Options*:

Bits 4, 3: Data Terminal Ready (see **&D** command):

0/0=Modem ignores DTR.
0/1=Modem goes to Command State when on-to-off transition is detected.
1/0=Modem hangs up and goes into Command Mode when on-to-off transition is detected.
1/1=Modem reinitializes RAM when on-to-off transition is detected, as if you had sent an **ATZ** command.

Bit 5: Data Carrier Detect (see **&C** command):

0=DCD always on (default)
1=DCD, when on, indicates a valid carrier signal

Bit 7: Long Space Disconnect
(see **Y** command):

- 0=Disabled (default)
- 1=Enabled

S22 *Bit-Mapped Options*

Bits 3, 2: Speaker Control (see **M**
command):

- 0/0=Speaker disabled
- 0/1=On until carrier detected
(default)
- 1/0=Always on
- 1/1=On until carrier detected
but off during dialing

Bits 6, 5, 4: Result Code Options
(see **X** command and **Section**
5.5):

- 0/0/0=X0
- 1/0/0=X1
- 1/0/1=X2
- 1/1/0=X3
- 1/1/1=X4 (default)

Bit 7: Make/Break Dial Pulse
Ratio (see **&P** command)—Sets
the ratio of Make (off-hook) to
Break (on-hook) interval used
for pulse dialing:

- 0=31/61 US/Canada
(default in US)
- 1=33/67

S23 *Bit-Mapped Options:*

Bit 0: Grant Loopback Test
request from remote modem
(see **&T** command):

- 0=Disabled
- 1=Enabled (default)

Bits 2, 1: Communications rate
(see **AT** command):

- 0/0=0 to 300 bps
- 0/1=Reserved
- 1/0=1200 bps
- 1/1=2400 bps (default)

Bits 5, 4: Parity (see **AT**
command):

- 0/0=Even (default)
- 0/1=Space
- 1/0=Odd
- 1/1=Mark/None

Bits 7, 6: Guard Tones
(international only—see **&G**
command):

- 0/0=Disabled (default)
- 0/1=550 Hz
- 1/0=1800 Hz
- 1/1=Reserved

S25 *Delay to DTR*. How the value
stored in S25 affects the
operation of the modem
depends on which mode the
modem is in.

Synchronous Mode M1: S25 specifies a delay (1 to 255 seconds) following the establishment of a connection before DTR is examined. This gives you time to disconnect an asynchronous terminal that you used to send the modem commands, to and connect a synchronous terminal.

All other modes: An on-to-off transition of DTR is ignored if it is shorter than the value (1 to 255 hundredths of a second) specified in S25.

The default in all modes is 5. In Synchronous Mode M1 that's five seconds; in the others it's 0.05 seconds.

S27 *Bit-Mapped Options*

Bits 1, 0: Transmission Mode:

- 0/0=Asynchronous (default)
- 0/1=Synchronous Mode 1
(asynchronous dialing)
- 1/0=Synchronous Mode 2
(DTR dialing)
- 1/1=Synchronous Mode 3
(manual dialing)

Bits 5, 4: Transmit Timing Source
(see **&X** command):

- 0/0=EIA Pin 15 is the clock
source
- 0/1=EIA Pin 24 is the clock
source
- 1/0=Clock from receive carrier
- 1/1=[Not used]

Bit 6: Communications Standard
(see **B** command):

- 0=CCITT V.22 bis, V.22,
V.21
- 1=Bell 212A/Bell 103
(default)

6. Using V.42 and MNP

6.1 Introduction to V.42 and MNP

The Tote-A-Fax supports V.42 and V.42 bis Link Access Procedure for Modems (LAPM) and the Microcom Networking Protocol (MNP). These industry-wide standards, supported by many information services and modem manufacturers worldwide, provide sets of guidelines for controlling information transfers. You can use your Tote-A-Fax for efficient, error-free communications with modems all over the world that support these protocols.

6.1.1 ERROR CORRECTION

Both V.42 and MNP® provide error correction. Two modems communicating with either protocol check information for errors. When errors are detected, the receiving modem discards the erroneous data and the sending modem transmits the original data again.

6.1.2 DATA COMPRESSION

Both protocols also provide optional data compression. When two modems link up, they may negotiate to use this feature, depending on the settings and capabilities of the two modems.

You'll probably want to use data compression when you can. It squeezes information into a more compact form, so that fewer bits of data are needed to transmit the same amount of information. And that means the same information goes through in less time.

V.42 and MNP both always use data correction, but data compression is optional. To use data compression, you must be sure that both your Tote-A-Fax and the remote modem are set up to handle it.

For V.42, data compression is handled through an adjunct version of the protocol called V.42 bis. For MNP, versions of the protocol are identified by classes. Data correction is implemented by MNP Class 4; data compression is added by MNP Class 5.

6.1.3 PROTOCOL NEGOTIATION

When two modems connect, they negotiate the methods they will use to communicate. One setting they negotiate is the speed of the connection. Another is the protocol to be used: One modem may be capable of using a particular protocol, and the other may not be. So the modems will try first one protocol, then another, until they find the one they can both use.

V.42 bis data compression increases your throughput by about a four-to-one ratio—data is transmitted about four times as fast as it would be at the same baud rate without V.42 bis. MNP increases throughput by about two to one.

You'll usually want to use the most efficient error-corrected link your Tote-A-Fax can establish with a remote modem. However, negotiating these protocols can take time. If the Tote-A-Fax is set to use a protocol the other modem can't use, the two modems will take a while to find another way to communicate. so sometimes it may be better to set your Tote-A-Fax not to use V.42 or MNP—especially if you already know that the remote modem is not capable of either.

In other cases, you may require that the connection be established using a particular protocol, to ensure error correction or increased throughput. In that case, you can set the Tote-A-Fax to use that protocol and hang up if the other modem can't use it, rather than negotiate another type of link.

6.2 Some Background Information on MNP and V.42

In this section you'll find some general information about V.42 bis. It should help you combine the commands described in the sections that follow to get the most from your Tote-A-Fax in your particular environment.

If you're already somewhat familiar with MNP and V.42, you might want to skip ahead to Section 6.5, which is the complete MNP and V.42 command list.

6.2.1 V.42 AND V.42 BIS

V.42 is a standard for error correction in modem communications. The method of error correction is called Link Access Protocol Method, or LAPM. Like MNP, this standard checks for errors during data transmissions and retransmits any erroneous information.

V.42 bis is an enhanced version that performs data compression as well as error correction. The data-compression method is called British Telecom Lempel Ziv (BTLZ). It increases throughput more efficiently than MNP Class 5—typically in a ratio of from 3:1 to 4:1. At 2400 bps, for example, an effective throughput of 9600 bps is possible.

What makes the BTLZ process more efficient is its “dictionary.” During the compression process, repeated character strings are memorized and assigned to a shorthand “word” in the dictionary. When a repeated character series is recognized, the shorthand word is substituted.

Another advantage of V.42 bis over MNP Class 5 is that it can automatically recognize binary, compressed, and encrypted files, which are best transmitted without further compression. When it recognizes that sort of file, V.42 bis doesn't try to compress it.

Finally, V.42 and V.42 bis are standards set by an international committee, the CCITT. That means they're more likely to be adopted by a growing number of modem manufacturers worldwide.

6.2.2 MNP CLASSES

MNP features are divided into "classes." The Tote-A-Fax is called an "MNP Class 5" modem because it implements all the features defined in Classes 1-5. Classes 3, 4, and 5 are of special interest, because they provide the standards for better integrity and efficiency in data transmission.

- *Class 3* uses synchronous framing techniques to transmit the data as a continuous stream of bits, minus the start and stop bits, to increase transmission efficiency. That means the modem can effectively send and receive faster than 2400 bps.
- *Class 4* defines techniques that let the modem automatically adjust the size of data packets (blocks of data bits separated into sections) to match the quality of the phone line. The better the line quality, the larger the packets can be. In addition, the modem performs error correction in an efficient way that lets it retransmit only the blocks that had errors.
- *Class 5* provides data compression, so that information is reduced in size before transmission and restored when it is received.

The different MNP classes all contribute to increasing the efficiency of data transmission. Together, they boost the effective speed of a 2400-bps link to about 4800 bps. And, as you know, faster transmissions save time and line charges.

6.2.3 OPERATING MODES IN MNP

There are three MNP operating modes: Direct, Normal, and Reliable.

Direct Mode is the default operating mode—standard data transmission *without* MNP. In Direct Mode, when you place or answer a call, your modem negotiates with the remote modem to determine the correct speed. If the on-line speed changes, the computer's port speed must change to match.

Normal Mode lets you communicate with remote modems that don't have MNP capability—without worrying about your computer's port speed. If the on-line speed changes, the modem will use data buffering to keep the modem-to-computer speed constant. (See the **VJ0** command in **Section 6.5**.)

Reliable Mode means that the modem tries to establish an MNP connection with the remote modem. See the **\N** command in **Section 6.5** for complete details on Reliable-Mode options.

6.2.4 HOW THE RELIABLE-MODE CONNECTION IS NEGOTIATED IN MNP

When you set it to negotiate a Reliable-Mode link (with \N2 or \N3), the Tote-A-Fax tries to establish a Class 5 MNP link. If it can't, it tries to use Class 4, and so on down the list of classes. When \N2 is in effect, the modem hangs up if it can't get any MNP connection; when \N3 is in effect, the modem negotiates a Normal-Mode connection.

If an MNP connection can't be established, it may be because the remote modem doesn't have MNP capabilities or isn't set up to use them. But it may also be because the phone line is so noisy that even an MNP link is impossible.

6.2.5 SELECTING A PROTOCOL

When you're deciding which protocol to use, consider these guidelines:

- The most efficient error-correcting method using data compression is V.42 bis. Its BTLZ compression method is more efficient than MNP 5, and it automatically detects which files benefit from compression and which don't.
- If the remote modem isn't capable of V.42 bis, MNP Class 5 may be the next-best choice. Standard V.42 does not perform any data compression, but MNP Class 5 does.

However, MNP Class 5 *always* uses its compression method on all files, even binary files, encrypted files, and files that are already compressed—including many executable files (files with an extension of .EXE). In many cases, using MNP Class 5 compression on files like those doesn't increase throughput at all. In fact, throughput can actually decrease, because some such files are actually made *larger* by a second compression.

So when you're sending or receiving binary, encrypted, compressed, or randomized files, and you can't use V.42 bis, you should use standard V.42. If the remote modem isn't capable of V.42, try MNP Class 4.

- If you don't know what protocols the remote modem supports, remember that setting the modem to use the best method (usually V.42 bis) and then to try other methods can increase your connect time. The handshaking process will take longer.

Once you've established a connection with a remote system for the first time, monitor the result codes or your software's messages to determine what kind of connection you've established. If the modem has fallen back to using MNP, or neither V.42 nor MNP, then in the future you can set the modem not to try V.42 or MNP connections. You'll save time, and that time can add up to significant money in repeated long-distance calls.

6.2.6 USING FLOW CONTROL IN BUFFERED OPERATING MODES

When you're using Normal or Reliable Mode, and the modem-to-modem speed is different from the computer-to-modem speed, the modem uses its data buffers to keep both speeds constant. In that case, you'll probably want to set the computer or software to use a flow-control protocol, and to set the modem (with the `\Q` command) to use the same flow-control protocol. That way the modem's buffers won't overflow if there's a large difference between the speeds of the modem-to-modem link and the modem-to-computer link. See the `\Q` and `\X` commands in **Section 6.5** for information on how to set the modem to use flow control.

6.5.7 HOW FLOW CONTROL WORKS

Flow control refers to any method two computer devices use to start and stop the sending of data. The purpose is to keep one device from sending data faster than the other can receive it. Without flow control, some data might be discarded and lost.

There are two types of flow control: software and hardware.

The most commonly used software flow control is called X-ON/X-OFF. If the receiving device can't handle all the data it's being sent, it sends an X-OFF character (**Ctrl-S**) to tell the sender to pause. When the receiver has caught up, it sends an X-ON character (**Ctrl-Q**) to tell the sender to resume. When you're using a Reliable-Mode connection, your Tote-A-Fax needs to control the data flow from the computer,

because the computer is sending data faster than the Tote-A-Fax is passing it on to the remote modem.

Hardware flow control works on the same principle, but the signal to start and stop transmissions is a small change in the voltage on one of the pins in the cable connecting the modem to the computer. To signal the computer to stop sending, the Tote-A-Fax lowers the voltage on the Clear To Send (CTS) pin. When it's ready to receive again, it raises the voltage. This method is called *unidirectional* hardware flow control, because, while the modem controls the computer with it, the computer can't signal the modem. It's good enough for most applications.

The Tote-A-Fax also offers bi-directional flow control. That could be necessary sometimes, if the computer can't keep up with the modem—for example, if it is saving a file to disk. During a disk operation that keeps the computer busy, the computer can lower the Request To Send (RTS) voltage to instruct the modem to stop sending, and raise it when it's ready to receive again.

6.2.8 WHEN TO USE FLOW CONTROL

When you use MNP Class 5 or V.42 bis, you should always set the computer to exchange data with the modem at 9600 bps, to take advantage of the increased throughput the protocol provides. Make sure you set the computer and the modem to use the same kind of flow control, to keep the computer from getting ahead of the modem.

6.3 Basic V.42 and MNP Commands

V.42 and MNP commands control what type of connection to establish and, when it can't be established, which alternate methods to try next.

Like the general modem commands in **Section 5.4**, all V.42 and MNP commands begin with the Attention command **AT**.

Since, in most cases, all you have to do to use V.42 or MNP is send a few basic commands along with the dialing or answering command, this section gives you just those basic commands you'll need to get on line right away. In **Section 6.5**, you'll find a complete list of all the V.42 and MNP commands in alphabetical order.

When you want to use V.42 or MNP, these five commands are the ones to remember:

\N3 *Autoreliable mode*—Tells the Tote-A-Fax to negotiate with the remote modem to establish a V.42 or MNP link. If the remote modem cannot support V.42 bis, V.42, or MNP Class 4 or 5, the Tote-A-Fax will “fall back” to a standard connection.

Remember that you might not want to use this mode for every connection, since the negotiations at the beginning take time. If you already know that the modem on the other end can't support V.42 or MNP, you can save on-line time if you don't use the **\N3** command.

\J0 This command tells the Tote-A-Fax not to change the transmission speed between your computer and modem. That way your computer or terminal can exchange data with the modem at 9600 or 4800 bps. The modem uses data buffers to communicate with the remote modem at a lower speed. This method lets you take advantage of the faster throughput you get from V.42 bis or MNP Class 5.

\Q1 Because the modem is using data buffers to keep the computer-to-modem speed at 9600 or 4800 bps, occasionally the computer will be sending data faster than the remote modem can receive it. To keep any data from being lost, the **\Q1** command instructs the Tote-A-Fax to use X-ON/X-OFF flow control to start and stop data transmission as needed.

You can also select bi-directional hardware flow control with the `\Q3` command, but we recommend `\Q1` here because a wide variety of computers, terminals, and communications programs support X-ON/X-OFF. See the full discussion of the `\Q` command in **Section 6.5** for more on how to use hardware flow control.

\V2 After the Tote-A-Fax and the remote modem have finished their negotiations, you might want to know what kind of connection they've finally established. The `\V2` command enables twelve special result codes that tell you the type of connection. When you're using the long-form result codes, these codes indicate that the modem is using one of these features:

- “MNP”: MNP
- “LAPM”: V.42
- “COMP”: Data compression

For a comprehensive listing of the exact result codes in both their forms, see the full discussion of the `\V` command in **Section 6.5**.

\J1 This command tells the modem to use V.42 bis/V.42 or MNP, but to prefer V.42 bis/V.42. The modem will first try to use V.42 bis or V.42, but will fall back to MNP if the remote modem isn't capable of V.42. This is the default setting, so you

don't have to send this command unless you've already reconfigured the modem with another version of the `\J` command.

These five are the most common commands that control V.42 and MNP. There are many others, all of which you'll find in **Section 6.5**.

6.4 How to Send V.42 and MNP Commands

Send V.42 and MNP commands the same way you would send any other modem command. If you wish, you can combine them with the dialing or answering command.

Here are some examples of basic MNP commands that perform common operations. Remember to set your computer speed to 9600 (or 4800) bps for these commands.

Dialing another V.42 or MNP modem:
Enter the command

```
AT\N3\J0\Q1\V2DT555-2368
```

to instruct the modem to dial and attempt to establish a V.42 bis/V.42 connection. If V.42 isn't possible, the modem negotiates to use MNP. If MNP isn't possible, the modem uses standard transmission methods.

Substitute `\N2` for `\N3` if you want to use MNP only, and *disconnect* when an MNP link cannot be established. Substitute `\N4` if you want to use only either V.42 or MNP, and to disconnect if such a link can't be established.

Answering with a basic setup. Enter the command

ATN3J0\Q1\V2S0=1

to answer all modems—V.42, MNP, or neither.

Using the “Automatic Speed Interface” without V.42 or MNP. To place a call in which the computer-to-modem speed is kept automatically constant regardless of the connection speed, but *without* V.42 or MNP, enter the command

ATN0J0DT555-2368

Disabling V.42 and MNP. To disable all V.42 and MNP capabilities and operate in the factory-default mode, enter the reset command **ATZ**. Your Tote-A-Fax always powers up with V.42 bis/V.42 and MNP disabled.

Using V.42 and MNP with your preferred software. You can use V.42 and MNP with the communications software you prefer—even if the software doesn’t specifically support either protocol—by incorporating these commands into the modem-setup string. This setting, provided in most communication programs, is sometimes called an “initialization string,” “startup command,” or something similar.

If your software doesn’t give you such a setting, you can add the commands to the “dialing string,” or whatever setting tells the software what commands to send at the time it sends the dialing or answering command.

6.5 The Complete List of V.42 and MNP Commands

This section lists all the V.42 and MNP “AT” commands in alphabetical order.

You’ll notice that these descriptions refer to the modem’s operating modes. You’ll find more about those in the **Section 6.2.3**. But here’s a brief review:

- *Reliable Mode* refers to V.42 and MNP connections with data buffering.
- *Normal Mode* refers to connections with data buffering but without V.42 or MNP.
- *Direct Mode* refers to connections without either data buffering or V.42 or MNP.

\A *Set Maximum Block Size*—In a Reliable-Mode connection, the modem can be set to transmit information arranged as blocks of data. On telephone lines that are relatively free from noise, large blocks of data can be transmitted. If line noise makes frequent retransmission necessary, the modem will use smaller blocks in order to save time. You can limit the block size to tailor it to known conditions with the **\A** command:

\A0=Maximum size 64

\A1=Maximum size 128

\A0=Maximum size 192

\A0=Maximum size 256 (default)

%An *Set Autoreliable Fallback Character*—Specifies the ASCII character that, when the Tote-A-Fax receives it before it gets a Reliable-Mode connection, causes the modem to fall back to Normal Mode. This feature is useful when answering a call from a modem that doesn't support V.42 or MNP—your Tote-A-Fax can fall back quickly when it receives, for example, a carriage return used to get your system's attention. The **\C2** command enables this capability. The range of values for **n** is 0-127; the default is 0.

\Bn *Transmit Break*—Transmits *n* 300-millisecond break signals to the remote modem. The range of values for **n** is 1-9.

\C *Set Autoreliable Buffer*—Controls how the modem reacts when its data buffer fills, or when it receives the ASCII character specified by **%An**.

\C0 Tells the modem to ignore the fallback character and the fullness of the buffer (this is the default)

\C1 Tells the modem to buffer up to 200 characters. If the buffer fills before a Reliable-Mode link is established, the modem falls back to Normal Mode.

\C2 Tells the modem to fall back to a Normal-Mode connection when it receives the fallback character.

- %C** *Set Data Compression*—Tells the modem whether to use the data-compression feature of MNP. **%C0** disables data compression; **%C1** (the default) enables it.
- \G** *Set Modem-to-Modem Flow Control*—Determines whether the modem uses X-ON/X-OFF flow control to manage information exchange with the other modem. **\G0** (the default) disables flow control; **\G1** enables it.
- "H** *Enable/Disable V.42 bis Compression:*
- "H0** Disables V.42 bis compression
 - "H1** Enables V.42 bis compression in the Transmit path only
 - "H2** Enables V.42 bis compression in the Receive path only
 - "H3** Enables V.42 bis compression in both Transmit and Receive paths (the default)
- \J** *Adjust bps Rate*—Determines whether the modem-to-computer speed will change to match the modem-to-modem speed, or whether the modem uses its buffers to keep the modem-to-computer speed constant.
- \J0** Tells the modem to maintain the original computer-to-modem rate—that is, the speed at which the command was sent.
 - \J1** Tells the modem to adjust the computer-to-modem speed (the default).

- J *Detection Phase Control*—Determines whether the modem negotiates with the remote modem to find out whether it is V.42-capable.
 - J0 Instructs the modem not to negotiate with the remote modem to transmit in V.42 mode. The Tote-A-Fax assumes that the remote modem is V.42-capable, and skips the detection phase. This is the quickest way to establish a V.42 connection when you know that the remote modem has V.42 enabled.
 - J1 The modem negotiates with the remote modem, when originating or answering, to establish a V.42 bis/V.42 connection. If it can't get one, it tries an MNP Class 4 or 5 connection. If it can't get that, it tries a Normal-Mode connection (if \N3 is enabled) or hangs up (if \N4 is enabled). -J1 is the default.
 - J2 When answering, the modem first tries to negotiate an MNP connection. If it can't get one, it tries a V.42 bis/V.42 connection. This command is like -J1, except that MNP is preferred over V.42.

- \K *Set Break Control*—Controls break-signal processing. Table 6-1 shows all the variations of the \K command.

Table 6-1. The \K (Break Control) Command

Command	On-line modem receives...			
	Break from computer (Reliable or Normal connection)	Break from computer (Direct connection)	Break from remote modem (Normal connection)	\Bn command from computer (Reliable connection)
\K0	Enter Escape state; do not send break to remote modem	Immediately send break, then enter Escape state	Purge buffers and immediately send break to computer	Purge buffers and immediately send break to remote modem
\K1	Purge buffers and immediately send break to remote modem	Immediately send break to remote modem	Immediately send break to computer	Immediately send break to remote modem
\K2	Enter Escape state; do not send break to remote modem	Immediately send break, then enter Escape state	Immediately send break to computer	Immediately send break to remote modem
\K3	Immediately send break to remote modem	Immediately send break to remote modem	Immediately send break to computer	Immediately send break to remote modem
\K4	Enter Escape state; do not send break to remote modem	Immediately send break, then enter Escape state	Immediately send break to computer	Immediately send break to remote modem
\K5	Send break to remote modem in sequence with data	Immediately send break to remote modem	Immediately send break to computer	Immediately send break to remote modem

- \L *Link Mode*—Selects how data is transmitted across a V.42 or MNP link.
 - \L0 Sets the modem for stream mode (the default)
 - \L1 Sets the modem for block mode. The maximum block size is increased from 256 bytes to 260.

- \N *Select Operating Mode:*
 - \N0 Normal Mode. The modem doesn't try to get an MNP link. It buffers data exchanged between itself and the computer. Should the modem-to-modem speed change during the connection, the modem-to-computer speed changes if \J1 (the default setting for \J) is in effect. If you choose \J0, however, the original modem-to-computer speed is maintained (and you should use a flow-control protocol to insure against data loss—see \Q).
 - \N1 Direct Mode. The modem doesn't try to get an MNP link. No buffering is used, so when the modem-to-modem speed changes, so does the modem-to-computer speed. (This is the default.)
 - \N2 Tells the modem to negotiate with the remote modem for a Reliable-Mode link—a link that uses MNP (but not V.42). If it succeeds, the modem buffers data to maintain a constant modem-to-computer speed (when \J0 is in effect, and uses MNP error correction and data compression. If the modem can't get an MNP link, it hangs up.
 - \N3 Autoreliable Mode. The modem first tries to get a V.42 link, then an MNP link. If it can't get either, it tries a Normal-Mode link.
 - \N4 The same as \N3, except that the modem won't try a Normal-Mode link if it can't get a V.42 or MNP link. It just hangs up.

NOTE: The \N3 mode will *usually* connect to modems that don't support V.42 or MNP. However, the modem will probably connect only after a handshake period that can take fifteen seconds or more. You should increase the value of Register S7 to 60 to allow extra time for the carrier to be detected if you're not sure whether the remote modem can use V.42 or MNP.

- "Nn** *Set V.42 bis Maximum Dictionary Size*—Sets the maximum dictionary size for the V.42 bis data-compression routine. The dictionary is memory set aside so that V.42 bis can memorize frequently repeated character strings to make data compression more efficient. Adjusting this value may increase throughput for certain types of data. The range for **n** is from 512 to 1024; the default is 1024. This command is not stored in nonvolatile RAM.
- %N** *Set Maximum Line Rate*—Sets the maximum modem-to-modem (DCE) rate for a connection. You can use this command to force the DCE rate to a speed lower than the computer-to-modem speed.
- %N0** The modem connects at the highest speed possible, but won't exceed the computer-to-modem speed.
- %N1** Maximum 300 bps
- %N2** Maximum 300 bps
- %N2** Maximum 300 bps
- %N4** [Not used]
- %N5** Maximum 1200 bps
- %N6** Maximum 2400 bps
- %N1** through **%N3** perform the same function in order to maintain compatibility with different versions of communication software.
This command is not stored in nonvolatile RAM.
- \O** *Originate Reliable Link*—Tells the modem to initiate a Reliable-Mode link regardless of whether the modem originates or answers the call. This command is valid only in the Escape state. If a Reliable-Mode link is already established when you send the command, the modem simply goes back on line.
- "On** *Set V.42 Maximum String Length*—Sets the maximum length, in characters, for strings used in V.42 bis compression. Adjusting this value may increase throughput for certain types of data. The range for **n** is 6 to 250; the default is 16. This command is not stored in nonvolatile RAM.

- \Q *Select Flow Control*—Specifies the flow-control method the modem uses during a Normal-Mode or Reliable-Mode connection.
 - \Q0 Disables flow control (the default)
 - \Q1 Sets the modem to use X-ON/X-OFF in the computer-to-modem link. When a Normal-Mode connection is established, it also controls modem-to-modem data flow. Note that the X-OFF character is **Ctrl-S**; the X-ON character is **Ctrl-Q**.
 - \Q2 Selects unidirectional hardware flow control: RTS/CTS signals on the hardware pins control the flow of data from the computer to the modem. There is no control of data flow from the modem to the computer.
 - \Q3 Selects bidirectional hardware flow control: RTS/CTS signals on the hardware pins control the flow of data both ways between the computer and the modem.

- \S *Show On-Line Status*—Displays the current status of an active connection, including the elapsed connect time and the telephone number dialed. This information takes more than one screen to display; press any key to display the next screen.

- \Tn *Set Inactivity Timer*—Tells the modem to disconnect when there has been no activity for **n** minutes. Setting **n** to 0 disables the timer. The range for **n** is 0-90 (in minutes).

- \U *Accept Reliable Link*—Tells the modem to accept a Reliable-Mode connection regardless of whether the modem originates or answers the call. This command is valid only in the Escape state. If a Reliable-Mode link is already established, the modem simply goes back on line.

- \V *Modify Result-Code Form*—Enables or disables the result codes that let you know when you obtain a Reliable-Mode connection.
 - \V0 Tells the modem to use the standard result-code set. (This is the default.)
 - \V1 Tells the modem to use the additional result codes that indicate when an MNP Reliable-Mode link has been established:

Short Long

- 20 CONNECT 300/REL
- 21 CONNECT 600/REL
- 22 CONNECT 1200/REL
- 23 CONNECT 2400/REL

\V2 Tells the modem to use a full set of result codes that indicate when a V.42 or MNP link has been established. Table 6-2 lists all these special result codes.

Table 6-2. Result Codes Enabled By \V2.

Long	Short	Physical Protocol	Data Protocol	Speed	Compression
CONNECT V21/REL-MNP	20	V.21	MNP	300 bps	No
CONNECT V21/REL-MNP-COMP		20	V.21	MNP	300 bps Yes
CONNECT V103/REL-MNP	20	Bell 103	MNP	300 bps	No
CONNECT V103/REL-MNP-COMP		20	Bell 103	MNP	300 bps Yes
CONNECT 1200/REL-MNP	22	V.22	MNP	1200 bps	No
CONNECT 1200/REL-MNP-COMP		22	V.22	MNP	1200 bps Yes
CONNECT 1200/REL-LAPM	22	V.22	V.42 (LAPM)	1200 bps	No
CONNECT 1200/REL-LAPM-COMP		22	V.22V.42 (LAPM)	1200 bps	Yes
CONNECT V2400/REL-MNP	22	V.22	MNP	2400 bps	No
CONNECT V2400/REL-MNP-COMP		22	V.22	MNP	2400 bps Yes
CONNECT V2400/REL-LAPM	22	V.22	V.42 (LAPM)	2400 bps	No
CONNECT V2400/REL-LAPM-COMP		22	V.22V.42 (LAPM)	2400 bps	Yes

See the **V** command in **Chapter 5** to find out how to select the long or short form for result codes.

- \X** *Set X-ON/X-OFF Passthrough*—Specifies whether X-ON/X-OFF characters are passed through the Tote-A-Fax.

 - \X0** This value (the default) tells the modem to recognize X-ON/X-OFF characters, but not to pass them through. X-ON/X-OFF characters controlling computer-to-modem data flow are received and recognized, but filtered out of the data sent to the remote modem. Likewise, X-ON/X-OFF characters controlling modem-to-modem data flow are not passed through to the computer.
 - \X1** Tells the modem to recognize X-ON/X-OFF characters controlling computer-to-modem and modem-to-modem data flow, and pass them through. X-ON/XOFF characters from the computer are recognized and then also passed through to the remote modem; X-ON/X-OFF characters from the remote modem are recognized and then passed through to the computer.

Passthrough should not be enabled when you're using X-ON/X-OFF to control the computer-to-modem data flow. But it should be enabled when the software at both ends of the link is using X-ON/XOFF to control the flow of data end-to-end.

- \Y** *Switch to Reliable Mode*—Tells the modem to try to establish an MNP Reliable-Mode link when it is connected in a Direct-Mode or Normal-Mode link. This command is valid only in the Escape state. If the modem has already established a Reliable-Mode link, it simply goes back on line.
- \Z** *Switch to Normal Mode*—Tells the modem to switch from a Reliable-Mode link to a Normal-Mode link. This command is valid only in the Escape state. Note that any data in the buffers is discarded when you send the **\Z** command.

7. A Data-Communications Primer

Many people have questions about modems and data communications in general. It might be useful to you to know the answers before you try any of the troubleshooting techniques in **Chapter 8**.

What is a modem? A modem is a device that allows computers to communicate over ordinary telephone lines. Although both computer cable and telephone lines are carrying electrical signals, the signals are very different: sound patterns for the telephone, and digital (on/off) patterns for the computer. A modem handles the task of converting each type into the other.

To send data, a modem receives a digital signal from the computer and changes (“modulates”) it into a sound-wave (“carrier”) signal transmitted over the phone system to another modem. To receive data, a modem receives a sound-wave signal from another modem and changes (“demodulates”) it into a digital signal which it sends to the computer. The word “modem” is a contraction of the words “MODulator” and “DEMulator.”

What is data? A computer identifies each character by the on/off state of combinations of seven or eight “bits.” A “bit” is a “Binary digIT,” which like a light is either on or off.

With 7 bits, you can represent 128 characters; with 8 bits, 256 characters. The 128-character set includes the alphabet, numbers, punctuation symbols, and special computer characters (like Escape and Carriage Return). The set is a type of language; in the U.S., it is called “ASCII” (American Standard Code for Information Interchange). Sets used in other countries may vary slightly from ASCII.

How is computer communication synchronized? For the conversion between sound and digital signals to work properly, data communication must be “synchronized.” Computers use one of two different methods of synchronizing communication. In “synchronous” data communications, special synchronizing characters are sent at the beginning of a stream of characters to ensure that the computer receiving the data is properly synchronized with the computer transmitting the data. In “asynchronous” data communications, each character has “markers” to tell the receiving computer when the data begins and ends.

How are characters “marked” in asynchronous communication? To identify when a character starts and stops, bit markers are placed at the beginning and end of each character. These markers are called, not surprisingly,

the “start” bit and the “stop” bit(s). Typical communications use 1 start bit, 7 or 8 data bits (the character itself), and 1 or 2 stop bits.

“Parity” is a method of error detection and correction that helps prevent line noise from causing data-transmission errors. When only seven data bits are used, the eighth data bit is often used to specify parity. If there are eight data bits, another bit is needed in order to specify parity.

How fast can I communicate? A modem’s transmission speed is rated in bits per second (bps). The range of speeds for ordinary microcomputer modems goes from a low of 75 to a high of 19,200 bps. The Tote-A-Fax can operate at speeds of 300, 1200, or 2400 bps.

Speed determines the rate at which files are transferred. If a typical character is 10 bits long, a modem operating at 300 bps, for example, transmits 30 characters per second. At 1200 bps, a modem would transmit 120 characters per second. There is a trade-off, however: the faster the speed, the greater the potential for transmission errors.

What’s Duplex and why is it either Full or Half? “Duplex” indicates how two-way communication is carried out. If communication is “half-duplex,” only one side can “speak” at a time, as in CB radio communication. If communication is “full duplex,”

both sides can speak at the same time, as in ordinary phone conversation. In other words, in half-duplex one side cannot transmit until the other is finished transmitting. In full duplex, both sides can transmit simultaneously.

How can you tell the speakers apart then, if you are in full duplex? Imagine trying to sort out a conversation between two people with absolutely identical voices, vocabularies, and speech patterns. That’s what full duplex would be like if there were no way to tell the “speakers” apart.

To avoid this kind of confusion, a distinction is made between the side that originated communication and the one that answered. The first uses the “Originate” carrier signal; the second, the “Answer” carrier signal.

You should be aware, however, that the two can sometimes be reversed: The initiating side can speak in “Answer” tones, while the receiving side speaks in “Originate” tones.

What’s “echo”? In data communications, “echo” is how your communications setup sends characters to the computer (actually, to the computer’s screen). “Local echo” means that each character you send to the modem is also sent (“echoed”) to your screen. “Echoplex” means that each character a remote computer receives from your computer is sent back to your computer’s screen.

In effect, echoplex serves as a check on the quality of the communications path. Data that appears garbled on the screen was probably garbled in transmission, and data that should appear on the screen but doesn't was probably lost in transmission. Most computer communications systems use full duplex with echoplex.

But if you have trouble transmitting and receiving data, you will need to use the troubleshooting techniques in **Chapter 8** to determine the cause of the problem.

What are Bell and CCITT standards?
These are two sets of communications standards. Bell applies mostly in North America, and CCITT applies everywhere else. Because these standards differ in the frequencies they use, the way they dial, and several other technical details, it is important that you use the appropriate standard when placing a call.

The "Bell" standards were established by Western Electric and Bell Labs: Bell 103 for 300-bps operation and Bell 212A for 1200-bps.

The "CCITT" standards are the international ones, adopted by most countries. CCITT are the initials of the French name for the International Telegraph and Telephone Consultative Committee. CCITT established the V.21 protocol for 300-bps, V.22 for 1200-bps, and V.22 bis for 2400-bps communication.

8. Troubleshooting

Your Tote-A-Fax modem has been thoroughly inspected and tested before shipment. Generally most problems will be in making the Tote-A-Fax work with either your computer or the communications software. Use this troubleshooting section *before* you call your dealer.

NOTE: This chapter deals with the physical operation of your Tote-A-Fax. Please refer to the software guide for problems with fax transmission.

8.1 If The Tote-A-Fax Will Not Dial or Connect...

First, know your software. You must have communications software to use your Tote-A-Fax. (Some computers—and all terminals—have this software built in.)

Be sure you thoroughly understand how your communications software works. It must be set up the right way for your Tote-A-Fax.

Try to use the Tote-A-Fax and watch its LEDs. Make a note of the status of each indicator, then find your symptoms in the list that follows.

8.1.1 TROUBLESHOOTING WITH THE LEDs AND THE SPEAKER

Data/Speed LED never comes on. If you are using a battery, try this:

1. Detach the modem completely from the computer and the telephone line.
2. Plug the supplied AC adapter into the side of the modem.
3. The Data/Speed LED will turn on as soon as power is supplied from the AC adapter. If it doesn't, make sure your AC adapter is working. If it is working, but the Tote-A-Fax isn't, then call your dealer.

Data/Speed LED will not light in battery operation, but lights with AC adapter. When you use a battery to power the Tote-A-Fax modem, it automatically turns on and off to conserve battery life. See **Section 3.1, "Powering Your Modem,"** for additional information. Remember:

1. The modem is configured by the factory to turn on when DTR (Data Terminal Ready) goes HIGH and to turn off when DTR goes LOW. You must have DTR available for this option to work properly. Check your cable and computer manual to verify that DTR is supported by your computer or terminal. Do *not* use a null-modem cable for an extension cable.

2. If the battery is totally discharged, the Low-Battery LED cannot light. The LED cannot indicate a dead battery.
3. Try to operate with the AC adapter before calling for assistance. Your dealer will need to know if the Tote-A-Fax works normally with the adapter despite problems in battery operation.

No sound from the internal speaker. Make sure your Tote-A-Fax is connected properly to the right RS-232 serial port and not, for example, to a printer port. Many computers have several connectors of similar shape.

Make sure you have configured your communications software to operate at 300, 1200, or 2400 bps only.

Make sure the computer and communications software are set up and operating correctly. For example, make sure the modem is connected to the same port chosen by the software (COM1, COM2, COM3, or COM4).

It's easy to check the modem connection on an MS-DOS® compatible system with the following Quick Test of your computer-to-modem hookup:

1. Turn the computer off, then back on.

2. At the DOS prompt, enter:

```
COPY CON COMn  
HELLO  
^Z
```

where **n** is the number of the port to which the modem is attached (1, 2, 3, or 4—try 1 first). Enter **^Z** by holding down the [CTRL] key and pressing [Z].

If you get the message “Write fault error device COMn,” the computer and modem are not connected properly.

If you receive the message “1 File(s) copied,” the computer and modem are probably connected properly. To be sure, disconnect the modem and repeat Steps 1 and 2. In this case, you should see the error message in Step 3.

If you are using communications software that can dial automatically, make sure it is set for a Hayes compatible modem. If the software cannot dial automatically, you must dial the number manually.

Verify that the telephone connection is good. In “standard” operation the Tote-A-Fax will not attempt to dial unless a dialtone is detected first. Connecting a standard telephone to the line is a good way to verify that the telephone wire is good.

If your computer cannot support DTR, then send the command **AT&D&2** to tell the modem to ignore DTR.

If Switch 3 is set to OFF, so that the modem powers on when it detects DTR from the computer, make sure you wait long enough for an adequate delay after power-up before you send your first AT command. If the modem works with an AC adapter yet seems to not respond when using batteries, the delay between power-up and the first AT command may not be long enough. You will probably need to set Switch 3 to ON.

Make sure the modem and DTE (computer or terminal) are *not* connected by a null-modem cable.

Make sure you are using a dialing method your telephone supports. If the telephone does not support tone-dialing, use pulse-dialing by typing **ATDP** rather than **ATDT** when dialing.

Carrier-Detect LED will not light or stay lit. The Carrier Detect LED should light once you have successfully dialed and connected to a remote computer. If it doesn't:

- Make sure your modem and the host are using the same communications standard. For the Bell standard, send the command **ATB1**; for CCITT, send the command **ATB0**.
- Make sure that the host can accept the speed you've chosen. See **Section 4.3, “Matching Different Speeds and Protocols,”** for more information.
- The host you are calling may disconnect you if it does not exchange initiating characters or passwords with your computer within a given time.
- Make sure you are not inadvertently “dropping” DTR by exiting your communications software while on line. If you expect that you'll need to go off line, send the command

AT&D&W

which tells the modem to ignore DTR. Otherwise, if you're using a battery and you've set the modem to use DTR to control the power, the modem may simply be turning off.

8.1.2 TROUBLESHOOTING WITHOUT LEDs

The Tote-A-Fax will not dial. First, check the LED troubleshooting section above. If you're still having problems, here are a few more things to try:

1. Switch to "dumb" terminal mode on your computer and type **ATD <CR>**. (In "dumb" terminal mode, characters you type at your keyboard are sent directly out the serial port.)
2. If you hear a dialtone, abort the call by pressing any key on the computer keyboard. Then refer to **Section 4.1, "Dialing."**
3. If you get an immediate "OK" response after typing **ATD**, it is possible that DTR is not being controlled by the computer. Send the command

AT&D&W

and try again.

Battery life seems poor. Unplug the modem to verify that it turns off. If it remains on, call for assistance. If you are using "RX sensing" to turn the modem on and off, remember that the modem will not turn off unless the computer is turned off or the modem is detached from the computer port.

The Tote-A-Fax always answers a ringing telephone. Use the command

ATS0=0&W

to disable auto-answer. Remember that the modem can answer a call even if the computer is not attached. Use

AT&F&W

to completely reset all DTR modes and the S0 register.

Auto-answer doesn't work. Auto-answer can function only if Register S0 is set to a number greater than 0 (for example, set the value in S0 to "1" to answer on the first ring). If you want the modem to answer automatically all the time, you must also "store" this setting using the **&W** command. (If you don't store the setting, the next time you turn the modem on, you will have to set the modem to auto-answer again). The full command would be **ATS0=1&W**. Many types of software automatically enter these settings when instructing the modem to "auto-answer." Auto-answering is discussed in detail in **Section 4.2**.

The Tote-A-Fax answers the telephone but disconnects immediately. Again, you might need to check DTR. If DTR is not set high by the computer, the modem will answer but hang up, because it sees no connection with its host. If you are using a battery and the modem is set to use DTR as the signal to turn on, change the setting of Switch #3. Then send the command

AT&D0&W

to tell the modem to ignore DTR. If you are using the AC adapter, just send the command—don't bother with the switch. **See Section 3.1, “Powering Your Modem,”** for more details.

The Tote-A-Fax dials and connects, but no characters appear on screen, or garbled characters appear. If you are using any cabling, make sure you have made all the required connections.

Make sure the host is in full duplex, echoing characters back.

If you are on a local area network, make sure its software is not interfering.

Some computers and terminals will not display data until “Carrier Detect” is asserted (high). Use

AT&C0&W

to force the carrier-detect LED on at all times.

NOTE: Use **AT&C0&W** only if you know the modem is dialing and seems to function, but data simply cannot be displayed on the screen. Terminals may require this setup more often than personal computers.

Characters appear twice on screen. Use **ATE0** to command the modem to stop echoing characters to the screen, or set your software for full-duplex if it is set to half-duplex.

Errors in transmission. Remember that transmitting at higher speeds is occasionally susceptible to errors. Your Tote-A-Fax is designed to be error-free at 2400 bps, but a noisy telephone line can cause errors. If this appears to be the case, try transmitting at a lower speed.

If you are using acoustic cups, make sure the fit is snug. Also make sure the cups are not picking up outside vibrations, like your typing on the keyboard. If errors keep occurring, try a lower speed.

Replace the battery if the low-battery LED is ON.

Enable X-ON/X-OFF protocol via your communications software, so that your modem and the host system can pause briefly for transmission to be stored, then displayed. If your problem is that some of the data appear correct but large blocks of data are simply missing, enabling X-ON/X-OFF will usually solve it.

Check that your communications settings (word length/data bits, parity, and stop bits) match those of the remote system.

See Chapter 9, “Testing Your Tote-A-Fax,” for more advanced troubleshooting techniques.

8.2 Problems with Acoustic Cups

Can't dial with acoustic cups. Remember, automatic dialing is not possible with acoustic cups. Dial the number manually and listen to the dialing through the cups to verify that the call is completed. Then send the **ATDC** command to connect. See **Section 4.1.3** for more about using acoustic cups.

Too many errors. Since acoustic cups use the air to transmit data, they are very susceptible to extraneous noise that will cause errors. When you use acoustic cups, remember:

1. Make sure the cups fit snugly on the phone.
2. Isolate the cups from external vibrations, including typing. (Your body is an excellent isolator. Use your shoulder or lap to absorb external vibrations.)
3. If errors are still too high, drop back a speed and try again.

9. Testing Your Tote-A-Fax

If you're experienced in data communications, you'll want to use the tests described in this chapter to help you diagnose any problems you might run into with the Tote-A-Fax. (If you don't have much data-communications experience, you might want to stop with **Chapter 8**, "**Troubleshooting**.")

9.1 Descriptions of the Tests

The Tote-A-Fax gives you five different testing options:

1. *Local Analog Loopback with Self-Test (&T8)*. This test checks the integrity of the local modem's processing ability. Your modem sends encoded and decoded data to itself—no telephone connection is needed—and, after a defined period of time, reports the number of errors that occurred.
2. *Local Analog Loopback (&T1)*. This test expands on the first by including the DTE and computer connection in the test setup. Your modem retransmits all the data you send it, back to your computer's screen. Again, there is no telephone connection involved.
- 3, 4. *Digital Loopback and Remote Digital Loopback (&T3, &T6)*. These tests are used to examine the quality of the telephone connection or the remote modem and its ability to communicate error-free with your modem. In these tests, the receiving modem retransmits data over the telephone line to the sender. The data may be reflected by your modem or by the remote modem, depending on which test you select.
5. *Remote Digital Loopback with Self-Test (&T7)*. This self-test is used to check the remote modem and the telephone line. Data is automatically sent internally from your modem, returned by the remote modem, and analyzed for accuracy by your modem. The numerical result is displayed when the test ends.

9.2 How to Use the Tests

To begin a test, first make sure you're in "dumb" terminal mode. Then enter the command

AT&Tn

where **n** is the number of the test you wish to execute.

To end a test, enter the escape code **+++**, then the command

AT&T90.

A test will end automatically when it exceeds the time limit set by Register S18. Use the command

ATS18=**n**

to set the test duration (in seconds) to any value between 1 and 255, or to 0 if you don't want the test to stop automatically.

NOTE: The default value for S18 is 0, so you must change the value of S18 before beginning the test if you want the test to stop automatically.

9.2.1 LOCAL ANALOG LOOPBACK WITH SELF-TEST (&T8)

You must perform this test off-line, without a telephone connection.

1. Enter the command **AT&T8**. (If you want to end the test yourself, you don't need to change Register S18. If you want the test to end after, say, thirty seconds, enter the command **ATS18=30&T8**.)
2. The modem responds with a single line feed and immediately begins the self-test.

3. If you didn't set register S18 to stop the test automatically, enter the escape code **+++** and then **AT&T0** when you want to end the test.
4. The modem sends you a numerical result at the end of the test. If the modem is working properly, the result should always be 000, meaning that no errors were encountered in the test. If repeated tests come up with any other number, call your dealer for help.

9.2.2 LOCAL ANALOG LOOPBACK (&T1)

This test, too, must be performed off-line.

1. To begin the test, enter the command **AT&T1**.
2. The modem responds with a single line feed, indicating that it is in the loopback test mode, ready to echo typed characters back to your screen.
3. Type in any phrase—for example, "The noblest mind the best contentment has."
4. Watch your screen and make sure that *everything* you typed appears on your screen exactly as you typed it.
5. Occasional errors indicate noise or a poor connection in the modem or the computer, or in the computer's RS-232 port.
6. If you didn't set Register S18 to stop the test automatically, enter the escape code **+++** and then **AT&T0** when you want to end the test.

9.2.3 REMOTE DIGITAL LOOPBACK (&T6)

Perform this test while you're on line with a valid connection to another modem. The remote modem *must* be a 2400-baud modem capable of responding to remote-request queries. Some 2400-bps modems and most 1200-bps and 300-bps modems will not grant remote-loopback requests, and many commercial host services also do not allow them.

1. Make sure the remote modem is set to accept a digital-loopback request. If the remote modem is Hayes compatible, the operator of the remote modem must have sent the command **AT&T4**. (If you don't want to grant access for a remote loopback test, enter the command **AT&T5**.)
2. In Command Mode, enter the command **AT&T6**.
3. Type in any phrase—for example, "The noblest mind the best contentment has."
4. Watch your screen and make sure that *everything* you typed appears on your screen exactly as you typed it.
5. Occasional errors indicate noise or a poor connection in the line, the modem, or the computer, or in the computer's RS-232 port.
6. If you didn't set Register S18 to stop the test automatically, enter the escape code **+++** and then **AT&T0** when you want to end the test.

9.2.4 REMOTE DIGITAL LOOPBACK WITH SELF-TEST (&T7)

This test is the same as the Remote Digital Loopback, except that the modem itself (not you) generates the characters. The modem makes the comparison between the characters it sends and the ones it gets back, giving you a cumulative error count after every 100 characters compared and at the end of the test (up to a total of 255 errors). If you want the test to stop automatically, set register S18 for a timeout.

9.2.5 LOCAL DIGITAL LOOPBACK (&T3)

In this test, the operator of the *remote* modem (not you or your modem) generates the command to loop back your characters through your modem. (You'll want to use this test if the remote modem can't recognize loopback requests—for example, if it is a CCITT V.54-compatible modem.

To end the test, type the escape sequence **+++**, then send the command **AT&T0**.

10. Synchronous Communication

Synchronous communication is a transmission method in which the modem sends data bits at timed intervals. Unlike asynchronous communication, which uses start and stop bits to signal the beginning and end of data, synchronous communication uses the timing itself. That means that start and stop bits aren't needed. Because it takes fewer bits of data to relay the same information, synchronous communication is more efficient than asynchronous.

Most Tote-A-Fax users, however, will never have any occasion for synchronous communication. It's used only for very specialized applications, such as certain types of connections to mainframes.

Particular protocols are needed to control synchronous communications. You need special hardware and software for your computer or terminal to implement the synchronous protocol, assemble frames of data for transmission, and disassemble them as they are received.

For a personal computer, you'll need a synchronous adapter card. And the computer will have to be able to exercise control over the DTR line. As you'll see, that hardware line controls many synchronous operations.

10.1 Getting Ready for Synchronous Communication

10.1.1 HOW TO SEND SYNCHRONOUS-MODE COMMANDS

Like all other AT commands, **&M** commands must be sent while the Tote-A-Fax is in the command state. That means that the commands **&M2** and **&M3**, which put the modem into Synchronous Modes 2 and 3 for use with a synchronous-only terminal, must be entered from an asynchronous computer or terminal, then stored in nonvolatile RAM with the **&W** command. Then you can connect the Tote-A-Fax to the synchronous-only terminal from which you plan to communicate. (See the **&W**, **Z**, and **&Z** commands in **Section 5.4** for more on how to store modem configurations.)

The **&M1** command, which selects Synchronous Mode 1 for use with an asynchronous/synchronous terminal, can be sent from that type of terminal without reconnecting the Tote-A-Fax.

10.1.2 CCITT COMPATIBILITY

The synchronous operating modes of the Tote-A-Fax are based on CCITT Recommendation V.24, Application 108.1, for specifying series interchange circuit designations. This alternative, entitled "Connect Data Set (Modem) to Line," is similar to EIA Recommendation RS-232.

10.1.3 MNP LOCKOUT IN SYNCHRONOUS MODE

If the Tote-A-Fax is configured for both MNP (\N0, \N2, or \N3) and synchronous operation (&M1, &M2, or &M3), it ignores the MNP parameters. To use Synchronous Mode, the modem should be configured for Direct Mode with the \N1 command (the default). Synchronous Mode should *not* be used with a terminal speed higher than 2400 bps.

10.2 The Synchronous Modes

10.2.1 SYNCHRONOUS MODE 1: SYNCHRONOUS/ASYNCHRONOUS MODE (&M1)

Synchronous Mode 1 supports terminals that can communicate both synchronously and asynchronously over the same serial port. In this mode, a call is originated asynchronously from the command state with the **D** or **A** command. Then the modem automatically switches to the synchronous on-line state and sends the “CONNECT XXXX” result code to the computer.

NOTE: The &M1 command setting cannot be stored in nonvolatile RAM.

The modem waits for the period of time specified in Register S25, then examines the state of DTR. The computer must turn DTR on; then the modem can begin data transfer. If DTR is off, the modem hangs up. During the transmission, the modem will hang up and return to Asynchronous Command State if:

- You’ve enabled &D1 and DTR is turned off, or
- The modem loses carrier for more than the time specified in Register S10.

10.2.2 SYNCHRONOUS MODE 2: STORED-NUMBER DIAL (&M2)

Synchronous Mode 2 supports a synchronous-only terminal or a computer with a synchronous adapter card. In this mode, the Tote-A-Fax automatically dials the first stored dialing string (stored with the &Z0=x command) when DTR is turned on. (See &Zn=x in Section 5.4.)

As in Synchronous Mode 1, the modem hangs up and returns to the asynchronous command state when carrier is lost for longer than the time specified in register S10. In Synchronous Mode 2, however, the modem *always* hangs up when DTR is off, whether or not &D1 is in effect.

NOTE: As soon as you send the &M2 command, the modem may immediately make the phone connection and start dialing. To keep it from dialing right away, disconnect the modem from the phone line while you send the &M2 command. Then store the configuration with the &W command, turn the modem off, and connect it to your synchronous computer or terminal. Reconnect it to the phone line, turn the modem back on, and toggle DTR on.

**10.2.3 SYNCHRONOUS MODE 3:
MANUAL DIAL WITH DATA/TALK
SWITCH (&M3)**

Synchronous Mode 3 is the same as Synchronous Mode 2, except that you manually dial the number (rather than telling the modem to dial a stored number). As in Mode 2, your terminal must be synchronous only, or your computer must have a synchronous adapter card. You'll also need to have a telephone connected to one of the jacks on your Tote-A-Fax (see Fig. 3-2 in **Chapter 3**).

In this mode, when DTR is off, the modem is in "talk" mode. You can dial the phone number with the telephone. (You can talk to someone on the other end, too, if you like.) When DTR is turned on, the modem goes into "data mode" and you hang up the phone.

As in Mode 2, the modem will hang up and return to the asynchronous command state if carrier is lost for longer than the time specified in register S10. It also hangs up when DTR is turned off, whether **&D1** is in effect or not.

If the modem can't get a connection, it hangs up and switches from data mode to talk mode. DTR must then be off for you to be able to retry the call by dialing with the telephone.

NOTE: See the **&X** command in Section 5.4 for more about the asynchronous timing selection.

Appendix: Regulations That Apply to the Use of the Tote-A-Fax

Connecting to the Telephone Company

It is not necessary to notify the telephone company before installing the Tote-A-Fax. However, the telephone company may request the telephone number or numbers to which the modem is connected and the FCC information printed at the front of this manual.

If the telephone company has any questions about your Tote-A-Fax, you may refer them to your dealer's technical-support department.

If the modem is malfunctioning, it may affect the telephone lines. In this case, disconnect the Tote-A-Fax until you find the source of the problem. Do not use the Tote-A-Fax on party or coin telephone lines.

For Canadian Users:

The Canadian Department of Communications (DOC) label identifies certified equipment. This means the equipment meets certain telecommunications-network protective, operational, and safety requirements. The Department does not guarantee that the equipment will operate to a user's satisfaction.

Before installing this equipment, make sure you are permitted to connect it to the facilities of the local telecommunications company. You must also use an acceptable connection method to install the equipment. In some cases, you may extend the company's inside wiring for single-line, individual service by using a certified connector assembly (telephone extension cord). You should be aware, however, that compliance with these conditions might not prevent degradation of service in some situations.

Repairs to certified equipment should be made by an authorized facility. Any repairs or alterations made by a user to this equipment, or equipment malfunctions, may give the telecommunications company cause to request the user to disconnect the equipment. For service and, if necessary, repair of this equipment, call your dealer.

For your own protection, make sure 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!

Do not attempt to make such connections yourself. Contact the appropriate electric inspection authority or electrician.

Glossary

Acoustic coupler. A device that converts electrical signals into audio signals, allowing data to be transmitted over the public telephone network via a conventional telephone handset.

Analog loopback test. A test that evaluates the internal operation of your modem by having it loop back the characters transmitted to it by your computer or terminal.

Application program. Software designed to perform a specific task, such as data communications or word processing.

ASCII. (Pronounced “Askee.”) Acronym for American Standard Code for Information Interchange. A 7-bit-plus-parity code set up by the American National Standards Institute to achieve compatibility between data services.

Asynchronous transmission. Data transmission controlled by start and stop bits at the beginning and end of each character. No additional timing or synchronizing is needed.

Baud rate. The speed at which a computer sends data. This speed is usually given in bits per second (see *Bps*), though technically the two are not identical.

Binary. A two-value system: zero or one (equivalent to space or mark in communication terminology). All data stored in a computer is stored as a combination of zeroes and ones.

Bit. The smallest unit of information in a binary system. A bit represents the choice between a one or a zero value.

Bit-mapped register. A register used to store information controlling the operation of your modem. You can change the contents of a register by sending a command to your modem. These contents can be saved and retrieved from nonvolatile *RAM*.

Block. A group of characters.

Bps. Bits per second. A measurement of the speed of data transmission. Your Tote-A-Fax can transmit at 2400 bps, but with data compression you can get an effective speed of up to 9600 bps.

Bulletin-board service. A program that provides public information exchange between various communicating computers.

Byte. A sequence or group of eight bits, representing one character.

Carriage return. A control code normally used to return the cursor to the left margin on the screen. In this manual, [CR] denotes a carriage return.

Carrier (Detect) signal (CD). A modem interface signal; it tells the attached *DTE* that the modem is receiving a signal from a remote modem.

CCITT. Abbreviation for Comité Consultatif Internationale de Télégraphie et Téléphonie, a committee that sets international communication standards.

Character. Anything that appears in a single space on your computer screen, including numbers, letters, and graphic symbols. In data communications, a character is usually one *byte*, and the terms are sometimes used interchangeably.

Code. A system of symbols for representing data or instructions (*ASCII*, for example). Also, any software program or part of a program.

Command. An instruction you enter to tell your modem to perform a specific function.

Command Mode. One of the modem's two operating modes. In Command Mode you can send commands from your keyboard to the modem. Compare *On-Line Mode*.

Computer. In this manual, "computer" is used primarily to refer to personal computers—small computers that are not dedicated purely to data communication. Compare with *dumb terminal* and *intelligent terminal*.

Configure. To prepare a piece of equipment or a program to work in a certain way or to match other equipment (such as a remote modem).

Connector. An outlet on equipment and cables that provides for a connection. Connectors are either "male" or "female"; a male connector can mate only with a female connector, and vice versa.

Control codes. One or more characters (which usually don't display or print) that initiate, change, or stop an action.

Data. Information stored or processed by a computer. The computer stores and transmits data in the form of *bits*.

Database. A collection of related data stored together so that information can be accessed easily and used for various applications.

Data bit. The character that is the information being transmitted not to be confused with an ordinary *bit*, of which there are several in one data bit). For asynchronous transmission, the data bit is preceded by one start bit and followed by one or more stop bits.

DCE. Data Communications Equipment. The equipment that provides the interface between the *DTE* and the telephone line. Usually synonymous with *modem*.

Data Terminal Ready (DTR) signal. A modem interface signal; it tells the modem that the attached *DTE* is ready for data transmission.

Default. A preselected value or setting that takes effect when you turn on or reset your modem. You can change a default setting by sending a command or (in some cases) by setting a jumper inside the modem.

Dialup network. A network that is shared by many users, any of whom can establish communication between desired points by using a dial or push-button telephone.

DTE. Data Terminal Equipment. The equipment that originates the data sent by the *DCE*. In this manual, “DTE” refers to your computer or terminal.

Dumb terminal. A terminal that can only send and receive data. Compare with *intelligent terminal*.

Echoplex. A way to check the accuracy of data transmission by returning the received characters to their point of origin for comparison with the original data.

EIA. Abbreviation for Electronics Industries of America, a U.S. trade organization that sets standards for the electrical and functional characteristics of interface equipment.

Escape Code. A code that switches your modem from *On-Line Mode* to *Command Mode* while keeping the data connection with the remote modem. Default for Escape is “+++” (43 ASCII), but this value may be changed by the command “S2=n” to any value of *n* between 0 and 255.

Execute. To perform an instruction or run a program.

Female connector. A connector with sockets into which fit the pins on a *male connector* of the same type.

Full duplex. Simultaneous, two-way, independent data transmission between computers. Compare with *half-duplex*.

Half-duplex. Data transmission in one direction at a time between computers. Compare with *full duplex*.

Handshaking. The exchange of predetermined audible signals to control communication between two modems when a connection is established.

Hardware. Physical equipment, such as a modem or your computer keyboard and monitor. Compare *software*.

Host computer. The central computer in a data-communications system; it provides the primary data-processing functions such as computation, database access, or special programming or programming languages.

Initialize. See *reset*.

Intelligent terminal. A terminal with which you can enter, store, and change data and run programs. Compare with *dumb terminal* and *computer*.

Interface. The *hardware* connection between two pieces of equipment or the *software* connection between two programs.

LED. Light-Emitting Diode. An indicator light that shows the status of equipment. Your Tote-A-Fax has four LEDs that show its operating status.

Line feed. An ASCII character (0A hex) that tells a piece of equipment, such as a printer, to add one line.

Local. The computer or modem you are using, as opposed to the *remote* modem or computer with which you are communicating.

Local digital loopback test. A test that evaluates the operation of your modem, the telephone line, and the remote modem. It causes all characters received by your modem to be looped back to the remote site.

Male connector. A connector whose pins insert into a *female connector's* sockets.

Modem. Contraction for "Modulator-Demodulator." A device that lets a computer send and receive digital signals transmitted over analog telephone lines.

Multiline telephone. A telephone that provides service to more than one line. A multiline telephone has a row of light-up buttons, each one indicating a separate phone line.

Noise. Random electrical signals, introduced by circuit components or natural disturbances, which tend to create errors in data transmission.

Nonvolatile RAM. In the Tote-A Fax, memory in which you store operational settings permanently (or until you change them) that you want to use the next time you turn your modem on.

Null modem. A cable or connector that reverses the wiring of the Transmit and Receive lines so that two devices of the same type can communicate directly. For example, without a null modem connecting them, two terminals could not exchange data because the two Transmit lines and the two Receive lines would be connected. Communication requires that each one's Transmit be connected to the other's Receive.

Off-hook. Open (of a telephone line); "The phone is off-hook" means that the phone is in use.

On-hook. Closed (of a telephone line); "The phone is on-hook" means that the phone is hung up and not in use.

On-Line Mode. One of the modem's two operating modes. In On-Line Mode the modem can send and receive data over the telephone line. Compare with *Command Mode*.

Operating System. A collection of programs that lets a computer control its operations. The operating system determines how programs operate on a computer and monitors the programs as you access them. MS-DOS ("Microsoft Disk Operating System") is a popular operating system on IBM and compatible personal computers.

Originate-only modem. A modem that can communicate only in the Originate frequency, whether it initiates or receives the call. (Usually only the modem initiating a call uses this frequency). Communicating with such a modem requires you to use the Answer frequency when calling. Include an **R** command at the end of your dial command.

Parameter. A value of a variable associated with a command. For example, 0 and 1 are parameters for the **B** command. **B0** means set to Bell compatibility; **B1** means set to CCITT compatibility. For commands that take parameters, 0 is the “implied” parameter: If you enter **B**, the modem takes it as **B0**.

Parity bit. A bit added to the *data bit* to provide error detection and correction, helping to ensure that transmitted data is received accurately at the remote system.

PBX. Private Branch Exchange. A telephone-switching system, installed on the user’s premises, that connects private telephones to one another and to the public network.

Pin. A metal post that is attached to wires within a male connector, and (more generally) the wire attached to it. Pins carry data and data-communication signals between communicating devices. Each pin has a specific signal assigned to it.

Port. A connection between a computer configured as *DTE* and a peripheral piece of equipment, such as a modem.

Printed Circuit Board. The part of your Tote-A-Fax that contains its electronics.

Program. A set of coded instructions that tell a computer what to do.

Protocol. A set of instructions that determines how a computer transmits data. Two computers must use the same protocol to communicate. Protocol settings include the number of *data bits*, *start bits*, *stop bits*, and *parity bits*.

Pulse-dialing. A dialing method in which telephone numbers are sent as pulses across the telephone line. Rotary-dial telephones use pulse dialing. Compare with *tone dialing*.

RAM. Random Access Memory. In your Tote-A-Fax, this is the memory that holds the settings used during communication.

Register. A physical location where a value affecting modem operation is stored.

Remote. The distant equipment with which you are communicating, as opposed to your own *local* equipment.

Remote digital loopback test. A test that evaluates the operation of your modem, the telephone line, and the remote modem. It causes all characters received by the remote modem to be looped back to your modem and computer.

Reset. To restore the default settings of your hardware. You can reset your Tote-A-Fax by turning it off and then on again, or by sending the command **ATZ**.

Result code. A message, in the form of words or numbers, that your modem sends to the monitor after receiving and executing or trying to execute your command.

Ringer Equivalence. A U.S. telephone term used to indicate the number of multiple telephone connections that may be attached to the same line. The total ringer equivalence of all devices attached to your phone line may not exceed a certain number; call your telephone company to find out exactly what that number is for you.

RJ-11 telephone jack. A single-line telephone connection used primarily in the U.S. and Canada. It's a four-conductor jack in which the two center conductors are used to carry the telephone signal.

ROM. Read-Only Memory. In your Tote-A-Fax, this is the memory that stores the factory-default settings for your modem—the settings in effect the first time you operate the modem.

RS-232C (serial) port. A port that follows the *EIA* recommended standard for an interface between Data Terminal Equipment and Data Communications Equipment.

Serial communication. Communication in which data bits are transmitted in series, one after another.

Software. Programs and instructions that tell your *hardware* how to operate.

Start bit. The bit signaling the start of the transmission of a byte.

Stop bit. The bit signaling the end of the transmission of a byte.

Tone-dialing. A dialing method in which telephone numbers are sent as tones, translated into varying electrical signals, across the telephone lines. Tone-dialing telephones have buttons numbered 1 through 9 and 0, and usually also have an asterisk (*) button and a pound (#) button.



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1000 Park Drive • Lawrence, PA 15055-1018 • 724-746-5500 • Fax 724-746-0746