

HEWLETT-PACKARD

HP 82950A

# Modem

OWNER'S MANUAL

SERIES 80



## Telephone Company Rights and Responsibilities

The circuitry in your modem is designed to protect both the phone lines and your computer from damage caused by high voltages. However, the telephone company has the legal right to stop service if the modem should somehow cause harm to the telephone network. In this case the telephone company shall:

1. Promptly notify you of the stoppage of service.
2. Give you the opportunity to correct the situation that caused service to stop.
3. Inform you of your right to bring a complaint to the FCC concerning the service stoppage.

The telephone company may make changes in its facilities and services which may affect the operation of your equipment. However, you shall be given adequate notice in writing to allow you to maintain uninterrupted service.

## Specifications

<b>Transmission Mode</b>	Serial, asynchronous, full duplex.
<b>Modulation</b>	Binary phase coherent FSK.
<b>Baud Rate</b>	Up to 300 bits/second.
<b>Modes</b>	Originate and answer.
<b>Modem Compatibility</b>	Bell 103/113.
<b>Connectors</b>	Two miniature six-position jacks with four conductors. One four-conductor cable with two miniature six-position plugs.
<b>Dialing</b>	Automatic or manual.
<b>Dimensions</b>	Approximately 16.5 by 12.7 by 3.2 cm (6.6 by 5.0 by 1.3 in.).
<b>Cable Length</b>	2.1 meters (7 ft).
<b>Operating Temperature</b>	0° to 55° C (32° to 131° F).
<b>Storage Temperature</b>	-40° to 65° C (-40° to 150° F).

## Modem Information

<b>Manufacturer:</b>	Hewlett-Packard Company.
<b>Model Number:</b>	HP 82950A.
<b>*Registration Number:</b>	BEA9FA-68867-DM-R.
<b>*Ringer Equivalence:</b>	1.0 B.
<b>Jack(s) Which May Be Used:</b>	RJ11C and RJ11W RJ12C and RJ12W RJ13C and RJ13W.

\* You need to provide these facts to the telephone company before you connect the modem to the telephone line.



**HP 82950A**  
**Modem**  
**Owner's Manual**  
**Series 80**

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## Getting Started

### Introduction

The HP 82950A Modem provides a data communications capability, in the United States, for HP Series 80 Personal Computers. This modem connects directly to the telephone line—a system that is superior to an acoustic coupler connection.

The Federal Communications Commission (FCC) requires specific procedures for installation and operation of equipment that uses public communications lines. **THEREFORE YOU SHOULD READ THE INSTALLATION INSTRUCTIONS CONTAINED IN THIS MANUAL THOROUGHLY BEFORE ATTEMPTING TO INSTALL YOUR MODEM.**

### Data Communications Path

Data communications (data comm) is the transmission of information from one point to another. A computer can be connected directly to a remote terminal using special transmission lines, but this becomes impractical for long distances. Although common telephone lines can be used, they are not made for the digital signals that a computer generates. Hence, a modem must be used to convert the digital signals into voice-type (or analog) signals acceptable to the phone system. The other end of the data comm path also requires a modem to demodulate or convert the analog signals in the phone line to digital signals acceptable to the computer or terminal. Figure 1-1 illustrates an entire data comm path with the HP Series 80 Personal Computer depicted as a remote terminal.

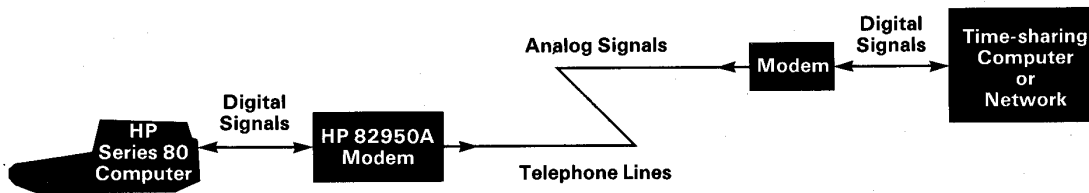


Figure 1-1. Data Comm Path

It is possible to initiate a data comm session with another personal computer. Most of the time, however, you probably will be using your computer as a remote terminal to access information or programs from a larger computer. Your HP 82950A Modem is designed to be compatible with the majority of the time-sharing computers available in the United States.

For the purposes of the discussion in this manual, the assumption has been made that you are familiar with your HP Series 80 Personal Computer and that you have a basic understanding of data communications.

## Unpacking and Inspection

Remove the items listed below from the shipping container and carefully inspect the modem, cable, tape cartridge, and disc for signs of damage that may have occurred during shipment. You should immediately notify your dealer and file a claim with the carriers involved if there is any such damage or any of the items is missing.

- HP 82950A Modem.
- One seven-foot cable with four-prong connectors on each end.
- Magnetic tape cartridge containing modem communications software.
- Magnetic disc containing modem communications software.
- Modem Owner's Manual and accompanying warranty information.

## System Requirements

In addition to your HP Series 80 Personal Computer with mass storage capability, you will need the following to establish a data comm system:

- Input/Output ROM.
- Memory Module.
- ROM Drawer.
- Modular telephone line (pay or party telephone lines may not be used).

You should install the necessary devices in your HP Series 80 Personal Computer.

### CAUTION

Before installing the ROM, ROM drawer, and memory module, read the installation instructions provided with each device. Failure to properly install any of these devices could cause damage to the computer and/or to the devices.

A peripheral printer is optional, since data ordinarily directed to the printer can instead be routed to the CRT. However, a printer that prints 80 characters per line is very useful if the host computer is sending lines that are longer than the width of your computer CRT.

## Select Code

The select code is used in programming to designate each module that is plugged into the computer. When you begin using the modem in the system, you may use the select code in some commands and statements to specify which module you wish to access.

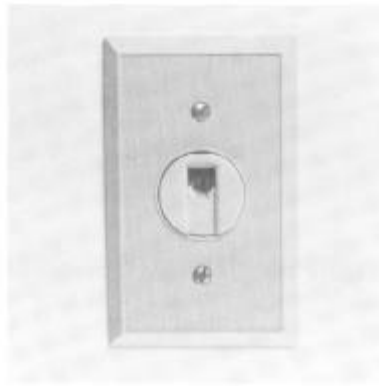
The select code on the HP 82950A Modem is preset to 10 at the factory. If you connect other interface modules to the computer, ensure that the select codes are *not* the same. Also, if you are using a serial interface in addition to the modem, the modem select code must be lower than that of the serial interface for the modem communications software to operate. Since the serial interface select code is also preset to 10 at the factory, you must change the modem's code in this case.

If the select code must be changed, refer to appendix C for instructions.



## Modem Installation

This modem is registered with the FCC for direct connection to a telephone line. However, only certain phone jacks will accept the plug from the modem. A modular telephone jack such as the wall jack shown in figure 1-2 is required.



**Figure 1-2. Modular Telephone Jack**

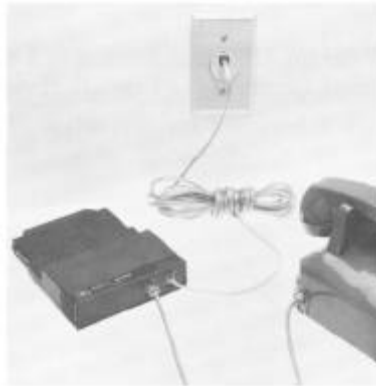
If you have a telephone jack with four round holes, you will need an adapter plug that converts your jack from four-prong to modular. If you do not have the proper type of telephone jack, your telephone company can install one for you. Your modem is designed to be used with a standard single-party telephone line; multiple lines and lines with special features may cause the modem to operate improperly. If you are unsure about the suitability of your telephone line, contact your telephone company.

Before you connect the modem to the telephone line, you are required by law to notify your telephone company. You should tell them of your intention to connect an FCC-registered device to your telephone line. They will need to know the telephone number, FCC registration number, and the ringer equivalence number. The latter two numbers are imprinted on your HP 82950A Modem. Refer to the inside cover of this manual for other pertinent information.

You are also required to notify the telephone company if you ever permanently disconnect the modem.

If you want to plug your modem into a jack that is currently connected to a telephone set, you must first unplug the telephone. Your HP 82950A Modem has a jack to permit you to connect your telephone to the data comm system if you choose to do so.

To connect the modem to the telephone line, plug one end of the cable into the modular jack. Then plug the other end into either one of the two jacks in the modem. To reconnect your telephone set to the system, simply plug it into the remaining jack in the modem.



**Figure 1-3. Modem Connections**

The plugs on your modem cable and telephone set can only be inserted into the jacks in one way. The small plastic tab will snap in when the plug is properly connected. When you pull gently on the cord, it should not unplug until you press on the plastic tab.

If you have a problem with your telephone line, you must disconnect the modem from the line to ensure that it is not the cause of the problem. If the problem then ceases, refer to section 6; if the problem persists, notify your telephone company.

**CAUTION**

Always turn the computer power off before installing or removing the modem. Failure to observe this procedure may result in damage to the HP Series 80 Personal Computer, the modem, or both.

With the computer POWER switch set to OFF, insert the interface end of the modem into any of the four I/O ports in the back of the computer as in figure 1-4. Make sure the modem is firmly seated in the port. Notice that the modem is thicker at the protruding end. It is possible to install the HP 82936A ROM Drawer in an I/O port directly above the port to be occupied by the modem. Other HP interfaces may not fit in that position, but all difficulty can be avoided by installing the modem in the top port (Number 1).



**Figure 1-4. Modem Installation Photo**

## Loading the Programs

The modem communications software consists of one BASIC program ("MODCOM") and two binary programs ("IPBIN" and "GETSAV"). MODCOM and IPBIN are used by your HP Series 80 Personal Computer to emulate a terminal. GETSAV is used to convert program files to data files suitable for data transmission and is discussed in section 4.

To program your computer to operate as a data communications terminal, make sure the required devices mentioned earlier in this section are properly installed in your computer. Then switch the computer to ON and insert either the tape or disc you received with your modem. Type: `LOAD "MODCOM"` and press `(END LINE)`. If you have a disc drive connected, you may need to add the *mass storage unit specifier*, or `msus`.

If you have not inserted a memory module in your computer, a memory overflow error will be displayed. In this case, switch off the computer and insert a memory module. Then switch on the computer and reload the MODCOM program.

Pressing `(RUN)` causes the program to load the binary program "IPBIN". At this time, the program checks to ensure that the HP 82950A Modem and an I/O ROM are present. If either of these items is missing, the appropriate error message will be displayed. You should then switch the computer off and install the required device(s).

**Note:** If you have installed the HP 82939A Serial Interface, but do not have a modem installed, the MODCOM program will not give the error message: `No modem`. Nevertheless, the program will operate improperly without the HP 82950A Modem.

If your system is properly set up, the terminal (computer) will display the CONNECT set of special function key labels. An HP-85, for example, will display:

```
Modcom ready for use

-----CONNECT-----
AUTO-ANS  ANSWER  ORIG   STEST
terminal  DIAL    REDIAL  HANGUP
```

## Dialing Example

The modem communications software makes operating the modem easy. To become familiar with your data comm system, try dialing a telephone number. First, press the `DIAL` special function key `(K2)`. The CRT will then display `Phone number/name? Enter the telephone number of someone you know (perhaps your home)`. If a pause is required after a digit, enter an "@" for each two-second pause. Then press `(END LINE)` and observe each digit on the CRT as it is dialed. (You should have a telephone set connected to the modem with the handset on the hook.)

When `Waiting for connection` is displayed, lift the handset, press `HANGUP` (to turn off the modem) and listen for the ringing signal. If someone answers, use the telephone set normally. If the line is busy or no one answers, hang up the telephone set. Later you can press `REDIAL`, and the same phone number will be dialed again.

Now press `terminal`; the `TERMINAL` set of special function keys will be displayed. The HP-83/85 key labels are:

```
-----TERMINAL-----
ESCAPE  BREAK  PRNT:OFF
direct transfer frame connect
```

Now press `direct` and see the `DIRECTORY` keys:

```
-----DIRECTORY-----
DELETE  RENAME  LIST  STATUS
terminal LOAD  ADD  STORE
```

These keys enable you to store phone numbers and terminal configurations on your mass storage medium. To store the number you have entered in the computer, press `ADD` and see the prompt:

```
New name?
```

Enter a name that corresponds to the number you just dialed (for example, `HOME`) and press `END LINE`. Your tape or disc drive should operate for a short period of time. Then you should see:

```
Phone directory doesn't exist.
Do you want to create it?
```

Type `Y` and press `END LINE`. The CRT will display: `Current phone:` and the number you dialed. After `New phone?` is displayed, press `END LINE`, indicating that you accept the current number. Continue to press `END LINE` after each prompt until `saved` is shown on the CRT. (These prompts refer to transmission characteristics that are discussed in later sections.) The phone number is now saved as an entry in a file named `PHONE#` on mass storage.

To dial the number at a later time you simply return to the `CONNECT` set of special function keys by pressing `terminal` and `connect`. Then press `DIAL`. When `Phone number/name?` appears, enter the name of the entry you created and press `END LINE`. After the number has been dialed, use the same procedure you used the first time you dialed the number.

This example illustrates one of the many capabilities of your HP 82950A Modem. Others are discussed in the following sections.

## Establishing a Data Communications Link

### Introduction

When it is functioning as an intelligent terminal, your HP Series 80 Personal Computer is capable of transmitting information to and receiving information from a host computer or another personal computer. As a terminal, it can interact with a time-sharing system, pass data to the host for analysis, or receive stored data from the host for processing by your personal computer. Additionally, your data comm system can be used in both the originate and answer modes, and can automatically dial or answer to establish data communications links.

This section explains the various ways you can use your modem to establish a data comm link with another computer. First, you will learn how to perform each connecting operation manually. Then, you will be shown how to automate both the dialing and the log-on procedures.

The HP 82950A Modem is compatible with Bell 103/113 modems, which operate at 300 baud.

The transmission options in the modem communications software allow you to achieve compatibility with most host computers. However, before you attempt to use your computer as a data terminal, you should obtain the transmission characteristics for your intended time-sharing system computer(s). For successful data communications, the following characteristics must be the same for both systems.

- Parity.
- Number of bits (7 or 8).
- End-of-line sequence (carriage return or carriage return/line feed).

It is possible to alter some of the transmission characteristics to match other modems using the FRAME set of keys discussed later in this manual. However, the baud rate must be 300 for the MODCOM program to operate correctly.

If you are logging on to a host that requires a specific log-on sequence, you will need to obtain those procedures prior to logging on.

**Note:** When you are entering information in the program or sending queries or control characters to the other computer, the **END LINE** key must be pressed for the computer to properly receive this information. When you answer any prompts caused by pressing the special function keys, you must press **END LINE** after each line you type.

### Special Function Keys

The MODCOM program defines the special function keys to enable you to quickly select the command or function that you need. You may have noticed in the dialing example in section 1 that you rapidly changed from one set of keys to another. Appendix A contains a summary of the special function keys; you may need to refer to it occasionally. As you read this manual, you will learn more about each key.

**Note:** When the MODCOM program is running, you should not repeatedly press (or play with) any key. Doing so may cause the program to malfunction.

The five sets of special function keys are related according to the following figure.

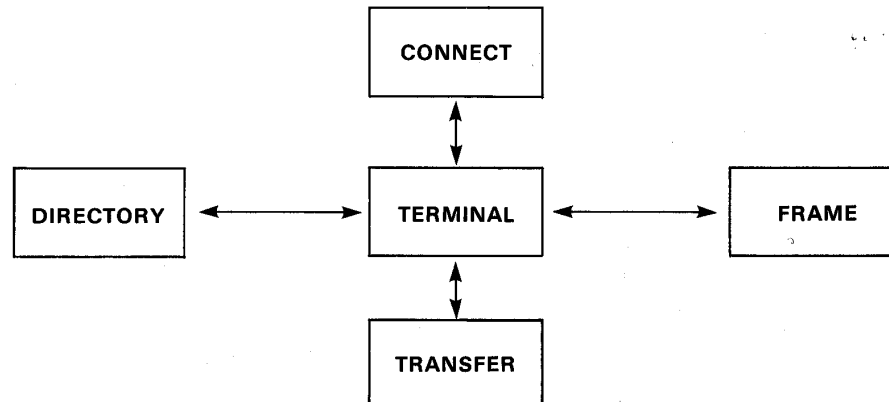


Figure 2-1. Special Function Key Relationship

When you LOAD "MODCOM" and press **(RUN)**, the program displays the **CONNECT** set of keys. After a connection has been made with another modem, the **TERMINAL** set of keys is shown.

```

-----TERMINAL-----
ESCAPE  BREAK  PRNT:OFF
direct transfer  frame  connect
  
```

HP-83/85 key labels

All other sets of special function keys can only be accessed from the **TERMINAL** set. To access any set of keys, press the lowercase label for that set. For example, to switch from the **TERMINAL** keys to the **CONNECT** keys, press **connect**. Note that the name of the key set (**CONNECT**) is displayed on the line above the key labels:

```

-----CONNECT-----
AUTO-ANS ANSWER  ORIG  STEST
terminal DIAL    REDIAL HANGUP
  
```

HP-83/85 key labels

## Origination

For data communications to occur, the modem on one end of the phone line must be in the **originate** mode while the modem on the other end of the line is set in the **answer** mode. This means that the originating modem transmits at one frequency, while the answering modem transmits at a different frequency (or pitch). Normally, when logging on to commercial data bases, your modem will operate in the originate mode. Also, whenever you use the automatic dialing capabilities of the program, the modem is in the originate mode.

## Manual Dialing and Log On

Although you will probably use the automatic dialing capabilities in the modem most of the time, manual dialing is sometimes necessary. Before you can program the computer to log on to a time-sharing system, you must understand each step in the dialing and log-on procedures. The sample procedure given here shows how to dial and log on to Dow Jones News Retrieval Service.

First, to dial any number, make sure the modem is off. You may need to press **HANGUP** to turn the modem off. After **Modem off** is displayed, you can lift the handset and dial the network number. In this example, you would dial 1 (503) 295-3000. When you hear the ringing signal, press the key labeled **ORIG** and then replace the telephone on the hook or cradle.

You should see: **Waiting for connection** on the CRT. When the answering modem sends a carrier, your modem will respond with a lower-pitched carrier and display: **Connection established**. If you leave the handset off the hook during this time, you can hear these two carrier tones.

When you have established a connection, the data communications link has been formed. Now you can follow the log-on procedures that are required by the computer system you are connected to. In this example, press **END LINE** twice and see:

```
TELENET 503 108L (example)
```

```
TERMINAL=
```

Now press **END LINE** once more. The CRT should display:

```
@
```

This is a prompt for the host address. In this example you type: **C 60942** (you must enter a space after the "C") and press **END LINE**. When prompted for the service, type: **DJNS** (for Dow Jones) and press **END LINE**. You will then be asked for your password. You must have an account to receive a password on this network. Contact the service you want to buy for account information.

After you type your individual password, you will be logged on to the Dow Jones News Retrieval Service. To log off, you may follow the host's log-off procedure, or press **HANGUP** in the **CONNECT** set of special function keys.

**Note:** If the special function key labels are overwritten, you can press **KEY LABEL** to return them to the CRT.

The above procedure illustrates the establishment of a modem connection and a representative log-on procedure. Other data bases and time-sharing systems may have somewhat different log-on requirements, but the general procedure is similar.

## Automatic Dialing and Log On

In the first section you used the modem's automatic dialing feature to dial a number. Now that you know what is required manually to establish a data comm link and to log on, you can program your HP Series 80 Personal Computer to dial the number of your chosen host computer and *automatically* log on. We will use the same example (Dow Jones) for this discussion.

First, press **KEY LABEL** if the special function keys are not displayed. Then press **terminal** if the **TERMINAL** set of keys is not displayed. Now press **direct** to obtain the **DIRECTORY** keys below.

```
-----DIRECTORY-----
DELETE  RENAME  LIST   STATUS
terminal LOAD   ADD    STORE
```

HP-83/85 key labels

In section 1 we used the **ADD** key to create an entry containing a phone number for automatically dialing a voice call. This same key is used to create files containing log-on sequences. At this time press the **LIST** special function key. This key is directly under the **LIST** key label; it is not the **(LIST)** key used for listing the program currently in memory. You should then see: **Names:** and the name of the entry you stored in section 1. This key can be used to obtain a listing of the names of all entries stored in the file named **PHONE#** on the tape or disc.

Now press **ADD** and see: **New name?**. The name can be up to 14 characters long. (If you press **(END LINE)** without typing any characters, the program will exit the **ADD** mode and display the **DIRECTORY** keys). Type **D.J.** (for Dow Jones) and press **(END LINE)**.

The display will then list any current phone number in computer memory and display: **New phone?**. The phone number can be up to 32 characters long, but only digits and @'s are significant. When automatically dialing, each "@" causes a two-second delay, digits are dialed, and all other characters are ignored. Delays are not normally needed, but they should be used if your phone system requires a pause. If you are using a tie line, you may need a pause to obtain a second dial tone. If you press **(END LINE)** without entering any number, the current phone number is used.

Enter the telephone number of the network that you have received with your account password (for example, 15032953000) and press **(END LINE)**.

Now you should see:

```
Current logon:
NONE
New logon (N for none)?
```

You can now enter the log-on sequence required by the time-sharing network you have selected. The log-on sequence can be composed of up to 96 characters. The log-on sequence can contain any or all of these five elements:

Element	Meaning	Remarks
E	End-of-line characters.	Each time an E occurs, these characters (CR or CR/LF) are sent.
W	Wait.	Wait the number of seconds specified by the following digit. (W6 causes a six-second wait, W0 a ten-second wait).
P	Pause.	Pauses the log-on sequence until <b>(RUN)</b> is pressed.
(string)	Literal string.	Characters between parentheses are sent. An end-of-line sequence is sent after the last character in the string.
Space	Ignored.	Spaces outside parentheses are ignored.

To log on to Dow Jones News Retrieval, we pressed **(END LINE)** twice; then we waited one second and pressed **(END LINE)** again. Using the elements defined above, this is represented by:

```
EEW1E
```

After a short wait, the @ appeared on the CRT, and we typed **C 60942**. This is a literal string and is represented as **(C 60942)**. The short waiting period preceding this string can be entered as **W2**.



So far, our log-on sequence looks like this:

```
EEW1EW2(C 60942)
```

An end-of-line sequence is automatically sent after the last character in the parentheses.

**Note:** Due to the time variation between prompts on host computers, a waiting period may be long enough sometimes, but too short at other times. If you encounter this problem, increase the wait or insert a P to pause the log-on sequence.

The next prompt requires a few seconds to appear; we estimate that a waiting period of 9 seconds is sufficient. Then DJNS should be entered.

Now the sequence is:

```
EEW1EW2(C 60942)W9(DJNS)
```

After waiting a few more seconds, the prompt for the password will appear. We choose to wait 10 seconds here, so we add W0 to the sequence. Then the password must be entered as a literal string in parentheses.

Our complete log-on sequence is:

```
EEW1EW2(C 60942)W9(DJNS)W0(password)
```

After you have typed the log-on sequence, place the cursor under any character in the sequence and press **END LINE**. You should now see:

```
Current echo:OFF
New echo?
```

The echo and the subsequent prompts for flip, bits, parity, error check, and EOL will be discussed later. Echo should be off for this example, so press **END LINE** and see the prompt for flip. As you continue to press **END LINE**, each of these parameters assumes the value set and indicated in the FRAME set of special function keys. These keys are described later in this manual. For our example, the default values are correct.

After all prompts have been answered with the **END LINE** key, the word `saved` will be displayed on the CRT. The phone number and log-on sequence for the Dow Jones example have now been stored in an entry named DJ in the file named PHONE#.

To use this file, press DIAL. When Phone number/name? appears, type: DJ, and then press **END LINE**. If all goes well, you should be logged on to the Dow Jones data base. If the line is busy, or connection is not established for some other reason, the modem will hang up after 30 seconds. To dial again, press REDIAL. REDIAL uses the phone number and log-on procedure already stored in computer memory by pressing either the DIAL or LOAD special function key. The LOAD key is discussed in section 3.

To halt an automatic log-on operation while it is in progress, press **SCRATCH**.

## Answer Mode

The HP 82950A Modem gives HP Series 80 Personal Computers the capability to communicate with each other over the phone line. In this case, one computer must be operating in the originate mode, the other in the answer mode. The answering modem sends data at a higher pitch than the originating modem. The answer mode can be entered manually or automatically.

**Note:** Refer to the last part of section 3 for additional information that is needed to communicate between HP Series 80 Personal Computers.

## Manual Answering

It is possible to establish a data comm link during a voice call. If two computer owners agree during a call to switch on their modems (one answering, one originating), the link can be formed. If you desire to operate in the answer mode, simply press the ANSWER key after you have dialed a phone number or are talking to someone on the phone line. You will hear a high-pitched tone in the handset. You should then hang up the telephone handset.

Your modem then attempts to establish a handshake with the originating modem. Upon successful completion of the handshake, the CRT displays: Connection established, and the TERMINAL set of special function keys is shown. If no handshake occurs within 17 seconds, the CRT displays: Time-out. No connection made, and the modem hangs up.

## Automatic Answering

Pressing AUTO-ANS causes the program to wait for a call. Once a ring is detected, the program answers the phone and attempts to establish a handshake with an originate-mode modem on the other end of the line. Upon successful completion of the handshake, the computer beeps and displays: Connection established and the TERMINAL set of keys.

If the handshake fails or a false ring is detected, a corresponding message is displayed, and the program goes back to waiting.

In this section you have learned how to establish a data communications link manually and automatically in both the answer mode and the originate mode.

Section 3 describes how to modify the operation of your computer by using the TERMINAL, FRAME, and DIRECTORY sets of special function keys.

## Operating as a Terminal

After you have established a data comm link, there are certain operations which your computer needs to enhance its capabilities as a terminal.

This section contains information about sending control characters, configuring the terminal to match other data comm systems, and using the directory file to store phone numbers and terminal configurations.

### The Keyboard

The MODCOM program redefines the following keys on your keyboard to provide the terminal functions listed:

Key	Function
<b>BACK SPACE</b>	Sends an ASCII back-space character.
<b>CLEAR</b>	Sends an ASCII form-feed character.
<b>END LINE</b>	Sends the end-of-line sequence defined in the program (CR or CR/LF).
<b>PAUSE</b>	Sends an ASCII DC3 (XOFF) handshake character.
<b>CONT</b>	Sends an ASCII DC1 (XON) handshake character.
<b>RESET</b>	Stops the program.
<b>PAPER ADVANCE</b>	Sends a blank line to the printer.
<b>RUN</b>	Continues a paused log-on sequence.
<b>SCRATCH</b>	Halts a log-on sequence.

**Note:** Refer to appendix D for more information about ASCII (American Standard Code for Information Interchange).

The special function keys, the cursor control keys, the character keys, and **ROLL▲** and **ROLL▼** retain their normal functions. Most of the other keys are disabled while the program is running.

### Terminal Keys

The TERMINAL set of special function keys, which appears on an HP-83/85 this way:

```
-----TERMINAL-----
ESCAPE  BREAK  PRNT:OFF
direct transfer  frame connect
```

contains several useful functions for operating your computer as a terminal.

#### ESCAPE

This key transmits the ESC character from your terminal to the host computer. The character is used in conjunction with other characters to send escape (instructional) sequences.

## BREAK

Press this key to transmit a BREAK to the system on the other end of the telephone line. You can cause some computers to stop transmission with this function.

## Printer

The printer key will be shown either as PRNT : OFF (default) or PRNT : ON, indicating the status of the printer. When the printer is on, all incoming characters are printed.

If the printer is off, pressing this key shows the current printer select code and gives you a chance to type in a new select code. If you press (END LINE) without entering a value, the old select code is used. If the printer is on, pressing the key labeled PRNT : ON switches the printer off.

You should not switch the printer on while data is being transmitted. Additionally, you should not use PRINT ALL while using the MODCOM program.

**Note:** The printer specified by this function is not necessarily the same as the printer specified by the PRINTER IS statement.

## Frame Keys

If you press frame in the TERMINAL set of keys, you will see these keys displayed:

```

-----FRAME-----
BITS:7   ODD   ERR:OFF
terminal ECHO:OFF FLIP:OFF CR

```

HP-83/85 key labels

These keys are used to alter the transmission characteristics of your modem. If you have already logged on to a data base and have successfully obtained the information you needed, you probably won't need to use these keys. The power-on (default) values for the transmission characteristics are correct for most 300-baud systems. However, if you are not happy with the performance of your data comm system thus far, these keys may help.

When logging on to a new computer system, you should obtain the transmission characteristics used by that system. Specifically, you need the character length (7 or 8 bits), the parity, the end-of-line sequence, and whether the system requires uppercase or lowercase characters. Then you can configure your computer to match those requirements using the frame keys.

Whenever any of the following parameters are changed, the name of the entry in memory (if any) changes to NONE.

## Echo

In full-duplex operation, which is the way your modem operates, a host computer can echo back characters that are sent to it as it receives them. Figure 3-1 illustrates this concept.

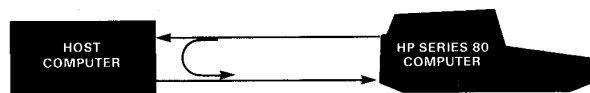


Figure 3-1. Host Echoes Characters


If the computer on the other end of the phone line echoes characters, you should not switch the echo on in the MODCOM program. If you do, you will see each character you type displayed twice on the CRT. However, if the other computer does not echo characters, you will not see the characters you type displayed on the CRT unless you press the ECHO:OFF key. The echo function in the MODCOM program will then be switched on and the key label will show: ECHO:ON.

When you are communicating with another personal computer, the echo should be on. Larger computer systems usually echo, so your echo should be off when communicating with them.

Initially, the echo function is off when the program is loaded and run.


### Normal Typewriting Mode

If the computer you are connected to requires small (lowercase) letters, you should press the FLIP:OFF key. The key label will change to FLIP:ON to reflect the current state of the function.

The FLIP function (similar to the function described in your HP Series 80 Personal Computer owner's manual) is more useful than the  key because it permits you to send proper control characters while retaining lowercase characters at the keyboard.

Pressing FLIP:ON switches the function off; the key label then becomes FLIP:OFF, which is the state at power-on.

### End-of-Line Sequence

The key labeled CR specifies the characters that are sent each time you press . Most computer systems recognize either a CR (carriage return) or CR/LF (carriage return/line feed) as the end-of-line sequence. Before you log on to a system, you should determine which sequence is required. The other computer may not let you log on if you have selected the wrong end-of-line sequence.

When the program is loaded, the key is labeled CR, indicating that the computer sends a carriage return as its end-of-line sequence. Each time the key is pressed, the program switches between CR (which is the power-on state) and CR/LF, and displays the current state as the key label.

When you are communicating with a computer that doesn't echo, such as another personal computer, this function should be set to CR/LF. Otherwise, your cursor will not move down the screen properly.

### Character Bits

The key labeled BITS:7 or BITS:8 selects the number of bits in each character sent on the phone line. The default value for character bits is 7, corresponding to the ASCII standard. A value of 8 can also be selected using this key. Pressing this key switches the value between 7 and 8 and displays the current value as part of the key label.

If you have not matched the number of bits with the computer on the other end of the phone line, the CRT will display meaningless characters.

### Parity

Parity allows the receiver to check incoming characters for possible transmission errors. The parity bit is appended to the sequence of character bits, and is set to 0 or 1 by the transmitter according to the parity type chosen and the character.

The MODCOM program allows you to select parity values of odd, even, always 1, always 0, or none. The power-on value is odd. When odd parity is used, the transmitter will set the parity bit to 1 or 0 such that an odd number of 1's are sent for each character. If even parity is selected, an even number of 1's are transmitted. When the parity is set to always 1 or always 0, the parity bit equals 1 or 0 respectively, regardless of the character. The parity check is used to flag transmission errors. If error checking is on, the HP-83/85 displays an underlined character for each error detected by the parity check.

To change parity, press the key labeled `ODD`. The key label should then display `EVEN`. As you repeatedly press this key, the parity will cycle through the five choices listed:

```
ODD
EVEN
ALWAYS 1
ALWAYS 0
NONE
```

The systems on both ends of the phone line should use the same parity. If parity is mismatched and error checking is on, you will see many flagged (underlined) characters.

**Note:** The MODCOM program interprets a parity setting of `NONE` as no parity bit in the character.

## Error Checking

The key labeled `ERR:OFF` or `ERR:ON` is used to switch the error checking on and off. When on, any errors detected by the parity check will be shown on the HP-83/85 CRT or printer as underlined characters.

On most systems you can use this feature to ensure that you have the proper parity. If you switch to `ERR:ON` and receive a large number of underlined characters from the other computer, try changing the parity until the problem is eliminated.

Normally it is beneficial to have the error check on, as it causes errors to be noted. In some systems, where there is an intermediate network computer involved, the parity may be different during logging on and afterward. In this case, set `ERR:OFF`. However, if `ERR:ON` causes no difficulties, then it is best to operate in that state.

To return to the terminal set of keys press the `terminal` key.

## The Directory

After you have adjusted the frame parameters as needed, you can easily store the terminal configuration by using the directory functions in the MODCOM program. In section 1 you stored a phone number in the directory using these keys:

```
-----DIRECTORY-----
DELETE  RENAME  LIST   STATUS
terminal LOAD   ADD    STORE
```

HP-83/85 key labels

To return to these directory keys, press the `direct` key in the terminal set of keys.

## Adding an Entry to the Directory File

The **ADD** key creates an additional entry in the directory file on the mass storage media (tape or disc). When you press **ADD**, you will see the prompt: `New name?` displayed on the CRT. You should enter the name of the configuration entry to be placed in the directory file and press **END LINE**. The name can be up to 14 characters long. The first character should be neither a digit nor an "@", or the name will be interpreted as a telephone number during automatic dialing. Pressing **END LINE** without entering any character aborts the **ADD** operation.

After you enter a name, any phone number currently in memory will be displayed, followed by: `New phone?`. If you want to use the phone number already in memory, press **END LINE**. For delays between digits, use a "@" for each two-second delay desired.

### Example:

```
9@@19997773333
```

After you have entered the phone number, the CRT will display: `Current logon:` and either `NONE` or a sequence that has been stored in computer memory. The next line of the CRT shows: `New logon (N for none)?`.

Log-on sequences were discussed in section 2. Pressing **END LINE** without entering anything stores whatever is in memory as the log-on sequence. To store a new log-on sequence, type it and press **END LINE**.

The CRT will then display a series of messages and prompts. Each message indicates the status of one of the frame parameters discussed earlier in this section and prompts you for any change. If you press **END LINE** after each prompt without entering a change, you will store the current setting in the directory.

After the prompts for echo, flip, data bits, parity, error check, and EOL (end-of-line) sequence have been answered or passed, the CRT will display: `saved`, indicating that your entry has been added to the directory.

## Updating an Entry in the Directory

After you have added an entry to the directory using the **ADD** key, you may want to make some changes and again store the entry in the directory. The **STORE** key permits updating of entries already in the directory.

When you press the **STORE** key, the CRT displays: `Name to store?`. Enter the name of the entry you wish to update and press **END LINE**. The program then begins with the phone number and goes through the same set of prompts and messages as the **ADD** key described above.

Suppose that we want to update our Dow Jones entry created in section 2. We want to have errors flagged, and we wish to insert a pause in the log-on sequence. To update our example from section 2, we can do the following:

1. Press **DIAL**, and respond to `Phone number/name?` with `DJ` and **END LINE**.
2. Press **HANGUP** while the program is dialing.
3. Press **STORE** and see: `Name to store?`
4. Type `DJ` and press **END LINE**.

5. The phone number is correct, so we press **(END LINE)** in response to the prompt: New phone?.
6. Next, the CRT will display:

```
Current logon:
EEW1EW2(C 60942)W9(DJNS)W0(password)
New logon (N for none)?
```

Since we want a pause just before the password is sent, we use the display/system control keys to delete W0 and insert P. Then press **(END LINE)** with the cursor under any character in the sequence. The CRT should display:

```
Current logon:
EEW1EW2(C 60942)W9(DJNS)P(password)
Current echo: OFF
New echo?
```

7. Press **(END LINE)** since we do not want to change echo.
8. Continue to press **(END LINE)** until the CRT displays:

```
Current error check: OFF
New error check?
```

9. Type: ON and press **(END LINE)**.
10. Press **(END LINE)** once more after the prompt for EOL and the CRT will display saved.

The Dow Jones entry in the directory is now stored with the desired changes.

**Note:** Changing a parameter or log-on sequence during an ADD or STORE operation does not affect the configuration that is currently in computer memory.

### Deleting an Entry From the Directory

To delete an entry previously stored in the directory with the ADD or STORE key, press the DELETE key. When the prompt: Name to delete? appears, enter the name of the entry to be deleted and press **(END LINE)**. The program then removes that configuration entry from the directory file.

### Listing the Directory

Pressing LIST produces a listing on the CRT of the names of the entries in the directory file.

### Changing a Name

To change the name of a configuration entry, press RENAME. The CRT will display the prompt: Name to change?. Enter the name of the entry you wish to change and press **(END LINE)**. Then the computer will search for that name. If the entry does not exist, the CRT will display: Name not found. Then Name to change? will be displayed again.

After an existing name has been entered, the program will display: New name? Enter the name you wish to change the entry to and press **(END LINE)**. The CRT will then display: Name changed,



indicating that the entry is now stored under the new name. Or, if you have selected a new name that already exists, Name already exists will be displayed. You will then be prompted for Name to change?(the first prompt) again.

### Accessing an Entry

The configuration entries in the directory file can be accessed using the DIAL key discussed in section 2. In this case the configuration is loaded into computer memory and the dialing and log-on operations are performed.

The LOAD key loads a configuration into the computer without dialing. It is useful in conjunction with the STATUS key for editing a configuration entry. We could have used the LOAD key instead of the DIAL key when we updated the Dow Jones entry earlier in this section.

Pressing the STATUS key prints (or displays) a listing of the configuration in memory such as the one below:

```
Modcom status:

Name.....NONE
Phone number...NONE
Logon Sequence..NONE
Echo.....OFF
Flip.....OFF
Data bits.....7
Parity.....ODD
Error check....OFF
EOL.....CR
```

This listing was obtained immediately after the MODCOM program was loaded and run.

The status can be noted, changes can be made using the frame keys, and the configuration can be stored in the directory using the ADD or STORE key.

## Communications Between HP Series 80 Personal Computers

If you desire to communicate with another HP Series 80 Personal Computer that also uses the HP 82950A Modem, you should set two parameters in the MODCOM program. Access the frame set of special function keys by pressing frame in the terminal set of keys. Then change the end-of-line sequence from a carriage return (CR) to carriage return/line feed (CR/LF) by pressing the key labeled CR. The key label should then change to CR/LF. If you don't do this, your cursor will not move down the screen as each line of characters is received. If you want to see the characters displayed on the CRT as you type them, you should also switch the echo to ECHO:ON. The bits and parity settings should be the same for both computers.

If the other computer uses something other than the HP 82950A Modem, you may need to experiment with the end-of-line sequence at both ends of the line to achieve correct operation.

This section concludes the discussion of the most commonly used terminal operations in the MODCOM program. The remaining operations enable you to send and receive data files and to store them on tape or disc. If you have need of these capabilities, read on.



## Mass Storage Operations

### Introduction

The MODCOM program provides five special function keys for transferring ASCII data files between local mass storage (tape or disc) and the computer at the other end of the phone line. The key labels, which are accessed by pressing the transfer key in the TERMINAL set of keys, are shown below:

```
-----TRANSFER-----
SHOWFILE  CAT
terminal  ENDXFER  UPLOAD  DOWNLOAD
```

HP 83/85 key labels

Proper use of the mass storage capabilities will permit you to minimize expensive connect-time when you are transferring files to or from the host computer.

The mass storage operations allow you to transfer only ASCII data files. Program files, assembly language source files, and files of numerical data cannot be uploaded and downloaded without first being converted to character strings. Two commands for performing program or source file conversions are discussed later in this section. You can use the VAL\$ function to convert numerical data to character strings.

During upload and download operations, transferred files are routed through the computer's input/output buffer. The transfer operation automatically uses DC1/DC3(XON/XOFF) handshaking to prevent loss of data from buffer overruns.

### Downloading

The DOWNLOAD key is used to transfer ASCII characters from a remote file to your local mass storage medium. The downloading concept is illustrated in the figure below.

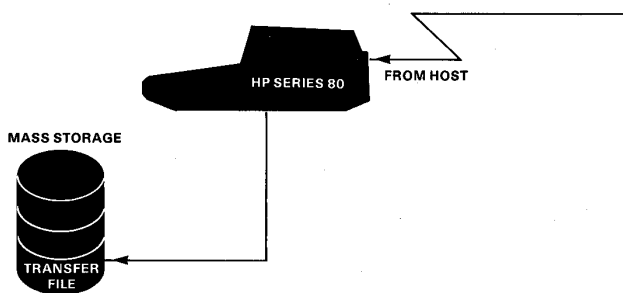


Figure 4-1. Downloading

The transfer file in the figure is a data file that has been created. You can either create the file before running the MODCOM program using the CREATE command, or you can use the DOWNLOAD key to do so. The DOWNLOAD key will only function if you have established a data communications link with another computer.

Pressing **DOWNLOAD** yields the prompt: **File name?**. You should type either the name of a previously created data file or your chosen name for the new file.

If you are not sure what files are stored on your tape or disc, you can press **CAT** to obtain a listing on the CRT of all existing files on the default mass storage device. This key has the same function as the **CAT** command described in your computer owner's manual.

If the file already exists, the program will display:

```
File open
Waiting for download data
```

If the file does not exist, the program will display:

```
Bad file name
Create a new file :Y/N?
```

If you respond with **N**, the program will prompt for a file name again.

If you respond with **Y**, the program will request a file size in physical (256-byte) records. At this point, you need to have an idea of the size file needed. Each character requires one byte and an additional three bytes are required for each string identifier. In general, you should allow ten percent additional space for string identifiers above the space allotted for characters. Alternatively, you may estimate the time required to transmit the file from the remote computer to your terminal. Approximately 30 characters are transmitted every second. A file that takes one minute to transmit over a phone line, for instance, will require eight, 256-byte records, (allowing ten percent additional space).

When you have entered the file size, the program will automatically create the file and then display:

```
File created
File open
Waiting for download data
```

When the **MODCOM** program is awaiting data, you should send the query or command to the other computer to start sending the data you desire (for example, stock information or news). If you are communicating with another personal computer, that computer should begin uploading the data.

When the file transfer is complete, you should press **END XFER** to clear out the buffer and store the remaining information on the disc or tape. You will see the Drive On light on the device for a short period. The CRT will display: **File transfer complete.**

**Note:** If the program finds no line feed characters embedded in the first 200 characters of each line of the data file, it disregards all characters after the first 200. Any null lines are altered to lines containing one blank.

You should be aware that under some circumstances it is possible for data loss to occur. If the remote computer does not handshake, you will probably lose data if the file is larger than the buffer size. Also, if you press **END XFER** prematurely or your transfer file is too small, you will almost surely lose some data during a downloading operation.

## Inspecting a Data File

To ensure that the data file has been properly received, you can press the **SHOWFILE** key. The prompt: **File name?** should be answered with the name of the file (transfer file) into which you downloaded data.

The CRT will then display the contents of the data file. When the file has been displayed, you will hear a tone and see a message indicating that the end of the file (or a null line) has been encountered.

If you need a printed copy of the file, switch the printer on first, and then use the **SHOWFILE** key.

**SHOWFILE** can also be used to inspect a file prior to uploading it to another computer system. Uploading is discussed next.

## Uploading

The **UPLOAD** key is used to transfer the contents of a local ASCII data file to a remote computer. The uploading concept is illustrated in the following system diagram.

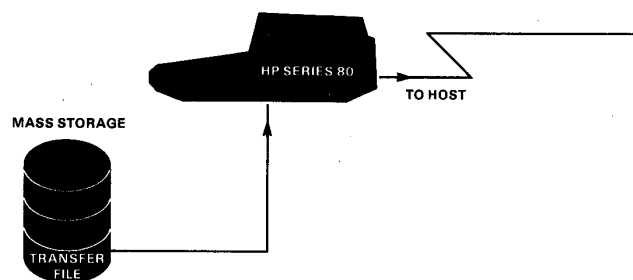


Figure 4-2. Uploading

During uploading, data is transferred one line at a time. The transfer is terminated automatically when either a null string or the end of the file is encountered.

To upload a data file, establish a data comm link, logging on if necessary. Prepare the other computer to prompt for data. For example, the editor of the remote computer might be used to accept input in the same manner that it would accept input directly typed from a terminal. Whatever the method used, the prompt must be the same for each line read.

Then press the **UPLOAD** key. After the prompt: **File name?** appears, type the name of the data file you wish to upload. The program then finds the file, opens it, and displays the question: **Does your host prompt: Y/N?** At this point you must decide either to upload only when a prompt is given by the other system or upload each string with a specified delay between strings sent.

If you type **Y** and press **END LINE**, the uploading operation will start. The upload function requires that the host use the same prompt for each line read, and each reading needs to accept an amount of data corresponding to one string from the transfer file. The prompt character is determined automatically; your computer expects the remote computer to use the last two characters it sends before uploading starts as the prompt characters.

If you type **N** and press **END LINE**, the CRT will display:

```

Enter delay (milliseconds) between
sending lines
?
```

You should enter the number of milliseconds that the host needs your system to wait between each line sent. Typical values range from 0 to 1200. If the waiting time is too short, data will be lost. (Some experimentation may be necessary to determine the optimum time for a specific host computer.) If you select the delay mode, your computer does not expect any prompt characters from the other computer.

In a transfer between two HP Series 80 systems with HP 82950A Modems, no delay is necessary. Most modern computer systems will not require a delay period even if no handshaking is used.

During uploading, the CRT will display `Upload in progress` and the transmitted data as if it had been typed on the keyboard.

When the transfer file has been successfully sent, the CRT displays `File transfer complete`.

**Note:** Any string in the file that contains more than 200 characters will generate a warning message, and that string will be ignored by the program. Uploading ceases when a null string or the end of the file is encountered.

## Terminating a Data Transfer

You may terminate uploading, downloading, and showfile operations at any time by pressing the `END XFER` key.

## Transferring Program Files

As mentioned in the introduction to this section, the MODCOM program allows you to upload and download ASCII data files only. You cannot use the programs to transfer program files, since program files cannot be read by BASIC programs.

The modem communications software includes a binary program named GETSAV that allows you to save and retrieve assembly language source and BASIC programs as ASCII character strings. The program is loaded into the HP Series 80 Personal Computer by executing:

```
LOADBIN "GETSAV"
```

If you are using the HP-85 tape unit or DRIVE 0 of the disc drive.

```
LOADBIN "GETSAVE:msus"
```

If you are using any DRIVE other than DRIVE 0 of the disc drive.

**Note:** The GETSAV binary cannot be loaded into the computer while the MODCOM program is paused, since there already is a binary (IPBIN) present in memory. In this case either SCRATCH the program in memory, or switch the power off and then on again.

The binary program provides two statements, `SAVE` and `GET`, for handling BASIC programs as data files. These statements cannot be used to handle any BASIC program that has an associated binary program.

The **SAVE** statement has the form:

```
SAVE "file name"
    "file specifier" [ , beginning line number [ , ending line number]]
```

where the quantities in brackets are optional.

When **SAVE** is executed, the BASIC program in computer memory is saved in a data file in the form of character strings, one string per program line. When no optional parameters are specified, the entire program is saved. If a beginning line number is included, program lines from that number to the end are saved. If beginning and ending line numbers are specified, that portion of the program is saved.

Programs stored in the form of data strings are retrieved using the **GET** statement, which has the form:

```
GET "file name"
    "file specifier"
```

**GET** can be used to retrieve any data file composed of program lines stored as character strings. The strings must consist of valid BASIC statements preceded by line numbers, stored one line per string. Although **GET** is designed to retrieve data files created by the **SAVE** statement, data files originating in other ways (for instance, downloaded from a host text file) can be retrieved. When a **GET** statement is executed, the HP Series 80 Personal Computer accesses the specified data file, expecting to find a succession of valid program lines in string form. The stored program lines are read into computer memory as program lines without scratching program lines already there. If a retrieved program line has the same line number as a line already in computer memory, the retrieved program line overwrites the original line. When **GET** encounters a string it cannot properly interpret as a program line, the line is interpreted as a remark line, if possible.

## BASIC Program Conversions

To **SAVE** a BASIC program as a data file, follow these steps:

1. Load the BASIC program into the computer.
2. `LOADBIN "GETSAV".`
3. Execute the **SAVE** command.

The BASIC program still remains in memory, and a data file now exists that holds the text equivalent of the program.

To **GET** a BASIC program:

1. Either scratch any old program or load in the BASIC program you wish to merge with the **SAVEd** program.
2. `LOADBIN "GETSAV".`
3. Execute the **GET** command.

The old program in memory (if any) together with the new lines read from the data file now reside in memory.

### Assembly Language Source Code Conversions

To **SAVE** assembly language source code, do the following:

1. Switch to the assembler mode.
2. Load the assembly language source code.
3. `LOADBIN "GETSAV".`
4. Execute the **SAVE** command.

The source code still remains, and a data file now exists that holds the text equivalent of it.

To **GET** a saved file containing source code:

1. Switch to the assembler mode.
2. Either scratch any old source code or load any source code that you wish to merge with the **SAVED** program.
3. `LOADBIN "GETSAV".`
4. Execute the **GET** command.

The old source code in memory (if any) and the new lines read from the data file now reside in memory.

Numeric data files cannot be transferred using these statements. They must first be converted to strings in a data file using `VAL$` in a BASIC program.



## Troubleshooting

If you encounter difficulties in operating the HP 82950A Modem you should perform a selftest on it by pressing the special function key labeled **STEST**. The message **Passed selftest** indicates that the modem is operating properly. If the message **Modem failed selftest** is displayed, the modem is not functioning properly, and it probably requires service. Refer to section 6 for service information.

If the message **Selftest error** is displayed, the characters received as a result of the selftest are in error. The transmitted and received characters should also be displayed. You should check for a clear telephone line by connecting a telephone set and lifting the receiver. If the line seems clear and the error message is again displayed when **STEST** is pressed, disconnect the line from the modem and press **STEST**. This procedure eliminates the possibility of phone line interference. If the modem test still generates an error, the modem is probably faulty and requires service.

The remainder of this section contains a partial list of possible error conditions, causes, and remedial actions. Problems that do not necessarily generate error messages are listed first; then some of the possible error messages are discussed. If an error number appears in an error message, you should refer to your computer owner's manual or the I/O ROM manual.

### General Error Conditions

Condition or Circumstances	Probable Cause	Action
CRT displays gibberish.	Both computers are not set for the same number of bits per character and/or parity.	Press <b>BITS:</b> key in the <b>FRAME</b> set of keys.
Error check is on; data characters are underlined.	One or more framing parameters are mismatched.	Try to match bits and parity.
	Phone line contains noise or interference.	Redial or use a different phone line.
Double characters are displayed on the CRT.	Other computer echoes data.	Switch <b>ECHO</b> key to <b>OFF</b> .
Typed characters are not displayed on the CRT.	Other computer does not echo data.	Switch <b>ECHO</b> key to <b>ON</b> .
Other computer does not receive or respond to data or characters that are sent to it.	Baud rates are not matched.	Change other computer's modem to 300 baud.
	End-of-line sequence is incorrect.	Press <b>CR</b> or <b>CR/LF</b> key.

Condition or Circumstances	Probable Cause	Action
During downloading, the listing does not resume after the file access is completed. Data is lost.	Other computer does not use DC1/DC3 handshaking.	Reduce the size of the file.
	Other computer uses DC1/DC3 handshaking.	Press <b>(CONT)</b> key to send additional DC1 characters.
Starts dialing without loading an entry first.	First character of name is an "@" or a digit.	Change entry to a different name using <b>RENAME</b> .

## Error Messages

Condition	Message	Probable Cause	Action
Loading MODCOM and attempting to run the program.	No modem	Modem not installed.	Switch off computer & install modem.
	No I/O rom	I/O ROM missing.	Switch off computer & install I/O ROM.
	Error 19: MEM OVF	Program requires more memory.	Switch off computer & install memory module.
Pressed <b>STEST</b> key.	Modem failed selftest	Faulty modem.	Have modem repaired.
	Selftest error	Bad phone line.	Disconnect phone line and press <b>STEST</b> key.
		Faulty modem.	Have modem repaired.
Attempted to <b>DIAL</b> using a name.	Phone directory not found	Phone directory has not been created on the tape or disc.	Create the entry and directory using the <b>ADD</b> key.
	Cartridge out or Disc out	Mass storage medium not available.	Insert tape or disc.
	Name not found	The name is not in the directory.	Press <b>LIST</b> to obtain listing.
Pressed <b>REDIAL</b> .	No phone number	Phone number has not been placed in memory using <b>DIAL</b> or <b>LOAD</b> key.	Use <b>DIAL</b> key.
Pressed <b>ORIG</b> , <b>ANSWER</b> , <b>DIAL</b> , <b>REDIAL</b> , or <b>AUTO-ANS</b> .	Modem busy	A previous command has switched the modem on.	Press <b>HANGUP</b> .
	Time-out. No connection made.	No modem handshake established within required time limit.	Try again. Use handset to listen for problems after dialing is complete.
		Line busy.	

Condition	Message	Probable Cause	Action
AUTO-ANS mode is operating.	Invalid ring!	No phone line connected to modem.	Connect phone line.
		Ring signal shorter than .5 seconds was received.	No action needed.
Enabled the printer.	Invalid select code	You entered a code that is out of range, the modem select code, or a non-existent code.	Enter the select code and address that specifies the printer.
Attempted to DELETE, LOAD, RENAME, or REPLACE an entry in the directory.	Name not found	The entry name does not exist on the tape or disc.	Press LIST to obtain a directory listing.
		If you have a mass storage ROM, the wrong device is the mass storage device.	Use MASS STORAGE IS statement to specify the medium containing the directory after pausing program.
SHOWFILE, DOWNLOAD, or UPLOAD operation.	Bad file name	The file name you entered does not exist on mass storage.	Press CAT key to list mass storage medium.
		The wrong type of file was selected.	Select only data files that have been downloaded, created using SAVE, or created using a text editing program.
Data comm link established.	Modem carrier lost	The phone connection has been broken or the other computer has switched off its modem.	Re-establish the connection by pressing ORIG, ANS, or by redialing.
Downloading or printing.	Input buffer over-run! Data lost	The hardware buffer has been filled more quickly than it has been emptied.	Disable printer.
		System on other end of line does not use DC1/DC3 handshake.	Disable printer and download a file smaller than the buffer size.
Logging on automatically.	Invalid char in logon:	A character other than E, W, P, space, or <string> has been sent while logging on. The character is displayed after the "i".	Press STATUS to obtain entry list; press STORE to update logon sequence.



## Maintenance and Service

### Maintenance

The HP 82950A Modem does not require regular maintenance. However, the way that you treat it will affect its performance and reliability. Be sure to use the modem within the operating environment guidelines.

These are some cautionary areas that you should consider:

#### WARNING

Do not place fingers, tools, or other foreign objects into the plug-in receptacles in the modem or computer. Such actions may result in minor electrical shock hazard and interference with some pacemaker devices. Damage to plug contacts and the computer's circuitry may also result.

#### CAUTION

Always switch off the computer when inserting or removing the modem or other modules. Use only plug-in modules and cables designed by Hewlett-Packard specifically for an HP Series 80 Personal Computer. Failure to do so could damage the controlling computer or the modem.

### Service

Should you suspect that the modem is malfunctioning, the following information will help you determine whether or not service is needed.

Turn the computer off. Ensure that the modem is firmly seated in the I/O port in the back of the computer. Also check the cable connecting the modem to the phone line. The plugs should be seated in the modular jacks. Check to see that the appropriate hardware, as listed in section 1, is also connected to the computer. Turn the computer on. You should perform a modem selftest. If the modem test fails, disconnect the phone line and rerun the selftest. This procedure eliminates the possibility of phone line interference. If the modem still fails the selftest, have it repaired.

If the modem passes the selftest when disconnected from the phone line, attempt to place a telephone call using your telephone set. If there is no indication that the phone line is causing the problem, refer to the service information for your system for more information, specifically your HP Series 80 Personal Computer owner's manual.

### Warranty Information

The complete warranty statement is included in the information packet shipped with your modem. Additional copies may be obtained from any authorized Hewlett-Packard dealer, or the sales and service office where you purchased your modem.

If you have any questions concerning the warranty, please contact one of the Field Repair Centers listed on the Service Information Sheet packaged with your owner's documentation.

### How to Obtain Repair Service

For information on service in your area, contact your nearest authorized HP dealer or the nearest Hewlett-Packard Sales and Service Office.

If your modem malfunctions and repair is required, you can help assure efficient servicing by having the following items with your modem at the time of service:

1. A description of the configuration of the computer and peripheral devices, exactly as they were at the time of malfunction, including any plug-in modules, tape cartridges, flexible discs, and the data comm program being used.
2. A brief description of the malfunction symptoms for service personnel.
3. Printouts or any other materials that illustrate the problem area.
4. A copy of the sales slip or other proof of purchase to establish the warranty coverage period.

### Potential for Radio/Television Interference (For U.S.A. Only)

The HP 82950A Modem generates and uses radio frequency energy and may cause interference to radio and television reception. Your HP Series 80 Personal Computer and modem comply with the specifications in Subpart J of Part 15 of the FCC Rules for a Class B computing device. These specifications provide reasonable protection against such interference in a residential installation. However, there is no guarantee that interference will not occur in a particular installation. If your data comm system does cause interference to radio or television reception, which can be determined by turning the computer off and on, you can try to eliminate the interference problem by doing one or more of the following:

- Reorient the receiving antenna.
- Change the position of the computer with respect to the receiver.
- Move the computer away from the receiver.
- Plug the computer into a different outlet so that the computer and the receiver are on different branch circuits.

If necessary, consult an authorized HP dealer or an experienced radio/television technician for additional suggestions. You may find the following booklet helpful: *How to Identify and Resolve Radio-TV Interference Problems*. This booklet is available from the U.S. Government Printing Office, Washington, D.C. 20402, Stock No. 004-000-00345-4.

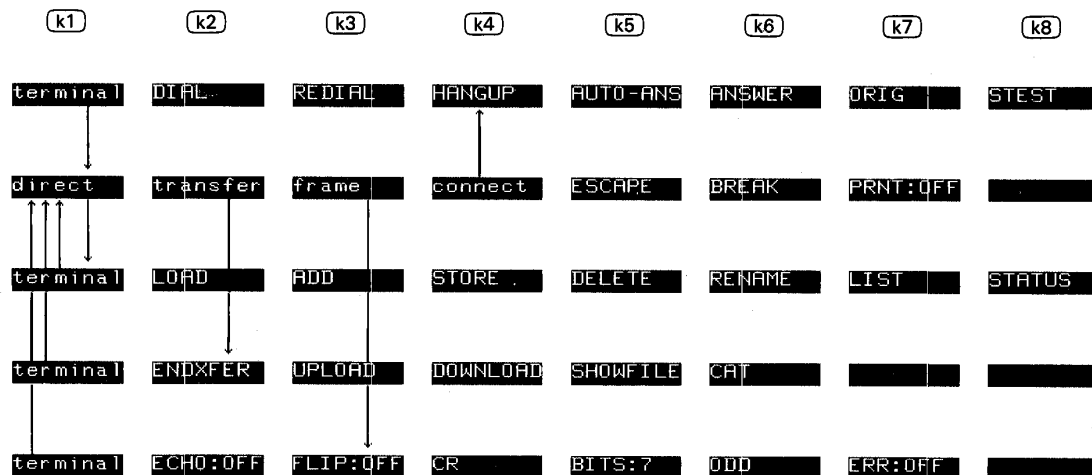
### General Shipping Instructions

Should you ever need to ship the modem, be sure that all components are packed in a protective package (use the original shipping case) to avoid in-transit damage. Hewlett-Packard suggests that the customer always insure shipments.

## Program Documentation

### Special Function Keys

The five sets of special function keys are shown below in the command tree. A brief description of each key is given as each set is listed.



The CONNECT set of special function keys appears when the program is loaded and run. When connection is established, the TERMINAL set of keys is active. Any loss of connection causes the CONNECT keys to reappear.

Connect Set		
Key	Section	Function
terminal	1	Invokes the TERMINAL set of special function keys.
DIAL	1	Requests and dials using a phone number or a configuration entry name.
REDIAL	1	Dials the number already in computer memory.
HANGUP	1	Turns off the modem and hangs up.
AUTO-ANS	1	Waits for phone call; when ring is detected, attempts to establish handshake with originating modem.
ANSWER	1	Attempts to handshake with originating modem.
ORIG	1	Attempts to handshake with answering modem.
STEST	1	Performs a selftest on the modem.

Terminal Set		
Key	Section	Function
<b>direct</b>	2	Invokes the DIRECTORY set of special function keys.
<b>transfer</b>	4	Invokes the TRANSFER set of special function keys.
<b>frame</b>	3	Invokes the FRAME set of special function keys.
<b>connect</b>	1 & 2	Invokes the CONNECT set of special function keys.
<b>ESCAPE</b>	3	Sends an escape character on the phone line.
<b>BREAK</b>	3	Sends a break on the phone line.
<b>PRINT:OFF</b> or <b>PRINT:ON</b>	3	Switches printer off and on, prompting for a select code when appropriate. Default is off.

Directory Set		
Key	Section	Function
<b>terminal</b>	2 & 3	Invokes the TERMINAL set of special function keys.
<b>LOAD</b>	3	Loads a configuration entry into program memory from the directory file.
<b>ADD</b>	2 & 3	Enters a new configuration and phone number into the directory file.
<b>STORE</b>	3	Updates a configuration entry already in the directory file.
<b>DELETE</b>	3	Removes a configuration entry for the directory file.
<b>RENAME</b>	3	Changes the name of a configuration entry.
<b>LIST</b>	3	Lists the names of the configuration entries in the directory file.
<b>STATUS</b>	3	Prints a record of all specifiable parameters in program memory.

Transfer Set		
Key	Section	Function
<b>terminal</b>	2 & 3	Invokes the TERMINAL set of special function keys.
<b>ENDXFER</b>	4	Terminates UPLOAD, DOWNLOAD, or SHOWFILE operations.
<b>UPLOAD</b>	4	Sends data file to system on other end of telephone line.
<b>DOWNLOAD</b>	4	Receives data through the phone line and stores it on the mass storage medium.
<b>SHOWFILE</b>	4	Displays a data file on the CRT.
<b>CAT</b>	4	Displays the catalog of the current local mass storage device.



Frame Set		
Key	Section	Function
<b>terminal</b>	2 & 3	Invokes the TERMINAL set of special function keys.
<b>ECHO:OFF</b> or <b>ECHO:ON</b>	3	Switches the echo function. When it is off, the computer on the other end of the line is expected to display the transmitted data on the screen by sending it back. Default is off.
<b>FLIP:OFF</b> or <b>FLIP:ON</b>	3	Switches flip on and off. When it is on, typed characters are sent in lower case. Default is off.
<b>CR</b> or <b>CR/LF</b>	3	Switches the end-of-line sequence between carriage return and carriage return/line feed. Default is CR.
<b>BITS:7</b> or <b>BITS:8</b>	3	Switches between seven and eight data bits (with one stop bit). Default is seven.
<b>ODD</b> <b>EVEN</b> <b>ALWAYS 1</b> <b>ALWAYS 0</b> <b>NONE</b>	3	Selects any one of five parity checks. Default is ODD.
<b>ERR:OFF</b> or <b>ERR:ON</b>	3	Switches the error check on and off. When it is on, any characters received with parity errors will be underlined. Default is off.

## MODCOM Program Documentation

If you wish to obtain a program listing, you must press **(LIST)** or **(PLST)** after both the MODCOM program and its supporting binary program, IPBIN, are present in computer memory. You cannot obtain a program listing while the programs are running. Pressing the **(LIST)** key while the program is active will cause the computer to beep and otherwise ignore the key.

There are two ways to obtain a program listing. You can pause the program by pressing **(RESET)** and then press **(LIST)** or **(PLST)**. Or, you can load the MODCOM program, and then manually load the IPBIN program by executing:

```
LOADBIN "IPBIN"
```

If your system includes a disc drive, you may need to include the appropriate form for the file specifier.

Once the binary program has been loaded, press **(LIST)** or **(PLST)** to obtain the listing of the BASIC program. You cannot obtain a listing of the binary program on your computer.

## Routines

These five routines are given for use in programming the HP 82950A Modem for specialized applications.

### Phone Directory Listing

```

1000 ! Program to read and display the contents of the phone directory
1010 ! of the MODCOM program. The directory is in the file PHONE#
1020 !
1030 ! VERSION 1 10/27/81
1040 !
1050 ! The name field is set to CHR$(128) when that record is
1060 ! empty. Name is set to CHR$(255) to indicate the end of
1070 ! file.
1080 !
1090 ! So to print out the file, read every record until either
1100 ! a name of CHR$(255) is found or an EOF error is generated.
1110 ! Remember to skip records with name CHR$(128)
1120 !
1130 ! Variables
1140 ! N$ Installation name
1150 ! P$ Phone number
1160 ! L$ Logon sequence
1170 ! R4 Parity and data bits
1180 ! E0 Error check
1190 ! L9$ End of line sequence
1200 ! F8 Flip
1210 ! E Echo
1220 ! R Record number
1230 ! X Temporary variable
1240 !
1250 !
1260 DIM N$[14],P$[32],L$[96],L9$[2]
1270 INTEGER R4,E0,F8,E,R
1280 !
1290 !
1300 ! NOTE: Installation name, phone number and end of line
1310 ! are stored in the file as
1320 ! strings. Flip and Echo are integers set to 1 for on and
1330 ! 0 for off. Error check is 8 or 0 for on or off.
1340 ! R4 is the byte from control/status register 4 of the
1350 ! modem interface (see appendix on control and status registers
1360 ! in the modem owner's manual).
1370 !
1380 !
1390 ON ERROR GOTO 1690
1400 ASSIGN# 1 TO "PHONE#"
1410 ! Now read the directory file
1420 ON ERROR GOTO 1760
1430 R=0
1440 R=R+1 @ READ# 1,R ; N$
1450 IF N$=CHR$(128) THEN PRINT "Empty record" @ PRINT @ GOTO 1440
1460 IF N$=CHR$(255) THEN 1840 ! End of file, goto close and end
1470 READ# 1 ; P$,L$,R4,E0,L9$,F8,E ! Read in a record
1480 PRINT "Name: ";N$
1490 PRINT "Phone: ";P$
1500 PRINT "Logon: ";L$
1510 PRINT "Data bits: ";R4 MOD 4+5
1520 X=R4\8 MOD 8 @ PRINT "Parity: ";@ IF X=0 THEN PRINT "None"
1530 IF X=1 THEN PRINT "Odd"
1540 IF X=3 THEN PRINT "Even"
1550 IF X=5 THEN PRINT "Always 1"
1560 IF X=7 THEN PRINT "Always 0"
1570 IF X MOD 2=0 AND X#0 THEN PRINT "Unknown"
1580 PRINT "Error check: ";@ IF E0 THEN PRINT "ON" ELSE PRINT "OFF"
1590 PRINT "Output separator: ";@ IF L9$=CHR$(13) THEN PRINT "CR" @ GOTO 1620

```

```

1600 IF L9$=CHR$(13)&CHR$(10) THEN PRINT "CR/LF" @ GOTO 1620
1610 PRINT L9$
1620 PRINT "Flip: ";@ IF F8 THEN PRINT "ON" ELSE PRINT "OFF"
1630 PRINT "Echo: ";@ IF E THEN PRINT "ON" ELSE PRINT "OFF"
1640 PRINT @ PRINT
1650 GOTO 1440 ! Go back for another record
1660 !
1670 !
1680 !
1690 ! Error handler for ASSIGN
1700 !
1710 DISP "Error in assign";ERRN @ GOTO 1850
1720 !
1730 !
1740 ! Error handler for READ #1
1750 !
1760 IF ERRN=71 THEN 1840 ! End of file error
1770 DISP "Error in read";ERRN @ STOP
1780 !
1790 !
1800 !
1810 !
1820 ! A name of CHR$(255) or and ERRN=71 jumps here
1830 !
1840 DISP "End of file" @ ASSIGN# 1 TO *
1850 END

```

### Automatic Dialing

```

10 ! subroutine to dial a string of digits
20 ! using an HP-82950A modem and an I/O rom
30 !
40 ! VERSION 03 12/03/81
50 !
60 ! Reads each character in K$;
70 ! if the character is a digit, then pulses that many times ;
80 ! waits for one second for each @ ;
90 ! and ignores any other characters.
100 ! Must use a timer for critical timing measurements,
110 ! as "WAIT" is accurate only to the nearest 1/60'th of a second.
120 !
130 ! input parameters
140 ! -----
150 ! S      select code of modem
160 ! K$     string to be dialled
170 !
180 ! internal variables
190 ! -----
200 ! K1$    current char from K$
210 ! K      NUM(K1$)-48
220 ! I      loop counter
230 ! J      loop counter
240 ! S3     status of modem
250 !
260 ! start of routine
270 !
280 DIM K$[30],K1$[1]
290 INTEGER K,I,J,S3
300 ! check if modem is busy
310 STATUS S,3 ; S3
320 IF S3<>2 THEN DISP "modem busy!" @ STOP
330 ENABLE KBD 128 ! disable all but reset key
340 CONTROL S,2 ; 6 ! defeat auto-disconnect
350 WAIT 100
360 CONTROL S,2 ; 4 ! hang up
370 WAIT 1600 ! give enough time to hang up
380 CONTROL S,2 ; 6 ! take phone off hook

```

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```
390 WAIT 2000 ! wait for dial tone
400 ! start dialing
410 FOR I=1 TO LEN(K$)
420 K1$=K$[I,I] ! get one character
430 ! wait one second if an @
440 IF K1$="@" THEN DISP "waiting" @ WAIT 1000 @ GOTO 580
450 K=NUM(K1$)-48 ! convert character to pulse count
460 ! check for digit
470 IF K<0 OR K>9 THEN DISP "ignoring";K1$ @ GOTO 580
480 DISP "dialing";K1$
490 IF K=0 THEN K=10 ! 0 means ten pulses
500 FOR J=1 TO K
510 ! do one digit
520 ASSERT S;5 @ ON TIMER# 3,51 GOTO 540 ! make line active and set timer
530 GOTO 530 ! wait for timer interrupt
540 ASSERT S;6 @ ON TIMER# 3,25 GOTO 560 ! line back to inactive and set timer
550 GOTO 550 ! wait for timer interrupt
560 OFF TIMER# 3 @ NEXT J
570 WAIT 700 ! inter-digit delay
580 NEXT I ! back for next char
590 ENABLE KBD 255 ! reenable keyboard
600 DISP @ DISP "dialing complete"
610 CONTROL S,2 ; 7 ! make the modem active in originate mode
620 RETURN ! to calling program
630 END
```

### Automatic Answering

```
10 ! subroutine to wait for a ring and answer in answer mode
20 ! using an HP-82950A modem and an I/O rom
30 !
40 ! VERSION 01 8/28/81
50 !
60 ! Wait for a ring, check again half a second later;
70 ! if not ringing, indicate an invalid ring and go
80 ! back to waiting. If still ringing, answer and
90 ! wait 17 seconds for a modem handshake to be established.
100 ! If the handshake is not established, then hang up and wait again,
110 ! otherwise indicate connection is made and return.
120 !
130 ! input parameters
140 ! -----
150 ! S select code of modem
160 !
170 ! internal variables
180 ! -----
190 ! S3 status of modem
200 !
210 ! also, timer #1 is used
220 !
230 ! start of routine
240 !
250 INTEGER S3
260 DISP "modem waiting for ring"
270 CONTROL S,2 ; 5
280 ! wait for ring
290 STATUS S,3 ; S3
300 IF NOT BIT(S3,3) THEN 290 ! if no ring, then loop
310 WAIT 500 ! wait half a second
320 STATUS S,3 ; S3 ! check for ring again
330 IF NOT BIT(S3,3) THEN DISP "invalid ring" @ WAIT 200 @ GOTO 260
340 DISP "phone answered"
350 CONTROL S,2 ; 5 ! answer in answer mode
360 CONTROL S,2 ; 1
370 WAIT 100
380 CONTROL S,2 ; 5
390 DISP "waiting for modem handshake!"
```

```

400 ON TIMER# 1,17000 GOTO 460
410 STATUS S,3 ; S3
420 IF S3<>1 THEN 410 ! wait for handshake
430 OFF TIMER# 1 ! handshake was successful
440 DISP "connection made" @ RETURN
450 ! if you get here, the time expired without a modem handshake
460 OFF TIMER# 1 @ DISP "connection not made" @ GOTO 260 ! try again
470 END

```

## File Creation

```

10 ! program to create a file that is compatible with the
20 ! upload and download routines in MODCOM.
30 !
40 ! VERSION 01 10/2/81
50 !
60 ! Asks for the name of a data file;
70 ! then asks for lines of text, which it places in the file,
80 ! until a null line is input (which ends the program).
90 !
100 ! variables
110 ! -----
120 ! N$ name of file to be used
130 ! A$ string read from user
140 !
150 ! start of program
160 !
170 DIM N$[17],A$[100]
180 ! get name of file to use
190 ON ERROR GOTO 310 ! in case of an error in input
200 DISP "Name of file to use";@ INPUT N$
210 ON ERROR GOTO 360 ! in case the assign doesn't work
220 ASSIGN# 1 TO N$ ! open the file
230 ON ERROR GOTO 310 ! in case of an error in input
240 DISP "line of text";@ INPUT A$ ! get a line of text
250 ON ERROR GOTO 430 ! in case the write to the file fails
260 PRINT# 1 ; A$ ! write the string to the file
270 IF A$="" THEN 490 ELSE 230 ! a null line ends the program
280 !
290 ! error handler for input error
300 !
310 OFF ERROR ! in case of more errors
320 DISP "bad input" @ GOTO 190
330 !
340 ! error handler for assignment errors
350 !
360 OFF ERROR ! in case of more errors
370 IF ERRN=67 THEN DISP "bad file name" @ GOTO 190
380 IF ERRN=68 THEN DISP "bad file type" @ GOTO 190
390 DISP "error ";ERRN;" on line ";ERRL @ PAUSE ! any other error
400 !
410 ! error handler for reading a string
420 !
430 OFF ERROR ! in case of more errors
440 IF ERRN=71 THEN BEEP @ DISP "File too small" @ GOTO 490 ! end-of-file error
450 DISP "error ";ERRN;" on line ";ERRL @ PAUSE ! any other error
460 !
470 ! reach here when a null string is input or end-of-file is reached
480 !
490 ASSIGN# 1 TO * ! close the file
500 DISP "File closed, program ends"
510 END

```

## File Printing

```

10 ! program to print out a file that is compatible with the
20 ! upload and download routines in MODCOM.
30 !
40 ! VERSION 01 9/30/81
50 !
60 ! Reads a string from the file; if it is a null string
70 ! or end-of-file is reached then the program stops,
80 ! otherwise the string is printed and the program
90 ! goes back for the next string.
100 !
110 ! variables
120 ! -----
130 ! N$   name of file to be printed
140 ! A$   string read from file
150 !
160 ! start of program
170 !
180 DIM N$[17],A$[200]
190 ! get name of file to print
200 ON ERROR GOTO 320 ! in case of an error in input
210 DISP "Name of file to print";@ INPUT N$
220 ON ERROR GOTO 370 ! in case the assign doesn't work
230 ASSIGN# 1 TO N$ ! open the file
240 ON ERROR GOTO 440 ! in case the read doesn't work
250 READ# 1 ; A$ ! read a string from the file
260 IF A$="" THEN 500 ! end of file
270 PRINT A$ ! print the string
280 GOTO 250 ! back for next string
290 !
300 ! error handler for input error
310 !
320 OFF ERROR ! in case of more errors
330 DISP "bad input" @ GOTO 200
340 !
350 ! error handler for assignment errors
360 !
370 OFF ERROR ! in case of more errors
380 IF ERRN=67 THEN DISP "bad file name" @ GOTO 200
390 IF ERRN=68 THEN DISP "bad file type" @ GOTO 200
400 DISP "error ";ERRN;" on line ";ERRL @ PAUSE ! any other error
410 !
420 ! error handler for reading a string
430 !
440 OFF ERROR ! in case of more errors
450 IF ERRN=71 THEN GOTO 500 ! end-of-file error
460 DISP "error ";ERRN;" on line ";ERRL @ PAUSE ! any other error
470 !
480 ! reach here when a null string is read or end-of-file is reached
490 !
500 DISP "*** end of file ***"
510 ASSIGN# 1 TO * ! close the file
520 END

```

## Modem Control and Status Registers

The HP 82950A Modem and accompanying software have been designed to operate in a data comm system with minimum intervention from the programmer. However, the modem can be adapted somewhat to meet particular data comm needs by accessing the modem control and status registers. The modem interface contains 24 distinct registers (numbered 0 through 23).

The following information is presented for use in data comm systems that require specialized programming applications. You can write to the control registers with the `CONTROL` statement. The `STATUS` statement accesses the readable registers. Refer to the *I/O ROM Owner's Manual* for additional information on writing to and reading from registers. Figure B-1 shows the relationship of the main subsections in the modem.

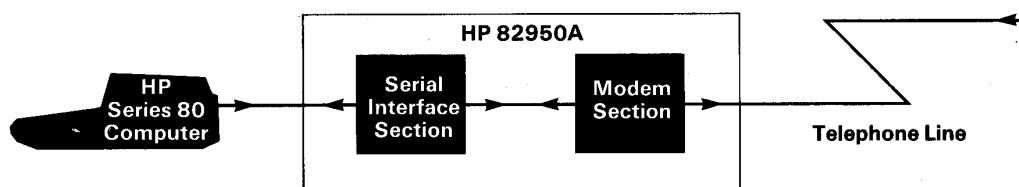


Figure B-1. HP 82950A Block Diagram

These six control and status lines are the active elements in establishing a data comm path:

- DTR (Data Terminal Ready).
- DSR (Data Set Ready).
- RTS (Request To Send).
- CTS (Clear To Send).
- DCD (Data Carrier Detect).
- DRS (Data Rate Select).

### Register 0

Register 0 is a read-only register. The value returned (always 2) indicates that this is a serial interface.

### Register 1: Interrupt Mask

bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
Break Received	Framing Error	Parity Error	Received Data Available	DCD	Auto-disconnect	DSR	CTS
Value = 128	64	32	16	8	4	2	1

Register 1 is a read/write register. The value contained in this register determines the conditions that cause an interrupt to the computer.

Modem control is achieved by writing to Register 2. The contents of this register control the state of the three modem control lines (DRS, RTS, and DTR) from the serial interface section to the modem section. Modem status, or input from the modem section to the serial interface section, is obtained by reading Status Register 3. The contents of this register contain the state of the three modem status lines (DCD, DSR, and CTS).

The following table lists, for each operating mode, the state of the modem control and status lines, and the contents of the associated register. Control Register 2 is abbreviated CR2; Status Register 3 is SR3.

MODE	DRS	RTS	DTR	CR2	SR3	DCD	DSR	CTS
Modem Off	1	0	0	4	2	0	1	0
Self Test	0	1	1	3	1	0	0	1
Auto Dial	1	1	0	6	0	0	0	0
		pulse		pulse				
		1		6				
Manual Dial	Dialing, modem off				then originate			
Originate	1	1	1	7	0,1	0	0	0,1
					Note 1			
Ready to Answer	1	0	1	5	2	0	1	0
Answer	pulse	0	1	5, 1, 5	Note 2	0, 1, 0	0	0, 1
	low							
Auto-disconnect	x	0	0	0 or 4	2	0	1	0

**Notes:**

1. CTS = 1 after handshake completion.
2. When phone rings, DCD goes high. SR3 was 2, now goes to 6. When phone is answered (DRS pulsed low) DCD returns to 0, DSR goes to 0. CTS = 1 after handshake completion.

**Register 2: Modem Control Signals**

					bit 2	bit 1	bit 0
Not Used	Not Used	Not Used	Not Used	Not Used	DRS	RTS	DTR
Value =					4	2	1

Register 2 is a read/write register. The value contained in this register controls the state of the interface control signals shown.

**Control Register 3**

Control Register 3 is a write-only register. The value in this register determines the baud rate for transmitted and received data as shown in the table on the next page. This register selects standard baud rates only. Registers 6 and 7 specify non-standard rates. Reset default is 6 (300 baud), which is the maximum for this modem.



Value	Rate Specified
0	50
1	75
2	110
3	134.5
4	150
5	200
6	300

**Status Register 3: Modem Status**

bit 3				bit 1		bit 0	
Not Used	Not Used	Not Used	Not Used	DCD	Not Used	RTS	DTR
Value =				8		2	1

Status Register 3 is a read-only register. The value returned from this register indicates the status of the specified modem signals. Bit 0, 1, or 3 set indicates that the corresponding modem signal is active (high).

**Register 4: Line Characteristics**

bit 6		bit 5		bit 4		bit 3		bit 2		bit 1		bit 0
Not Used	Set Break	Force Parity	Even Parity	Enable Parity	Stop Bits	Character Length						
Value =		32	64	16	8	4	2	1				

Register 4 is a read/write register that specifies character length, stop bits, parity, and forces a break to be transmitted. The reset default is 10 (seven bits, odd parity, one stop bit). The following table shows how to select the value for the `CONTROL` statement to specify combinations of character length, parity, and stop bits.

Bits/Character	Parity Specifier				
	None	Odd	Even	1	0
5	0	8	24	40	56
6	1	9	25	41	57
7	2	10	26	42	58
8	3	11	27	43	59

**Note:** This table specifies 1 stop bit. To specify 2 stop bits, add 4 to the values found in the table.

**Register 5: Modem Features**

			bit 4			bit 1	bit 0
Not Used	Not Used	Not Used	Transmit Handshake	Not Used	Not Used	DSR	CTS
Value =			16			2	1

Register 5 is a read/write register. The value contained in this register determines the auto-handshake and auto-disconnect features that are specified.

**Registers 6 and 7**

These are both read/write registers. They specify the baud rate for data transfer and can be used for non-standard baud rates. The values for these registers are determined by the following equations:

1. Divisor =  $115\,200 / (\text{Baud Rate})$
2. Register 6 value = (Divisor)DIV 256
3. Register 7 value = (Divisor)MOD 256

Reset defaults are 1 for Register 6 and 128 for Register 7. These values yield a 300 baud rate. 110 baud is also a standard rate.

**Register 8: Error Replacement Character**

Register 8 is a read/write register. The value contained in this register is the decimal value of the ASCII character that is specified as the parity and framing error replacement character. When a parity or framing error is detected in the input data, the character that contained the error can be replaced with the character in this register. This feature is used to flag errors and simplify troubleshooting. This feature is enabled by bit 4, Register 9.

**Register 9: Transmitter/Receiver Control**

bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
Enable Transmitter	Strip Received Rubouts	Strip Received Nulls	Change Character if Error	Set Bit 7 of Character if Error	Reset Receive Queue	Auto-echo Enable	Enable Receiver
Value = 128	64	32	16	8	4	2	1

Register 9 is a read/write register that controls the interface transmitter and receiver. Various control signals can be altered using this register. The reset default is 137 (bits 0, 3, and 7 set).

**Status Register 10: Line Status**

bit 5		bit 4	bit 3	bit 2	bit 0	
Not Used	Not Used	Transmit Register Empty	Break Received	Framing Error	Parity Error	Received Data Available
Value =		32	16	8	4	1

Status Register 10 is a read-only register. The value contained in this register provides information about each character as it is received. This status information is entered into the receive queue in synchronization with each character.

**Control Register 11: Input Data Control**

bit 7	bit 6	bit 4		bit 3	bit 2	bit 1	
Enable Transmit Flag	Disable Transmit Flag	Not Used	Terminate If CR15	Terminate If CR14	Terminate If CR13	Terminate If CR12	Not Used
Value =	128	64	16	8	4	2	

This register specifies the input terminator character location and provides control of the transmitter enable flag when input terminator characters are detected.

**Status Register 11: I/O Termination Cause**

bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
End of Output Data List	End of Input Data List	Transfer Count Expired	CR15 Character Received	CR14 Character Received	CR13 Character Received	CR12 Character Received	DELIM Character Received
Value =	128	64	32	16	8	4	2

This register is a read-only register that indicates the reason for terminating an I/O operation. When multiple conditions are specified, this register is read to determine the I/O termination cause.

**Control Registers 12 through 15**

These registers contain the termination characters that are specified by Control Register 11. The transmit enable flag is also controlled by the characters specified by Control Registers 14 and 15.

**Control Register 16****Output EOL Sequence**

bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
Auto RTS Enable	EOL Transmit Disable	Six Bit EOL Character Count					

Value =  
128                      64                      32                      16                      8                      4                      2                      1

Control Register 16 is a write-only register. The EOL (end-of-line) character count specifies the number of characters in the EOL sequence. This value ranges from 0 through 63. Long EOL sequences are normally used with slow printing devices such as teletypes to allow the print mechanism sufficient time to execute a carriage return/line feed before sending more data from the interface. The characters that make up the actual EOL sequence are contained in Control Registers 17 through 23.

Bit 7 set enables the auto Request To Send feature. This feature activates the Request to Send modem signal at the beginning of each transmission. When the EOL sequence is transmitted (end of TRANSFER or OUTPUT statement) the Request To Send signal is set to the inactive state. Bit 7 clear disables this feature.

Bit 6 clears the transmitter enable flag after all output data (including EOL sequences) have been transmitted. This flag must be reenabled from the program or by detecting a special received character (see Control Register 11) before transmission can resume. This feature is used with ENQUIRE/ACKNOWLEDGE handshakes. Bit 6 clear (0) disables this feature.

**Control Registers 17 through 23**

The register diagram below shows the relationship these registers have to each other.

Control Register Number	Default Contents	Register Function
16	2	Number of characters in end-of-line sequence.
17	13	EOL character—carriage return.
18	10	EOL character—line feed.
19	0	EOL character.
20	0	EOL character.
21	0	EOL character.
22	0	EOL character.
23	0	EOL character.

## Setting the Select Code Switch

The select code switch is contained inside the modem. All commands from the computer to the modem must use the select code. The select code for the modem has been set to 10 at the factory. If some other interface has 10 as its select code, then the modem select code must be changed. If you need to change the select code, carefully follow the procedure for disassembling the modem to access the select code switch.

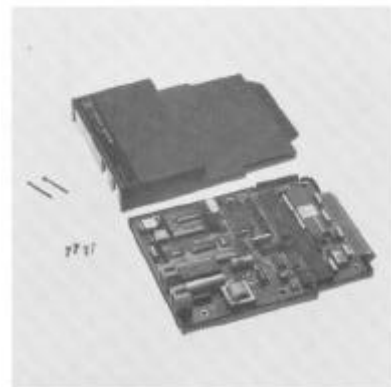
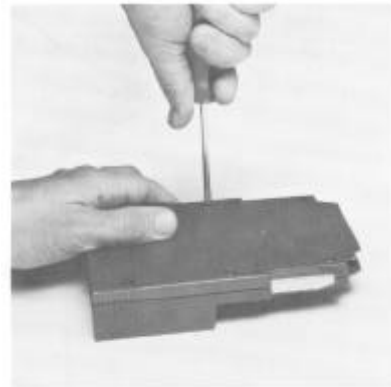
### CAUTION

When disassembling the modem, do not change anything except the select code switch. Any other changes could void the FCC Registration of the device and/or damage the public telephone network. It is illegal to make any change in the components of the modem.

## Disassembling the Modem

Figure C-1 illustrates how parts of the modem are assembled. See figure C-1 as you read through the disassembly procedure.

1. Place the modem on a flat surface with the bottom cover facing up and the thicker part to the left.
2. Use a Pozidriv® 1 screwdriver to remove the screws holding the top and bottom housings together. Notice that the two screws holding the thicker end together are longer than the other four. Set the screws aside.
3. Hold the modem parts together as you carefully turn the modem over so that the top housing is facing up and the thick portion is still to the left.
4. Lift the top housing to expose the modem printed-circuit assembly.



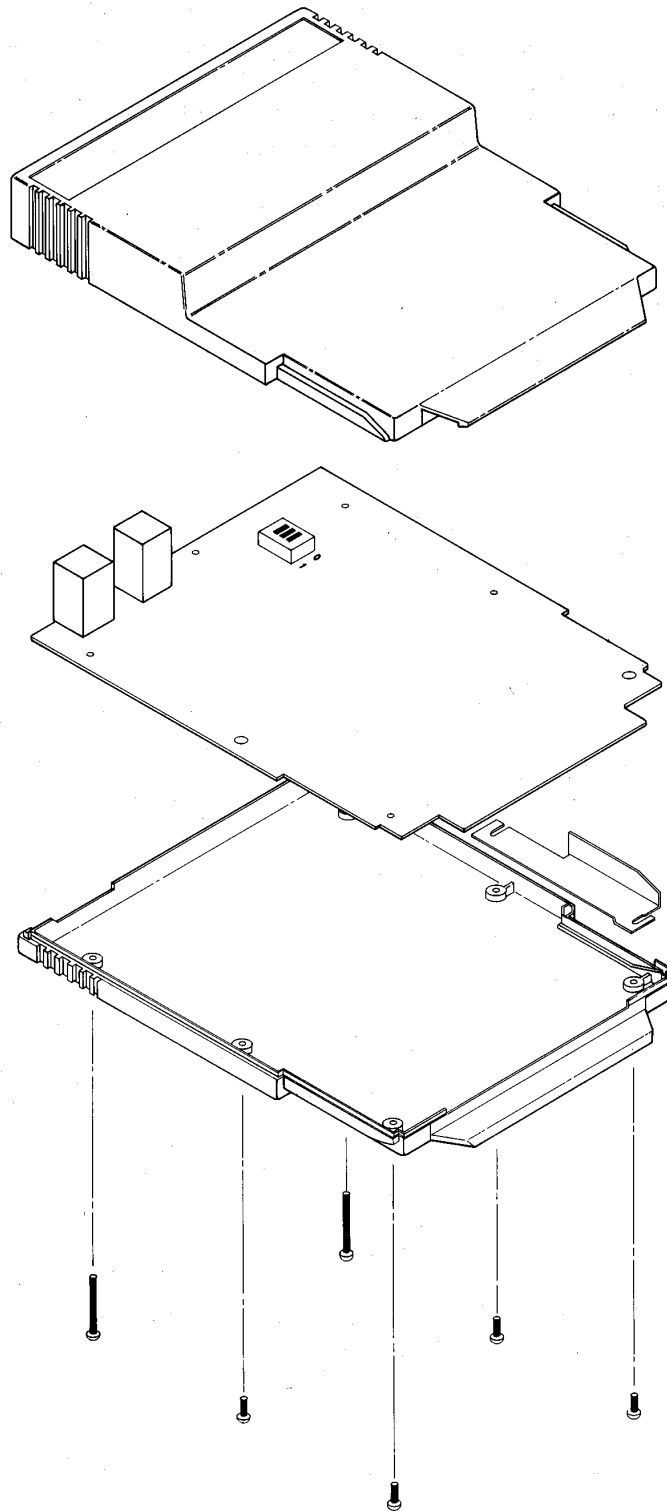
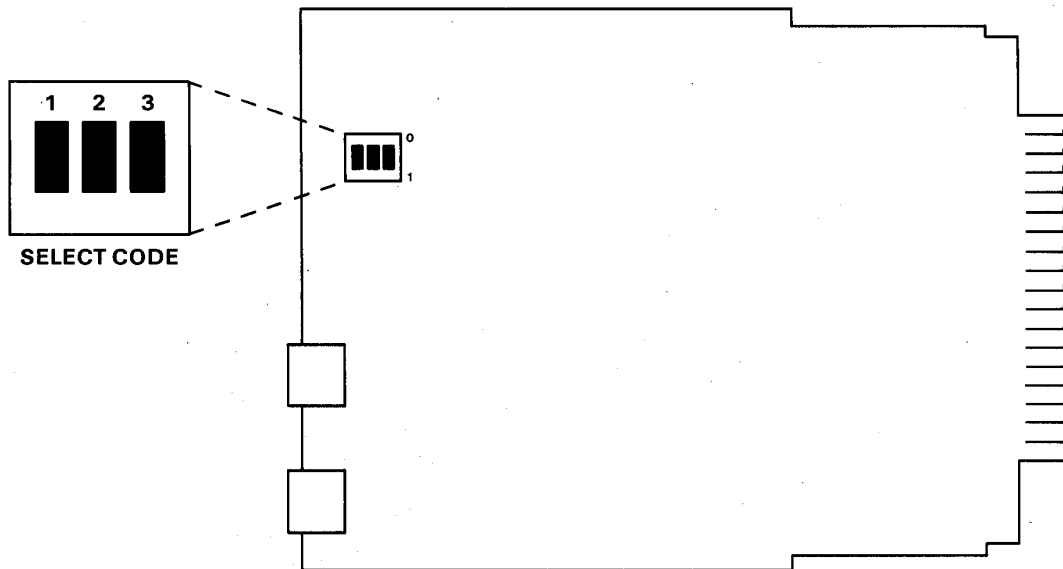


Figure C-1. Disassembly

## Modem Select Switches

The bank of three switches inside the modem allows a choice of eight codes. Each of the three switch segments can be set independently to the 1 or 0 position. These positions are marked on the printed-circuit board. The select code was preset to 10 by setting the switch segments to the positions shown in figure C-2. You can change the select code to any integer from 3 through 10 by changing switch segments 1, 2, and 3, according to the table in figure C-2.



SELECT CODE	Segment 1	Segment 2	Segment 3
3	0	0	0
4	0	0	1
5	0	1	0
6	0	1	1
7	1	0	0
8	1	0	1
9	1	1	0
Preset 10	1	1	1

Figure C-2. Modem Printed-Circuit Assembly Switch Assignments

**Note:** If you reset the select code, make sure you change the proper switch segments. Use an instrument small enough to change one switch setting at a time without disturbing adjoining switch segments. The small tip of a pencil or similar object is recommended for this purpose. Failure to set switch segments properly will produce an unexpected interface select code and erroneous results.

## Reassembling the Modem

To reassemble the modem, reverse the procedure for disassembly. Before replacing the top housing, be sure the printed-circuit assembly is correctly positioned in the bottom housing. The metal strip which is exposed on the outside of the modem is the ground contact. The ground contact should be seated between the printed-circuit assembly and the bottom housing, and in the upper right-hand corner when the modem is oriented as described for changing the switch segments.



## Glossary

**ASCII**—American Standard Code for Information Interchange is a code used to represent the alphabet (both upper and lower case), the numerals 0 through 9, punctuation, special symbols, and control functions. Typically, in serial transmission each character comprises one start bit, followed by seven data bits, a parity bit, and a stop bit.

**Asynchronous data transmission**—A form of serial data transmission in which characters are sent at a random rate, framed by start and stop bits. The sender and receiver are not synchronized before transmission begins.

**Baud**—The baud is the rate at which bits (0 or 1) are transmitted along a data line. In a train of binary signals one baud is equal to one bit per second.

**Break**—A break is a signal transmitted from a terminal to the host by holding the transmit line low for a specified period of time. The break signals the host to halt the current operation.

**Buffer**—A buffer is a portion of terminal or host memory through which incoming and outgoing data flow. The buffer is used to accumulate data temporarily to compensate for differences in rate of data flow.

**Echoplex**—When a terminal uses an echoplex link, characters typed into the terminal are transmitted to the host, and then “echoed” back to the terminal output device (CRT or printer).

**Escape character**—The ESC character, corresponding in ASCII code to decimal value 27, is used in conjunction with other characters to transmit instructions.

**Full duplex**—Describes a data communications link which allows data to be transmitted simultaneously in both directions.

**Half duplex**—Describes a data communications link which allows data transmission in only one direction at a time.

**Handshake**—Signals sent between transmitter and receiver to control timing of data transfers.

**Host computer**—The host is a larger computer with which your personal computer is communicating.

**Mainframe**—This term is often used to refer to a large computer system to which a number or peripherals, including terminals, are attached.

**Modem**—Modems are devices used for transmitting data over telephone lines. An acronym for modulator-demodulator, they derive that name from their function of converting digital data signals to audio tones for transmission over the phone line, and vice versa.

**Output separator**—The output separator is a character or sequence of characters appended to a line of data being transmitted from the terminal to the host. The most common output separator is a carriage return (CR).

**Parallel data transmission**—In parallel transmission, all the bits that constitute a character are transmitted simultaneously over separate data lines.

**Serial data transmission**—In serial transmission, the bits that constitute a character are transmitted over one data line, one bit after another. The order of transmission is least significant bit first to most significant bit last.

**Serial interface**—Circuitry designed to transform digital data from parallel to sequential format for serial data transmission.

**Simplex**—Pertains to a communications link in which data can be transmitted in one direction only.

**Start bit**—The start bit is sent at the beginning of each character to alert the receiver that the next string of data is a set of character bits forming one character.

**Stop bits**—One or two bits are transmitted at the end of a set of character bits to signal the end of a character.

**Synchronous data transmission**—Blocks of data are transmitted at a fixed rate.

# HP 82950A Modem Owner's Manual Supplement

This supplement contains updating information for the *HP 82950A Modem Owner's Manual*, part number 82950-90001, dated January, 1982.

When the HP 82950A Modem and accompanying software are used with an HP Series 80 Personal Computer that supports an 80-column display, the changes listed in this supplement apply.

The modem communications software for 80-column display use comprises the following programs: MODCOM87, IPBIN87, and GETSAV87. These should be used in lieu of MODCOM, IPBIN, and GETSAV respectively.

## System Requirements

In addition to a disc drive and connecting cable, you will need:

- Memory Module (32K or larger).
- HP 82936A ROM Drawer.
- I/O ROM (part number 00087-15003).
- Modular telephone line (pay or party telephone lines may not be used).

You do *not* need a Mass Storage ROM or an HP-IB interface.

## Display Differences

- The 80-column display causes some of the messages in the program to appear differently than the illustrations in the owner's manual indicate. Also, the underline cursor described in the manual is replaced by a rectangle in inverse video.
- When error checking is enabled, any erroneous characters will appear in inverse video instead of the underlined characters described in the manual.
- Although the special function key labels on a computer with an 80-column display do not appear as depicted in the manual, the documentation in appendix A of the modem owner's manual is compatible with the MODCOM87 program.

## Operational Differences

- Both the IPBIN87 and GETSAV87 binary programs can be in computer memory at the same time.
- The (TR/NORM) key (located in the same place as the (SCRATCH) key on the HP-83/85) is used to abort an ongoing log-on sequence.
- There is no (PAPER ADVANCE) key function available.
- The references to loading the program from tape do not apply.



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