HEWLETT PACKARD

Series 80
Data Communications Pac

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Contents

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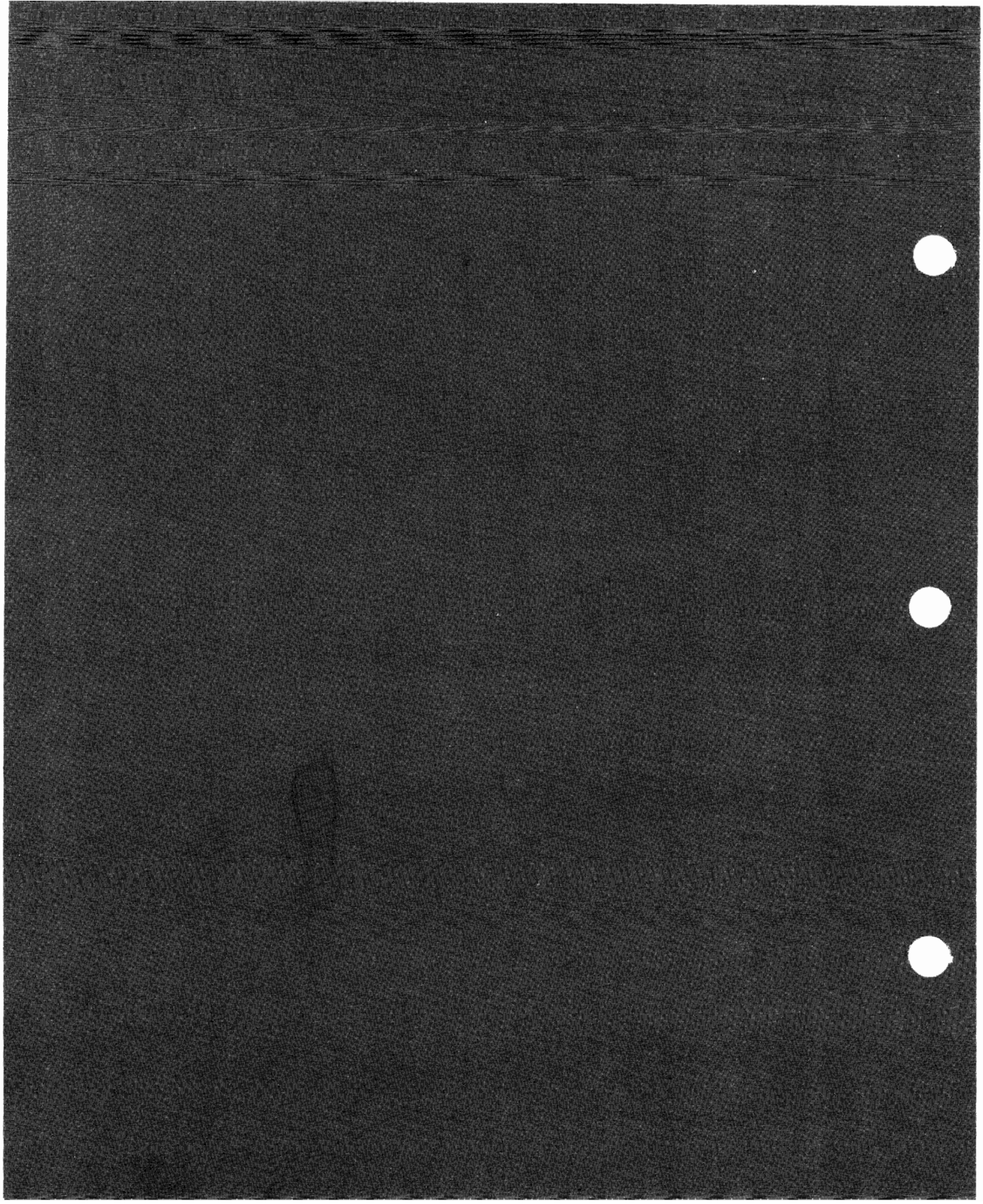


Section 1

Getting Started

Introduction

The Data Communications Pac for the Series 80 personal computers has been designed to allow those computers to function as terminals capable of communicating with various mainframe computers. The world of personal data communications includes huge computerized data bases, as well as computer conferencing and electronic mail.

When it is functioning as a terminal, your computer is capable of transmitting and receiving information under the control of a host computer. You can use your computer as a terminal to interact with a time-sharing system, to pass data to the host for analysis, or for receiving stored data from the host for processing by your local desktop computing system. An additional feature, remote console mode, provides for controlling your Series 80 computer.

This manual is not a course on data communications (data comm). Sections 1 and 2 will provide you with ample information to quickly get your system up and running; section 3 contains information for modifying the operation of your terminal. If you simply desire to connect your computer to a data base computer system and utilize news services, stock reports, time-sharing capabilities, etc., you may skip the more advanced and technical sections that follows section 3.

If your data comm needs involve mass storage operations or remote console applications, you will need to read section 4 or section 5 respectively. You should also refer to the *HP 82939A Serial Interface Owner's Manual* for additional information about data communications. Section 6 contains some troubleshooting suggestions.

Note: The examples in this manual use the HP-85. The 80-column display of the HP-86/87 causes the messages and key labels to be formatted somewhat differently.

Capabilities

The range of communications options in the pac's programs has been chosen to satisfy the requirements of almost any large host computer. However, before you attempt to use your computer as a data terminal, find out the time-sharing requirements of the host computer with which the terminal will be communicating. Compare those requirements with the following capabilities contained in the Data Communications Pac.

Transmission Mode	Serial, asynchronous, full duplex.
Terminal Connection	Hard-wired or modem.
Handshake	DC1/DC3 (XON/XOFF), ENQ/ACK, or none (default is none).
Baud Rate	50 to 9600 bits/second (default is 300).
Data Bits	5 through 8 (default is 7).
Start Bits	One.
Stop Bits	One or two (default is one).
Parity	Even, odd, none, one or zero (default is odd).

Note: The default values for baud rate, bits, and parity are valid unless the HP 82939A Serial Interface has been reset using the internal switches.

If some of these terms are unfamiliar to you, the glossary of terms in appendix B may be helpful. You are also encouraged to reproduce the time-share checklist in appendix C and use it for each host system with which you will be communicating.

Setting Up the Data Communications System

System Requirements

To use the terminal emulator programs in the Data Communications Pac, you must have the following items:

For the HP-85A:

- I/O ROM (part number 00085-15003).
- HP 82936A ROM Drawer.
- HP 82939A Serial Interface, option 001.
- HP 82903A 16K memory module.
- A modem (unless you are connecting the HP-85 to the host directly by cable).
- Plotter/Printer ROM (part number 00085-15002), required if you are using an external printer.
- If you will be loading the program from the disc, then you also need a Mass Storage ROM (part number 00085-15001), a disc drive, and an HP 82937A HP-IB Interface.

For the HP-86/87:

- I/O ROM (part number 00087-15003).
- HP 82936A ROM Drawer.
- HP 82939A Serial Interface.
- 64K or more bytes of user memory (RAM).
- A modem (unless you are connecting the HP-86/87 directly to the host computer by cable.

Using a Peripheral Printer

A peripheral printer is optional, since data ordinarily directed to the printer (internal printer on the HP-85, PRINTER IS printer on the HP-86/87) can instead be routed to the CRT. (The default output device on the HP-86/87 is the CRT.) A printer that prints 80 characters per line is very useful for the HP-85 if the host computer is sending lines that are longer than 32 characters. If you are using a peripheral printer and it requires a serial interface, the printer must use a separate interface from the one used for data communication.

Installing the Components

CAUTION

Before installing the ROM, ROM Drawer, serial interface, and memory module, make sure you 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.

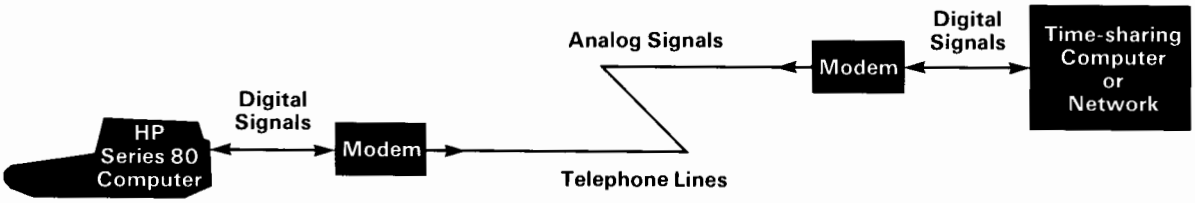
If your system includes any other device requiring a serial interface, then it must be connected via a separate interface, and each serial interface must have its own unique select code. The select code of the interface is preset at the factory to 10, but must be changed if there is more than one serial interface in the system. The interface that is used for data communications must have the lowest select code of all serial-type interfaces in your system. Instructions for changing the select code are provided in the *HP 82939A Serial Interface Owner's Manual.*

Connecting the Interface and Host

If your data communications will occur through a direct line to the host computer, the interface cable connector is attached to the host line. This is a *hard-wired* connection.

If you are using a modem, the interface connector cable is attached to the modem. Some modems may be incompatible with the interface cable, so that it may be necessary to rewire the 28-pin connector inside the interface housing. Instructions for reconfiguring the cable are included in the interface manual.

The following system diagram shows a typical data comm link with a host computer using the telephone network.



The Series 80 Computer as a Data Terminal

Loading the Programs

Your Data Communications Pac contains two programs for operating your computer as a terminal. The BASIC program "TERMEM" ("TERM87" for the HP-86/87) sets the serial interface and coverts the computer to a terminal. The "IPBIN" ("IPBIN87" for the HP-86/87) binary program provides some additional BASIC statements that are used by the TERMEM program. These statements are documented in appendix A.

To load the programs into your computer, you must execute the LOAD statement. If you are loading the program from a disc, be sure to turn on the disc drive before turning on the computer. This establishes DRIVE 0 as the default mass storage device. If the HP-85 is turned on before the disc drive, the internal tape unit is the default mass storage device.

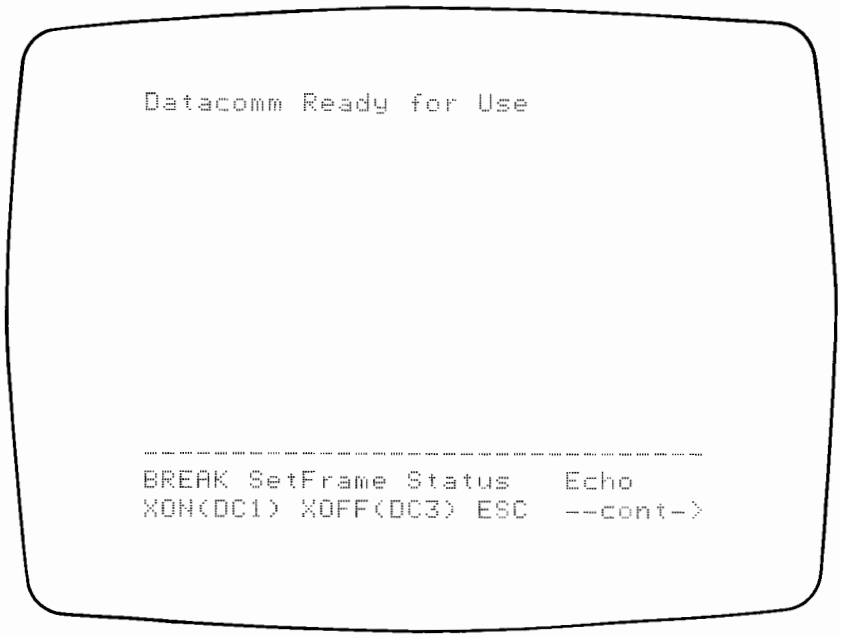
The following statements will load the TERMEM program from the default mass storage device:

LOAD "TERMEM" (END LINE)	For the HP-85.
LOAD "TERMEM87" (END LINE)	For the HP-86/87.

If you have less than 32K total user memory in the HP-85 or 64K in the HP-86/87, you will receive Error 19 : MEM OVF, indicating that the program has not been properly loaded because it is too large for computer memory. If this happens, turn OFF the computer, insert the memory module, turn the computer ON, and try loading the program again.

The TERMEM program has been successfully loaded when the Drive-ON light on the mass storage device goes off. Now, start program execution by pressing (RUN). A LOADBIN statement in the TERMEM program automatically loads the binary program. You will see the Drive-ON light come on while the IPBIN binary program is being loaded.

If your system is properly set up, the light will go off, and the program will beep and display:



The bottom two rows are key labels for HP-85 special function keys (k1) through (k8). The special function keys assigned by the TERMEM program allow you to communicate with the program and with the host.

> **Note:** The HP-86/87 displays the same set of key labels on each "page" of keys. For ease of use, however, the keys are numbered differently. For example, the `--cont->` key is assigned to (k7) on the HP-86/87.

The TERMEM program will generate an error message if your system is not set up properly. If there is no serial interface plugged into one of the module ports, the program displays:

```
NO RS-232 Card
```

RS-232 is an alternative name for the serial interface.

If there is no I/O ROM present, the program displays:

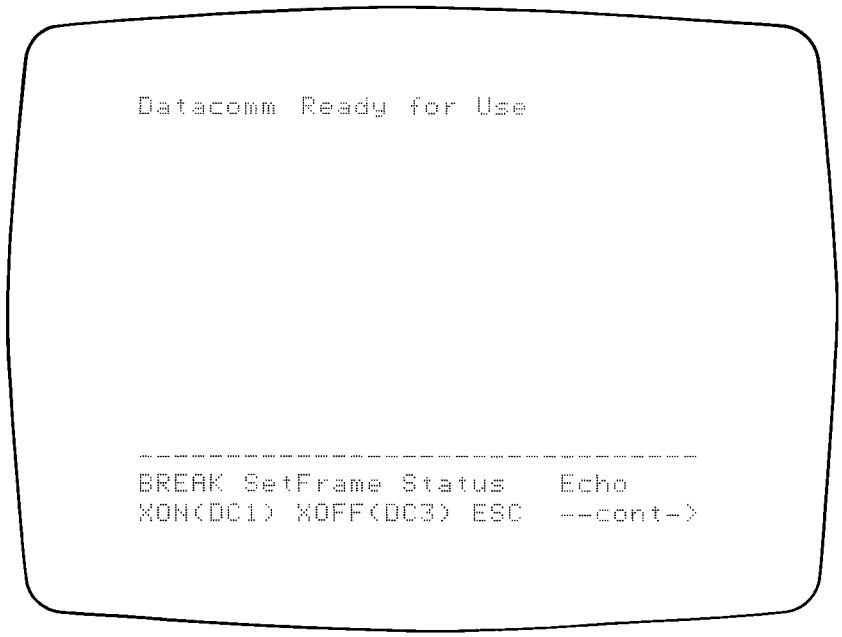
```
NO I/O ROM
```

If you receive either of these errors, you must correct the error condition by first turning off the computer and then plugging in the missing module(s). Make sure you follow instructions provided with those devices when inserting or removing them. Once the correct modules are installed, you can reload and rerun the TERMEM program.

Note: When the TERMEM program is running, you should not repeatedly press any key. Doing so may cause the program to malfunction.

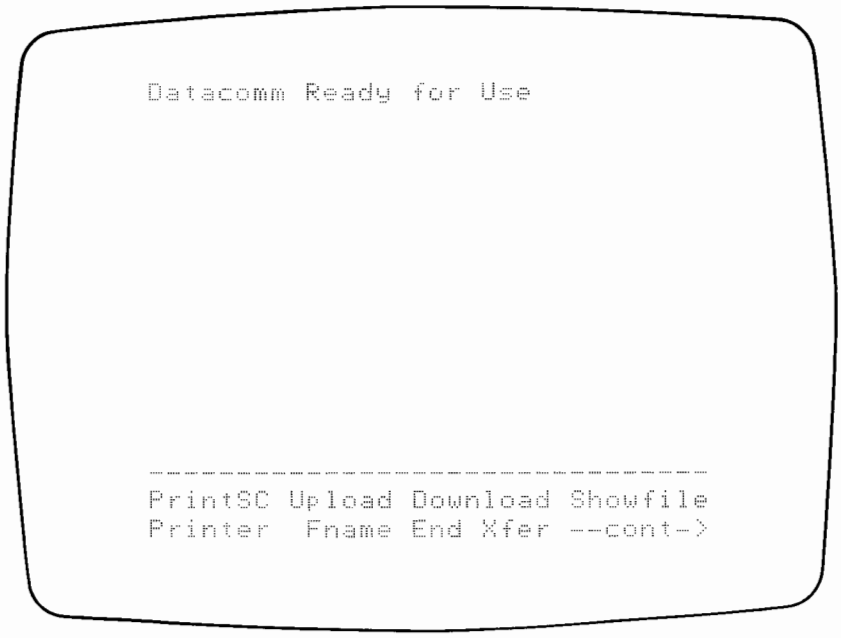
Special Function Keys

When you press (RUN), the first set of special function key assignments is activated. The HP-85 key assignments are shown below:

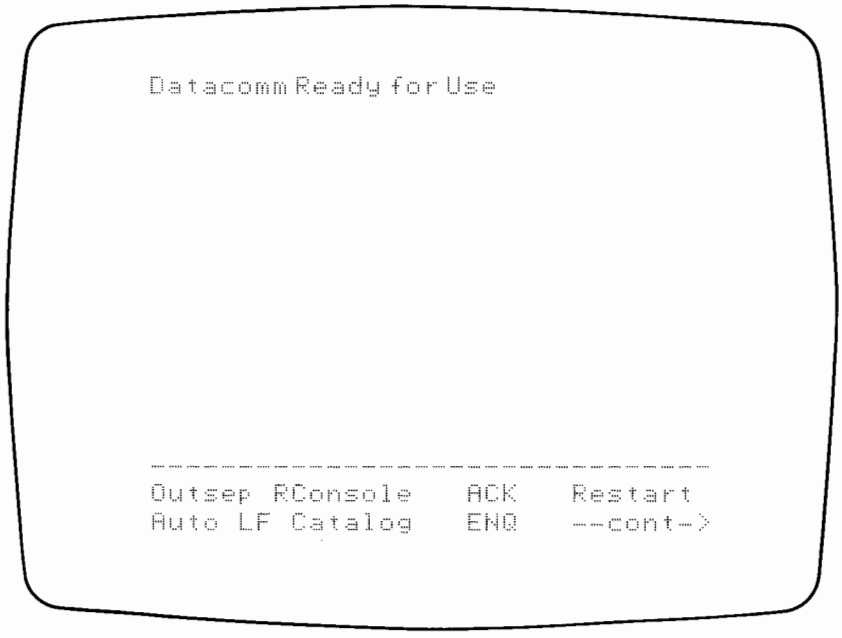


On the HP-85, the bottom row corresponds to keys (k1) through (k4); the top row corresponds to (k5) through (k8).

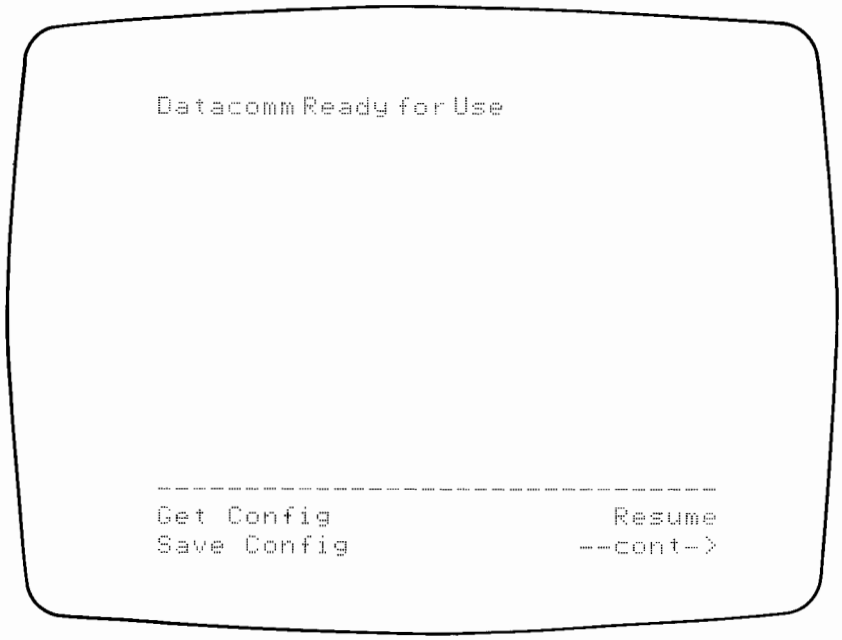
The program is designed to reassign the special function keys based on your interaction with the TERMEM program. Before explaining how to change the program's data communications options using the special function keys, you might first want to *page* through the alternative sets of key assignments. This is done using the `--cont->` special function key. When you press `--cont->`, the special function keys are reassigned and the new key assignment labels appear at the bottom of the screen.



Pressing `--cont->` again accesses the third group of key assignments.



Pressing `--cont->` once again accesses the fourth group of key assignments.



Now, press --cont-> one more time to return to the first set of key assignments.

The actions taken by the TERMEM program when you use the special function keys fall into several main categories. Each of the keys will be discussed in greater detail later. For now, you should be aware of the range of actions they invoke.

- A control character or control character sequence may be sent to the host (for example, XON(DC1), ENQ, ESC).
- The operating status of the program or serial interface may be altered. The ability to easily edit the TERMEM program makes adapting the program to your host system easy (for example, Echo, PrintSC).
- The special function keys may be reassigned (for example, --cont->, SetFrame).
- Pressing a special function key may initiate a mass storage operation (for example, Upload, Download, Catalog).
- A terminal configuration can be saved and reused (for example, Restart, GetConfig).

In addition, one key, RConsole, is used to enter Remote Console Mode.

If the current key labels are overwritten, they can be recalled to the CRT at any time by pressing (KEY LABEL).

Appendix D contains a summary of all the special function keys and their functions.

Notes

Section 2

Establishing a Data Communications Link

This section provides the minimum required information and procedures to turn your computer into a terminal connected to a powerful host computer. To establish this data comm link, certain transmission characteristics must be matched between the Series 80 computer and the host computer. After you have configured the system to match the host, you will be able to log on to the system.

Using the Status Keys

Before logging on the host computer, you should obtain a list of the program status to insure that you have prepared the program for communication with the host. The TERMEM program will print (or display) a list of the relevant program parameters when you press either of the two status special function keys. The `Status` key provided in interface edit mode is convenient for reviewing the framing parameters (discussed later). The `Status` key in the first bank of special function keys allows you to obtain the program status at any time without entering interface edit mode.

The following program status listing shows the default value of each program parameter. It was obtained by pressing the `Status` key immediately after the TERMEM program was loaded.

```
        DATACOMM STATUS

Serial Select Code.....10
Remote Console Mode....DISABLED
Printer.....OFF
Echo.....OFF
Restart Option.....ON
Output Separator:
   Char# 1.....13
Transfer File Name.....DUMMY
Config File Name.....DUMMY

Frame:
   Modem.....OFF
   Handshake.....NONE
   Error Check.....ON
   Baud.....300
   Data Bits.....7
   Stop Bits.....1
   Parity.....ODD
```

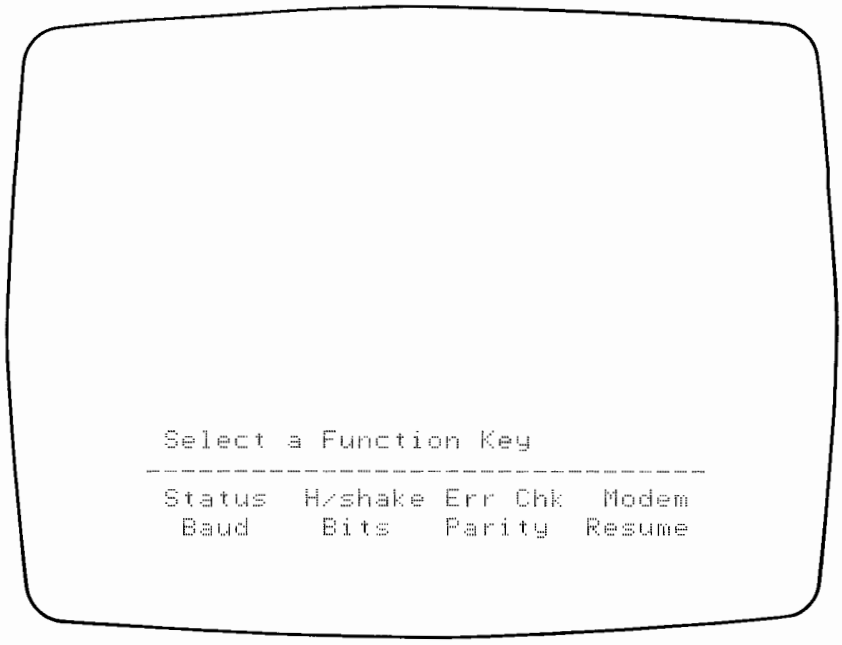
The parameters in the first group need not be set before logging on and are discussed in later sections. Items listed under Frame: must be set to provide compatibility between host and terminal before you proceed to log on to the host, unless the default values coincide with the host's requirements. If they are the same as the default values, then you may skip the following procedures and go directly to the log on instructions. Note that if you are using a modem you will need to set the modem handshake to ON even if the other frame parameters are correct.

Programming the Serial Interface

The serial interface regulates several of the parameters governing communication between the Series 80 terminal and the host computer. These parameters are:

- The type of handshake, if any, used.
- The baud rate.
- The number of data and stop bits per character.
- Parity.
- Status of the modem handshake (ON or OFF).

Each of these parameters is set by writing to a register in the serial interface. The TERMEM program allows you to alter the contents of the registers via *interface edit mode*. To enter interface edit mode, press the SetFrame special function key. The program immediately enters interface edit mode and reassigns the special function keys as illustrated below:



The SetFrame key derives its name from the purpose for editing the serial interface. Together, the bits and parity parameters specify the structure of the data bits used to represent, or frame, the ASCII characters transmitted between the terminal and the host. Changes made in interface edit mode are said to alter the interface *frame status.*

The Resume key is used to exit interface edit mode; the other keys allow you to change the contents of the appropriate interface registers.

H/shake Key

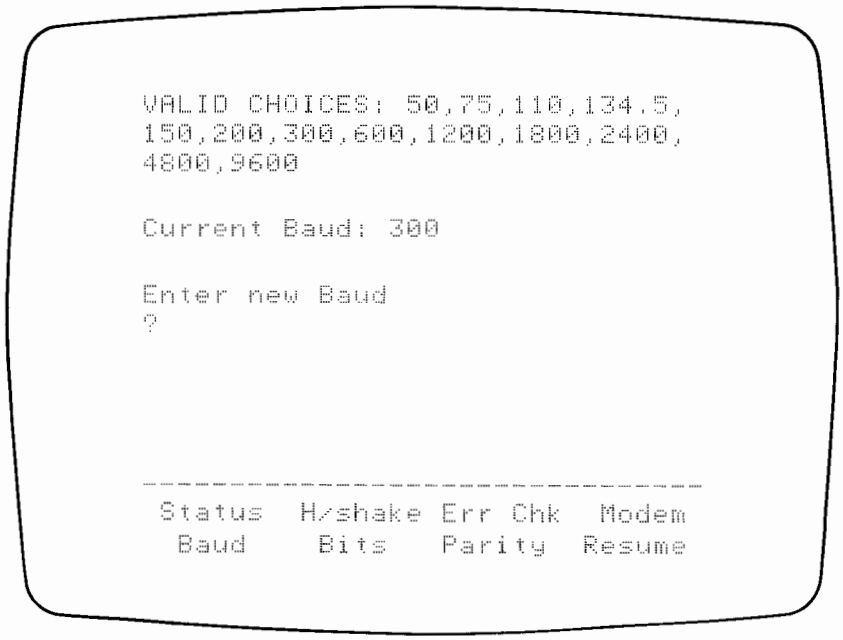
The H/shake key is used to select one of three handshaking modes—None, XON/XOFF (DC1/DC3), or ENQ/ACK. The default mode, None, is used if no other handshake option is selected. Pressing H/shake changes the handshake mode and causes the printer to output the new handshake mode. If the host requires the ENQ/ACK handshake, you should select that handshake mode before setting any other frame parameters.

The None handshake option should never be used at baud rates exceeding 1,200 or with a terminal printer. Otherwise, an INPUT BUFFER OVERRUN error could occur.

> **Note:** The ENQ/ACK handshake used in this program is designed to operate with the HP 1000 E/F Series Computer using drive :DVA05 Rev. 2013 or later with the HP 12966A Buffered Asynchronous Communications Interface. The ENQ/ACK handshake may not be compatible with other systems.

Baud Key

The baud rate is the number of bits transmitted per second, and it must be identical for transmitter and receiver. The default value is 300 (unless the factory setting on the serial interface has been changed). If the host requires a different baud rate, press the Baud special function key and see:

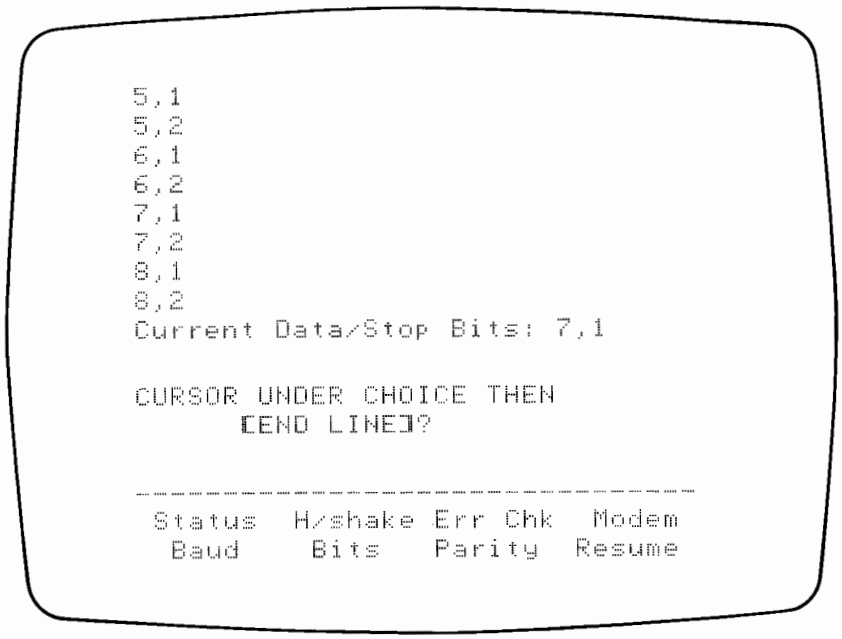


You must enter one of the standard baud values listed. If you attempt to enter an invalid choice, the terminal will beep and display INVALID BAUD RATE...PLEASE REENTER.

Pressing (END LINE) while the cursor is positioned on an empty line maintains the current baud rate.

Bits Key

The Bits key allows you to change both the number of data bits sent per character (excluding the parity bit) and the number of stop (empty or value = 0) bits sent at the end of each character. The default value for character bits is 7, corresponding to the 7-bit ASCII code, but can be reassigned values ranging 5 through 8. The default value for the number of stop bits is 1; values of 1 or 2 are allowed. To change the number of data or stop bits, press the Bits key to receive a listing of the various choices on the CRT:



The pairs of numbers separated by commas are the allowable choices. The first number in the pair is the number of character bits; the second number is the number of stop bits. Place the cursor under the proper choice and press (END LINE).

If you attempt to enter an illegal number of bits, the terminal will beep and display INVALID DATA/STOP BIT...PLEASE REENTER.

You should keep in mind that characters are transmitted serially with the least significant bit first. If the number of character bits is set to a number less than 7, bits will be lopped off the character starting with the most significant bit. For instance, the character G has the binary ASCII representation 1000111, and is transmitted as shown below:

1 0 0 0 1 1 1 ⟶

If the number of character bits is changed to 5, the five transmitted characters are:

0 0 1 1 1 ⟶

The character has been truncated, causing erroneous results.

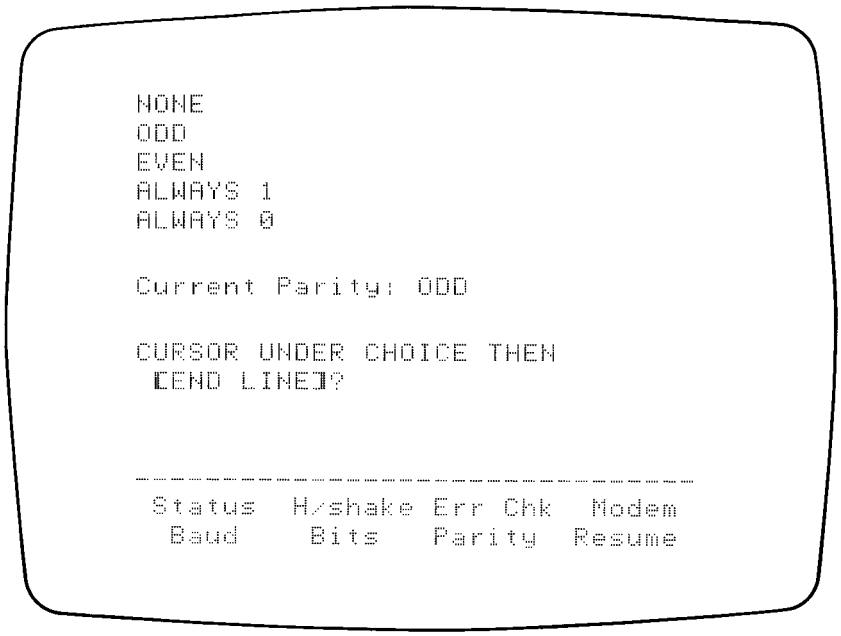
Pressing (END LINE) while the cursor is positioned on an empty line maintains the current bit parameters.

Parity Key

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 TERMEM program allows you to select parity values of even, odd, none, always 0, and always 1. The default 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 1 or 0, the parity bit equals the parity value, regardless of the character. The parity check is used to flag transmission errors by underlining (HP-85) or highlighting (HP-86/87) them.

To change parity, press the Parity key. The following instructions will be displayed on the CRT:



Use the cursor control keys to place the cursor at the proper parity and then press (END LINE). Pressing (END LINE) while the cursor is positioned on an empty line maintains the current parity.

If you attempt to enter an invalid choice, the terminal will beep and display: `INVALID PARITY... PLEASE REENTER.`

`Modem` Key

The `Modem` key allows you to switch the program between modem handshake ON and modem handshake OFF. The default value is modem handshake OFF. When the `Modem` key is pressed, the program first changes the status of the modem handshake and then prints the new status on the system printer. If there is no system printer, the new status is displayed on the CRT. For instance, if the modem handshake has been OFF, pressing the `Modem` key enables the handshake. The printer (or CRT) will output:

```
Modem.....ON
```

The procedure for establishing a handshake between the Series 80 terminal and the modem is explained under Establishing a Modem Handshake, discussed next.

`Resume` Key

Pressing the `Resume` key takes the TERMEM program out of interface edit mode. The program returns to the first set of key assignments. If the modem handshake is OFF, the program displays:

```
Datacomm Ready for Use
```

If the modem handshake is ON, the program displays:

```
Datacomm Ready for Use
Awaiting modem carrier detect...
```

Establishing a Modem Handshake

If you are not using an acoustic coupler or modem/data set, you may skip this subsection.

If you are using a modem, you must provide for proper communication between the Series 80 terminal and the modem by activating a modem handshake. The modem handshake is a sequence of signals exchanged between the serial interface and the modem to insure that no data is lost. For additional information on the nature of the serial interface's modem handshake, refer to the serial interface manual.

To establish a modem handshake, carefully follow these instructions:

1. Make sure the interface cable connector has been properly attached to the modem.
2. If you are not currently in interface edit mode, use the SetFrame special function key to enter that mode.
3. Turn on the modem or acoustic coupler.
4. Press the Modem special function key to enable handshaking between the interface and modem. The program will print (or display):

```
Modem.....ON
```

5. Press the Resume key. The program leaves interface edit mode and displays:

```
Datacomm Ready for Use
Awaiting modem carrier detect...
```

indicating that the program is waiting for the modem to acknowledge a proper connection.

If you are using an acoustic coupler, follow this sequence of instructions (steps 6 through 11). If you are using a data set/modem, skip to the next set of instructions (steps 6A through 8A).

6. Set the duplex switch to FULL.
7. If the coupler has an Originate/Answer switch, set it to Originate.
8. Dial the computer's number and wait for the computer to answer with a high-pitched tone.
9. When you hear the tone, place the handset in the coupler, making sure the receiver and transmitter ends are placed in their proper places. If your modem does not have the receiver and transmitter ends marked, refer to the documentation accompanying the modem for further instructions.
10. If the modem has a carrier indicator light, it should come on, indicating an adequate connection. The program will indicate that the terminal/modem link is properly established by displaying:

```
Connection established
```

11. If the coupler has a line switch, set it to ON-LINE.

If you are using a data set/modem, which connects directly to the telephone network, follow this sequence of instructions:

6A. Press the talk button on the data set.

7A. Dial the computer's number and wait for a high-pitched tone.

8A. When you hear the tone, press the DATA button until the DATA light comes on.

After the modem handshake has been established, the Series 80 terminal is in communication with the host. Carefully follow instructions in the next subsection for logging on.

If a previously established modem handshake fails, the auto-disconnect feature of the serial interface causes the TERMEM program to halt and display the message:

```
MODEM CARRIER LOST
```

Handshake failure occurs when the Data Carrier Detect signal line or both the Clear to Send and Data Set Ready signal lines connecting the modem and terminal become low. If you are using an acoustic coupler, the modem handshake is also automatically disconnected if you hang up the phone or remove the handset from the coupler. When the error is generated with Restart ON, program execution is automatically resumed with the previous frame parameters. If the Restart option is OFF, the frame parameters return to their default values and may require resetting. The Restart key will save you some time by storing the parameters you have selected. This action will be discussed later, however, since it is not essential for establishing the data comm link.

Once a modem handshake has been established, you should not change the frame parameters (baud, bits, parity). If you find that you need to change any of these parameters, you will have to re-establish a modem handshake using the Modem and Resume keys.

Logging On

If you are using a hard-wired terminal port, which is a direct connection to the host computer, make sure the serial interface cable connector is plugged into the cable from the computer. If you are using a modem, you must establish a modem handshake before attempting to log on.

Most host computers require terminals to transmit a carriage return (CR) to initiate a data comm session. Pressing (END LINE) sends this character, which is called an output separator. The computer should respond with a prompt. When you receive the prompt, follow the log on procedure for your host system. Type in the necessary user ID and passwords and then press (END LINE) to transmit the output separator sequence.

Some hosts require a carriage return/line feed (CR-LF) sequence as the output separator. If your host requires this sequence, or any output separator other than a CR, you will have a change the output separator sequence using the Auto LF or Outsep special function key provided by the TERMEM program. If you are using a hard-wired connection to the host, the host may require that a DC1 or ACK character be sent prior to logging on.

If you are using a modem, you should keep in mind that some host computers are designed to terminate communications with your modem if you fail to log on in a certain amount of time. The program will inform you of the discontinued link by displaying:

```
MODEM CARRIER LOST
```

If this happens, it will be necessary for you to re-establish the modem handshake.

Once you have logged on through the Series 80 terminal, usually the host computer will automatically log the terminal off if the communications link is broken (for example, if you hang up the phone).

When your data communications session is completed, follow the host's log off procedure.

Halting the Program

Pressing (RESET) while the TERMEM program is running halts program execution and causes all parameters to assume the default values. The program must be configured again to run properly. The program is restarted using the (RUN) key.

Section 3

Operating Features of the Terminal Emulator

Introduction

The TERMEM program contains a number of features that allow you to adapt the running program to your data communication needs. Section 2 covered using special function keys assigned by the program to alter the serial interface. Those alterations were necessary to establish a common language between the terminal and host so that you could log on. This section will cover using other assigned special function keys to direct operation of your Series 80 terminal. It will also describe a number of specific changes in the keyboard when the computer is operating as a terminal.

The special function keys take on a number of different assignments through the TERMEM program, since the program provides for reassigning the keys and paging through the sets of key assignments. Refer to Special Function Keys in section 1 for instructions on paging through the key assignments.

The Terminal Keyboard

When the computer is operating as a terminal, characters typed into the keyboard are transmitted to the host in the form of 7-bit (excluding parity) ASCII code. However, the keyboard includes a number of keys that initiate a computer operation (for example, (RUN)). The HP-85 keyboard also includes several typing aids (for example, (STORE)). These keys either take on a different function while TERMEM is running, or they have no function at all.

The following keys are reassigned by the TERMEM program to perform new functions:

(RESET) — Pressing (RESET) first resets the serial interface and then halts program execution. The Series 80 computer once again functions as a desktop computer. However, the TERMEM program remains in computer memory and can be executed by pressing (RUN). (Keep in mind that you may need to re-enter your required framing parameters before performing any data communications operations.)

(BACK SPACE) — Pressing (BACK SPACE) sends the ASCII character BS, corresponding to `CHR$(8)`, to the host. The cursor moves back one space. (BACK SPACE) operates only if the host computer accepts the BS character.

(CLEAR) — Sends the ASCII FF (form-feed), coresponding to `CHR$(12)`, to the host.

(END LINE) — The (END LINE) key is used to transmit the current output separator sequence to the host.

(PAPER ADV)* — Used to print a blank line on the current system printer.

* HP-85 only.

The following keys have no function while the TERMEM program is running. Pressing any of these keys will cause the terminal to beep.

(A/G)†
(AUTO)*
(-LINE)
(-CHAR)
(CONT)
(DEL)*
(GRAPH)*
(INIT)
(INS RPL)*
(I/R)†
(k9)-(k14)†
(LIST)
(LOAD)*
(PAUSE)
(PLST)
(RESLT)
(RUN)
(SCRATCH)*
(STEP)
(STORE)*
(TEST)
(TR/NORM)†

(KEY LABEL), (ROLL), (REW)* and (COPY)* retain their normal functions.

The cursor control keys (except (BACK SPACE)) can be used during program editing but have no function when the terminal is communicating with the host.

All the other keys, when pressed, transmit the corresponding character to the host.

Controlling Program Operation

The special function keys used to edit the serial interface (Baud, Bits, Parity, Modem, SetFrame) were discussed in section 2. The remaining special function keys perform operations that can be grouped into the following categories:

- Sending control codes or signals to the host.
- Editing the TERMEM program, including designating a terminal printer.
- Configuration file keys.
- Initiating various mass storage operations.

The first three categories are covered in this section. Using the Series 80 terminal to perform mass storage operations is explained in section 4.

Transmitting Control Codes and Signals

The following special function keys are accessed by using the --cont-> or the SetFrame special function key to page through the sets of keys provided by the TERMEM program.

BREAK Key

Pressing this key transmits a BREAK to the host computer. The BREAK signal is used to interrupt the current operation of the host computer.

---

* HP-85 only.

† HP-86/87 only.

Pressing BREAK while the host is outputting a large data string may cause the input buffer to over-run, generating an error. During a mass storage operation, the BREAK may be interpreted as an end of transfer command.

ESC Key

The ESC key is used to transmit the ESC character (CHR$(27)) from the terminal to the host. The character is used in conjunction with other characters to send escape (instructional) sequences.

XOFF(DC3) Key

Pressing this key transmits a DC3 character (CHR$(19)) from the terminal to the host computer. This character, part of the DC1/DC3 handshake protocol, directs the host to halt data transmission until it receives a DC1 character from the terminal.

XON(DC1) Key

Pressing this key causes the DC1 character (CHR$(17)) to be transmitted from the terminal to the host computer. The DC1 character instructs the host to resume the data transmission halted by a previously transmitted DC3 character.

ENQ Key

Pressing this key causes the ENQuire character (CHR$(5)) to be transmitted to the host computer.

ACK Key

Pressing this key causes the ACKnowledge character (CHR$(6)) to be transmitted to the host computer. The ACK character signals the host to continue transmission when ENQ/ACK handshaking is implemented.

Control characters can also be sent by including the characters (generated on the display using the CTRL key with alphanumeric keys) in the data transmitted to the host. Refer to the table of character and key codes in your computer owner's documentation for necessary keystrokes.

Editing the Program for Host Compatibility

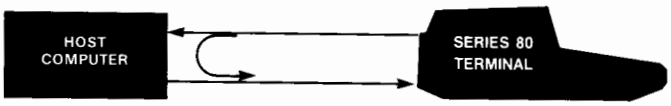
Four special function keys allow you to edit the TERMEM program to alter the operation of your terminal. These editing keys do not involve altering the form in which individual characters are transmitted and thus may be changed after you have logged on to the host.

Auto LF Key

The Auto LF key is used to change the output separator from its default value, a CR character (carriage return, CHR$(13)), to the CR-LF sequence (carriage return/line feed, CHR$(13)&CHR$(10)). The output separator character or character sequence is appended to the characters transmitted to the host when the END LINE key is pressed. Once the output separator sequence has been altered, it can be returned to its default value or changed using the Outsep special function key.

Echo Key

The Echo key switches the terminal between echo OFF and echo ON. The default value is echo OFF. When the key is pressed, the program changes the echo status and prints (or displays) the new echo status. If the host does not echo back characters sent to it, switching echo ON will cause the characters to be displayed after they have been sent. The echo should be off if the host echoes characters sent to it, as in the figure.



Host Echoes Characters

Outsep Key

The Outsep key can be used to change the characters sent from the terminal to the host as output separators. When Outsep is pressed, the program responds with the prompt:

```
Length of separator  0-18 chars?
```

Enter the number of characters (maximum of 18) to be included in the new output separator sequence. The program will request each character. Respond to the request(s) with the decimal equivalent of each character. Pressing (END LINE) without entering any separator length causes the original parameter to remain in effect.

Err Chk Key

This key switches between ON and OFF. The underline (HP-85) or inverse video (HP-86/87) feature caused by a parity error is active when this feature is ON and is suppressed when OFF.

Establishing a Terminal Printer

The TERMEM program allows you to establish a *terminal* printer. The terminal printer is used to produce a copy of terminal and host output. All other print output (e.g., program status) is directed to the *system* printer. The system printer is the printer specified by a PRINTER IS statement, or, if no system printer has been specified, the internal printer on the HP-85 or the CRT on the HP-86/87. If a system printer is to be specified using the PRINTER IS statement, the statement must be executed before the TERMEM program is run.

Local language characters, available on the HP-86B options 001 through 021, cannot be printed on the terminal printer.

PrintSC Key

The TERMEM program allows you to choose the select code or address of the printer to which terminal output is directed. When PrintSC is pressed, the program displays:

```
Printer Select Code?
```

If the printer you wish to assign as terminal printer is attached to the Series 80 terminal via a serial or parallel printer interface, enter the select code of the printer's interface. If the printer uses an HP-IB interface, you must enter the three-digit address of the printer, consisting of the select code and primary address. Refer to the HP-IB manual for additional information on device addresses.

The default printer address is 2 (HP-85 internal printer) or 1 (HP-86/87 display).

Printer Key

The Printer special function key allows you to choose whether or not data transmitted and received by the terminal is routed to a terminal printer. The key switches between printer ON and printer OFF. When the key is pressed, the TERMEM program changes the ON/OFF status of the terminal printer and prints the new status. If the terminal printer has been turned on, the program also prints the select code or address of the terminal printer.

If you have entered an invalid printer select code, when the program attempts to send data to the terminal printer, it will display: PRINTER ERROR! SET TO OFF, switch the printer function off, and continue to run.

> **Note:** A terminal printer should not be used with baud rates exceeding 2,400. Also, do not use a terminal printer when the Series 80 terminal is operating in None handshake mode.

Configuration File Keys

Three special function keys greatly simplify the operation of your data communications system. They involve storing the configuration parameters that you have selected either temporarily or permanently on the mass storage medium.

Restart Key

This key switches the restart feature OFF and ON and prints the new status. When Restart is enabled, the system automatically restarts the terminal emulator program and resets all the configuration parameters if the program was stopped due to loss of carrier detect or a mass storage error. The default is Restart ON. The stored configuration parameters are lost when the TERMEM program is scratched.

Save Config Key

This special function key allows you to permanently store the terminal configuration in a file on the mass storage medium. Pressing Save Config yields the prompt:

```
Create New Config File: Y/N?
```

Type YES (END LINE) and see:

```
New file name?
```

Enter a file name. The name may correspond to the time-sharing system for which the terminal is configured so that you will be able to easily recognize and recall it during future data communications operations. If you will be logging on to several hosts with different configurations, you can store each terminal configuration separately under an appropriate file name.

If you type NO after the first prompt, the system responds with:

```
Enter Config File Name?
```

You may now enter the name of an existing file, and that file will be overwritten with the new set of parameters.

In either of the above cases, when the file has been saved, the system printer will output:

```
Config Saved
```

Get Config Key

Before logging on, this key can be used if you have stored a terminal configuration using Save Config. To configure your terminal using a stored set of parameters, press Get Config and see:

```
Enter Config File Name?
```

Enter a previously stored file name; the system will load the parameters into the TERMEM program. The system printer will output the datacomm status. You must now press Resume to enter the terminal emulator mode.

Obtaining the Program Status

You can use the Status special function key at any time while the TERMEM program is running to obtain a list of the parameters you have set. The status listing is printed on the system printer. The following example illustrates a listing obtained after some program parameters were changed.

```
        DATACOMM STATUS

Serial Select Code.....10
Remote Console Mode....DISABLED
Printer.....ON
   Select Code.....801
Echo.....OFF
Restart Option.....OFF
Output Separator:
   Char# 1.....13
   Char# 2.....10
Transfer File Name.....TESTDATA
Config File Name.....DUMMY

Frame:
   Modem.....ON
   Handshake.....DC1/DC3
   Error Check.....ON
   Baud.....4800
   Data Bits.....7
   Stop Bits.....1
   Parity.....ODD
```

Transfer file name refers to the name assigned to the mass storage file used for uploading and downloading. Mass storage operations are discussed in section 4 of this manual.

Section 4

Mass Storage Operations

Introduction

The Data Communications Pac provides six special function keys for transferring ASCII data files between local mass storage (tape or disc) and the host computer.

- Fname allows you to establish a particular local file as the transfer file.
- Upload sends the transfer file to the host.
- Download transfers data from a host data file to the transfer file.
- End Xfer immediately halts a file transfer operation.
- Showfile displays the contents of the transfer file.
- Catalog yields a directory listing of your mass storage media.

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 pac mass storage operations allow you to transfer only ASCII data files. Program files, binary program files, and files of numerical data cannot be uploaded or downloaded without first being converted to character strings. Two statements for performing program file conversions are discussed later in this section.

During upload and download operations, transferred files are routed through the terminal's and host's input/output buffers. The transfer operation can use DC1/DC3 or ENQ/ACK handshaking to prevent loss of data from buffer overruns. Alternatively, None handshaking mode can be used.

Files containing local language characters cannot be uploaded and downloaded.

Establishing a Transfer File

Before any other mass storage operations can be performed, a transfer file must be designated and opened. The transfer file is the data file located on the local mass storage medium which is used for uploading or downloading operations. The Fname special function key allows you to establish a previously created local file as the transfer file or to create a new file on local mass storage to be used as the transfer file. The newly assigned transfer file is automatically opened. The default transfer file name is DUMMY.

To establish a transfer file, press Fname. The program returns the prompt:

```
Create a file: Y/N?
```

If you respond with YES, a new file will be created and designated the transfer file. If you respond with NO, a previously created file becomes the transfer file.

If you respond YES, the program first requests a file name. If you enter a name only, the file will be created on the default mass storage device. If you enter a file specifier, the file is created at the msus or volume label included in the file specifier.

Once you have entered the file name, the program requests a file size in physical (256-byte) records. When you have entered the number of physical records, the program creates the file and then displays:

```
File created
```

If for any reason the program has been unable to create the file, the program displays:

```
File not created
```

If the program is unsuccessful at creating the new file, you may wish to obtain a directory listing on the CRT using the Catalog key. Check the directory for a duplicate name and for sufficient space to create another file.

You should not create a file named DUMMY, as that name is used by the program to check for a valid transfer file name.

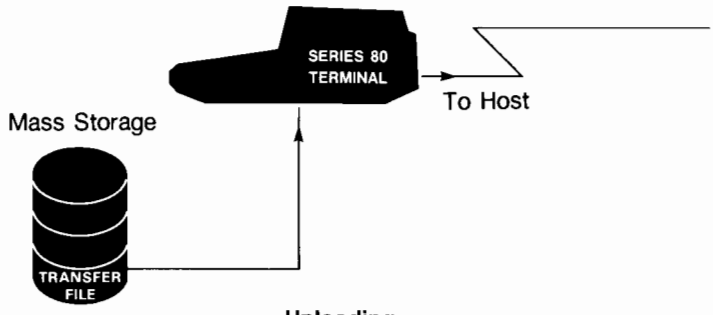
If you respond to the initial prompt with NO, the program will ask you to enter a file name. You must enter the name of a previously created file. The message File Open is displayed after the transfer file has been opened. If the specified file is not found, the program displays:

```
BAD FILE NAME
```

You may obtain the name of the current transfer file using the Status special function key.

Uploading

The Upload key is used to transfer the contents of the transfer file to the host computer. The uploading concept is illustrated in the following system diagram.



Uploading

During uploading, data is transferred one line at a time. Consequently, uploading is considerably slower than downloading. The transfer is terminated automatically when the local file's end-of-file marker is encountered.

Uploading With DC1/DC3 or No Handshaking

To upload a file in DC1/DC3 or None handshake modes, perform the following steps:

1. Press the Fname key. When the question Create a file: Y/N appears, type N and press (END LINE).
2. When the question: File Name? appears, enter the name of the data file to be uploaded. This establishes that file as the transfer file and opens it.
3. Log on to the host and prepare it to prompt for data. For example, the editor of the host 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 read, and each read must accept an amount of data corresponding to one line of the transfer file.
4. Press the Upload key. When the question: Does Your Host PROMPT:Y/N? appears, enter the appropriate response as described below.

If you type YES and press (END LINE), the uploading will start. If the program does not find a prompt or handshake character, the CRT will display:

```
No Prompt/Handshake Char
Does Your Host PROMPT:Y/N?
```

If you type NO and press (END LINE), the CRT will display:

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

You should enter the number of milliseconds that you want to the host to wait between each read. Typical values are 0 to 1200. If the wait time is too short, data will be lost. (Some experimentation may be necessary to determine the optimum time for a specific host computer.)

The uploading operation should then begin.

During uploading, the CRT will display:

```
UPLOAD IN PROGRESS
```

When the transfer file has been successfully sent, the CRT displays:

```
File transfer complete
```

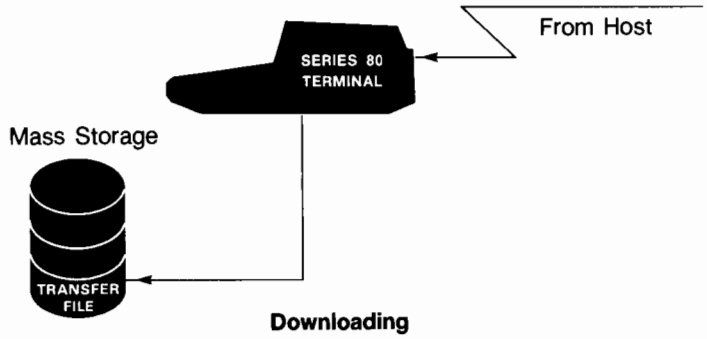
Uploading With ENQ/ACK Handshaking

To upload a file using ENQ/ACK handshake mode, follow steps 1, 2, and 3 for DC1/DC3 and no handshaking, described on page 35. Then, perform the following step 4:

4. Press the `Upload` key. The file transfer immediately begins, and the message `UPLOAD IN PROGRESS` is displayed. The entire contents of the file has been transferred when the message `File transfer complete` appears.

Downloading

The `Download` key is used to transfer ASCII characters from a host file to a local mass storage medium. The diagram below depicts the downloading operation.



Downloading

The downloaded data is directed to the current transfer file established and opened with the `Fname` key. When you are creating the local transfer file, 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 time the transmission of the file from the host to your terminal by listing it on the CRT. At a baud rate of 300, approximately 30 characters per second are transmitted from the host to the terminal. 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).

Downloading With DC1/DC3 Handshaking

To prevent data loss with DC1/DC3 handshaking, the downloading operation must be terminated when all data has been listed. Pressing End Xfer halts downloading, transfers characters in the transfer buffer to the destination transfer file, and then closes the file.

To download a file, perform the following steps:

1. Use the Fname key to open the transfer file in which the downloaded information will be stored. If the transfer file does not already exist, it may be created.
2. Type a command for the host to send data (for example, LIST or PRINT). Do not press (END LINE) yet.
3. Press the Download key. The TERMEM program will display Waiting for Download Data. Now press (END LINE) to execute the LIST or PRINT command from step 2.
4. When the downloading is complete, press the End Xfer key to terminate the data transfer. If you wish to terminate the downloading operation before all data has been transferred, perform the following steps:
   a. Use the XOFF(DC3) key to interrupt the data transfer.
   b. Press End Xfer to close the destination file. The program displays the message File transfer complete.
   c. Press the XON(DC1) key to complete the listing of the source file to the display. The lines listed after End Xfer was pressed are not downloaded to the transfer file.

Data transfer can be interrupted at any time by pressing the XOFF(DC3) key. To resume the transfer, press XON(DC1).

Downloading Using the ENQ/ACK Handshake

Steps 1 through 4 for downloading with DC1/DC3 handshaking also apply to ENQ/ACK handshaking. However, the following differences exist:

- The message DOWNLOAD IN PROGRESS is displayed during downloading. No listing of the data being downloaded appears on the display.
- The transfer can be terminated at any time by pressing End Xfer.
- The protocol assumes that each line of data is terminated by a carriage return/line feed sequence and that the host sends ENQ at the end of each line.
- The protocol requires that the host send XON (DC1) when the transfer is complete.
- It may not be possible to interrupt the transfer using the ENQ key.
- If the host sends any messages during the downloading operation, they will be embedded in the transfer file.

Downloading With No Handshake

Steps 1 through 4 for downloading with DC1/DC3 handshaking also apply to downloading in None handshake mode. However, the following differences exist:

- Downloading can be terminated by pressing `End Xfer`. The transfer terminates automatically if the data buffer becomes full.
- The amount of data that can be transferred depends on the size of the data buffer. Downloading terminates automatically when the buffer is full. The following table lists the approximate number of bytes that can be transferred, based on the amount of user memory (RAM) available at power-on.

Maximum Transfer File Size

Amount of Memory (Bytes)	Maximum Data Transfer (Bytes)
32K (HP-85)	1,500
64K (HP-86/87)	3,500
128K (HP-86/87)	12,250

Errors During Downloading

If an error occurs while data is being written into the file, the program displays the error message:

```
NO FILE TRANSFER
```

If `Program Input Buffer Over-run` is displayed, the carrier detect may be lost, necessitating your re-establishing the modem handshake and logging on.

`Error In File` is displayed if either the transfer file is too small or some other problem is encountered while the program is trying to write to the file. In this case the listing will continue on the CRT, but the transfer file will be closed and the downloading terminated.

One possible cause for a transfer error is that the host is transmitting data too rapidly for the TERMEM program to handle. Errors during downloading may also occur if the host does not implement the DC1/DC3 or ENQ/ACK handshake during download operations. In such cases, the source file should be kept smaller than the size shown in the table of Maximum Transfer File Size so that the buffer capacity is not exceeded during the download process.

Another reason for transfer errors is that the terminal emulator is set with the wrong handshake (that is, the host expects DC1/DC3 handshaking, but the program is sending ENQ/ACK, or vice versa).

Terminating a Data Transfer

The End Xfer key is used to terminate an upload or download operation. The key has different functions during uploading and downloading.

During uploading, pressing End Xfer immediately terminates the upload operation and closes the local file.

The End Xfer key must be used at the end of a download operation with DC1/DC3 handshaking to transfer the contents of the buffer to the local destination file and then close the file. A download operation can be terminated at any time by first interrupting the transfer using the XOFF(DC3) key and then pressing End Xfer.

During downloading in None handshaking mode, the End Xfer key must be used to terminate the transfer whenever the buffer has not been filled by the downloaded data.

You should be aware that under some circumstances it is possible for data loss to occur. If no handshake has been established with the host or if the host and terminal are handshaking in different modes, data loss will probably occur. 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. If End Xfer is pressed and no transfer is in progress, the message: No transfer is printed.

Reading the Transfer File

If the transfer file is a saved or downloaded program, you can view its contents at any time using the Showfile special function key. The file must first be opened using the Fname key. Then, pressing Showfile displays the contents of the file on the terminal CRT. If you have specified a terminal printer (using the Printer and PrintSC keys), the program will simultaneously produce a printed copy of the file contents. The program indicates the entire file has been written to the CRT by beeping.

Transferring Program Files

As mentioned in the introduction to this section, the Data Communications Pac allows you to upload and download ASCII data files only. You cannot use the pac's programs to transfer program files, since program files may contain characters used by the TERMEM program and host to control data flow.

The Data Communications Pac includes a binary program named GETSAV (GETSAV87 for the HP-86/87) that allows you to save and retrieve BASIC programs as ASCII character strings. The program is loaded into the computer by executing:

```
LOADBIN "GETSAV"
LOADBIN "GETSAV87"
```

Assumes you are using the default mass storage device.

Note: The GETSAV binary cannot be loaded into the HP-85 while the TERMEM program is halted, since there already is a binary (IPBIN) present in memory.

The binary program provides two statements, SAVE and GET, for handling BASIC programs as data files.

The SAVE statement has the form:

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

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. On the HP-85, binary program statements must be converted to comments by inserting the comment delimiter ! after the statement line number.

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 computer accesses the specified data file, expecting to find a succession of valid program lines in string form. The stored 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.

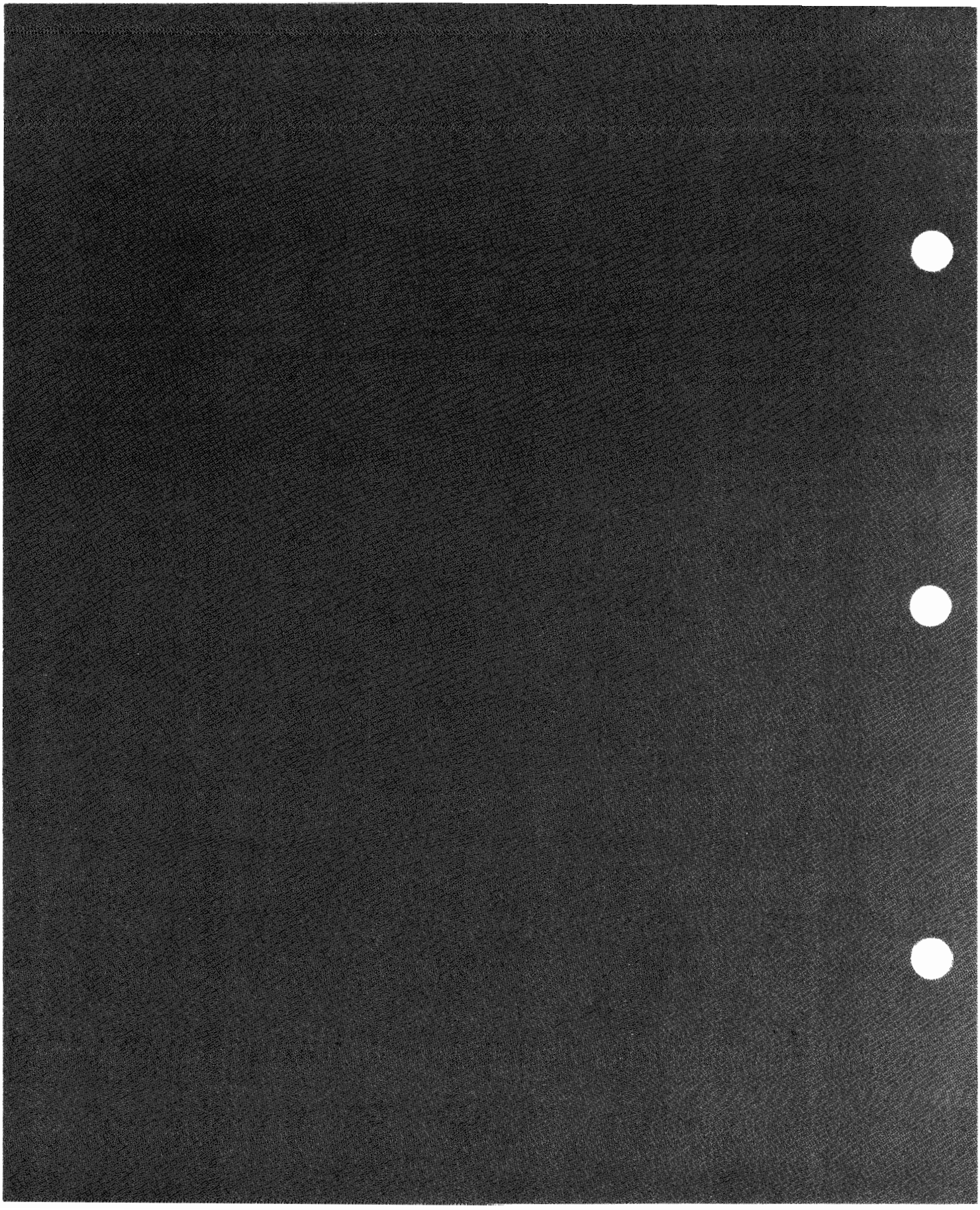
To SAVE a program file:

1. Clear computer memory by executing the SCRATCH command.
2. LOAD the program from mass storage or type it into memory. If the program contains binary program statements, LOADBIN the binary program. You may load up to four binary programs into the HP-86/87.
3. *(HP-85 only; skip this step for the HP-86/87.)* Convert program lines containing binary program statements to comments by inserting the comment delimiter ! after the line number. Store the edited program, SCRATCH program memory, and then load the edited program into the HP-85.
4. Type LOADBIN "GETSAV" and press (END LINE).
5. Type SAVE and your chosen file name in quotation marks, and press (END LINE).

Later, if you wish to upload the saved program, you must load and run the TERMEM program. The Fname key should be used to establish the saved program as the transfer file, and the uploading procedure described earlier should be followed.

To GET a downloaded or saved program:

1. Type `LOADBIN "GETSAV"` and press (END LINE). Normally you should scratch any other programs in memory.
2. *(HP-86/87 only; skip this step for the HP-85.)* `LOADBIN` any binary programs required by the BASIC program.
3. Type `GET` and the file name that contains the program to be restored in quotation marks, and press (END LINE). The program should now be in computer memory.
4. *(This step applies only to HP-85 programs containing statements using a binary program.)* Store the program and `SCRATCH` program memory. Reload the program. `LOADBIN` the binary program used by the BASIC program. Then, `LIST` the program and remove any comment delimiters inserted before binary program statements.

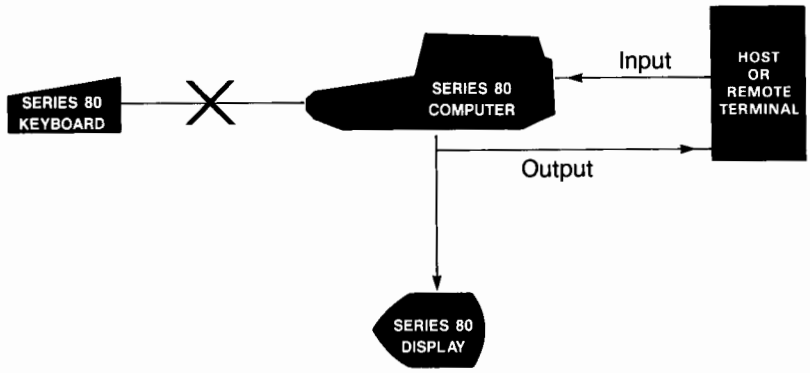


Section 5

Remote Console Operation

Introduction

Remote console mode allows you to control your Series 80 computer from a remote location. When the computer is operating in remote console mode, it is able to perform most of its desktop computer functions, except that the keyboard is no longer the computer's input device. Instead, the computer accepts incoming serial data transmitted from a remote location as though it were typed in at the keyboard, and the keyboard itself becomes completely inoperative. The link between the remote controller and the "slave" Series 80 computer is made possible by the IPBIN binary program.



Remote Console Mode

Entering Remote Console Mode

Remote console mode is enabled using the `RConsole` special function key. The key allows you to enable or disable remote console mode. Pressing the key first changes the remote control status (enabling or disabling) and then causes the system printer to output the new status.

Once remote console mode is enabled, the mode is entered from the remote location. It is essential that you make any necessary adjustments to program parameters (for example, baud, parity, and echo) before placing the computer in remote console mode since the keyboard, including the special function keys, will become inactive.

Remote console mode can implement either DC1/DC3 or no handshaking. The TERMEM program needs to be configured accordingly, and the controlling device must be compatible with that handshake mode to avoid data loss. The controlling device should also send a line feed (`CHR$(10)`) as part of its output separator. (Setting the data terminal for auto-line feed accomplishes this.) The HP Series 80 Computer does not echo characters back to the remote location, so the echo must be set at the data terminal to view character input.

To enter remote console mode with a data terminal as the remote controller, perform the following steps on the Series 80 computer:

1. Adjust the framing parameters (baud, bits, and parity) to the desired values.
2. Use the H/shake key to select DC1/DC3 or no handshaking.
3. Press the XON(DC1) key to send a DC1 character to the data terminal.
4. Press the RConsole key to place the computer in remote console mode. The system printer will output: Remote Console Mode.....ENABLED.

Now reset the data terminal and configure it to match the framing parameters that you set on the computer. Also turn on local character echo and set the end-of-line sequence to auto-line feed.

Press ESC+c to link the terminal with the computer. The system printer will output: Entering Remote Console Mode!.

Developing and Editing Programs

You may use remote console mode to develop and edit programs for the computer from a remote terminal. BASIC statements typed into the terminal will be entered into program memory as if you were working at the computer keyboard.

Before keying in a program, you should execute:

```
DELETE 1,9999
```

to delete the entire TERMEM program from program memory.

A previously stored program can be loaded into the computer using the CHAIN command. The CHAIN command is particularly powerful in remote console mode because it loads and runs a stored BASIC program in computer memory after scratching the current BASIC program without affecting the binary program. Thus, IPBIN, which is responsible for continued remote console operation, is preserved during CHAIN operations.

The automatic-run feature of the CHAIN command need not prevent you from editing the stored program before it is run. If the program contains a PAUSE statement, program execution will halt until continued by transmitting CONT (continue) from the remote location. Alternatively, the PAUSE statement can be removed, and the program initialized (using the INIT command) and run (by using the RUN command).

Note: Executing a LOAD command while in remote console mode will scratch the IPBIN binary program, causing the computer to leave remote console mode. Attempting to execute a LOADBIN command on the HP-85 will generate an error, since two binary programs cannot be present in HP-85 computer memory at the same time.

To halt a listing, type (CONTROL) (S); to resume the listing, type (CONTROL) (Q).

A program entered into computer memory can be stored in program form (as opposed to character strings) using the STORE command. However, if the controlling device uses a different form of BASIC than the Series 80 computer, some statements may not be interpreted properly and syntax errors will result.

Executing Programs

Typing RUN and (CR) from the remote location will begin execution of the BASIC program currently in computer memory. On the HP-85, you must be certain the program to be executed does not contain a LOADBIN statement that would attempt to load a second binary program into the computer, generating an error.

If the program you wish to run is in mass storage, executing a CHAIN command will load the program into the computer and immediately start program execution.

The remote console mode allows you to perform a system reset of the computer by sending a BREAK from the remote location. The reset is necessary if a running program develops a system or input/output malfunction. The BREAK resets all interface cards except the serial interface used as the remote console link. After a reset, use CRT IS and the serial interface select code to direct the CRT listing to the remote location. Reset can only be used once in a remote console session. If a second reset is required, the TERMEM program must be run again.

If a running program contains a PAUSE statement, program execution will halt until you transmit CONT from the remote location. A running program may also be paused from the computer keyboard. However, the CONT key remains inactive, and the program must be continued from the remote location.

Your running program can utilize the computer's *graph* mode. The computer will enter *graph* mode and plot data, and then will return automatically to *alpha* mode. Since you cannot enter *graph* mode from the remote location, you should make provisions in the program for plotting or printing the graphics display, or for storing the graphics display on disc (possible on the HP-85 only with a Mass Storage ROM). You cannot use the HP-86/87 *graph-all* mode while the computer is in remote console mode.

Remote Data Transfer

Remote console mode allows you to use the mass storage capabilities of the computer to access data files. You can input statements into the computer from the remote location to:

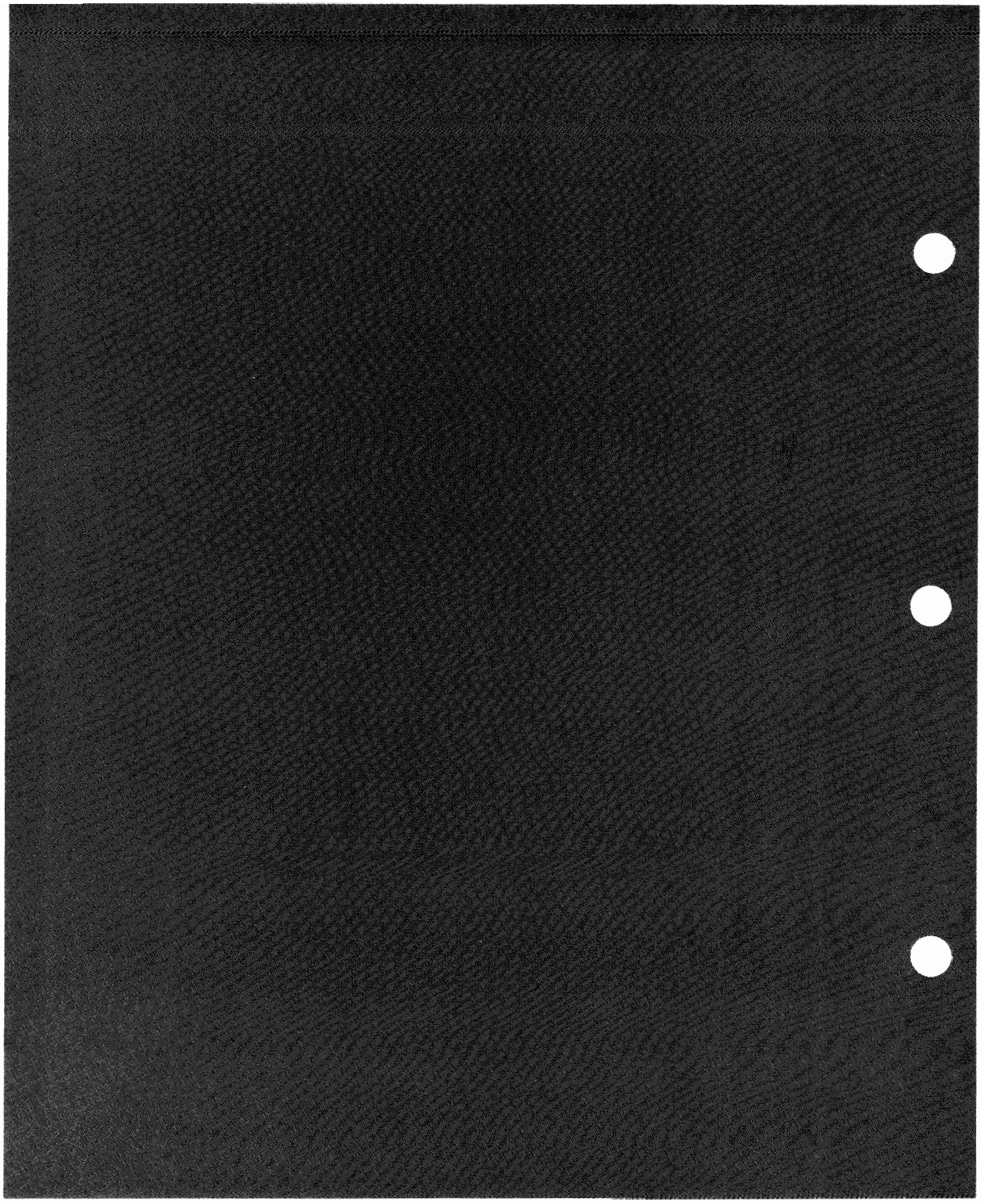
- Create data files.
- Open and close data files using the ASSIGN# statement.
- Serially or randomly read from and print to data files.

An important feature of remote console mode is that data files need not be in the form of ASCII character strings. Numerical data can be printed to and read from files using serial or random READ# and PRINT# statements.

Exiting Remote Console Mode

Send KEYBOARD IS 1 to exit remote console mode and return the system to terminal mode.

Notes



Section 6

Troubleshooting

The following table provides a number of suggestions for remedying improper operation of the Series 80 terminal. The list of possible problems and their solutions is by no means complete. Frequently, there are several possible causes of a particular terminal malfunction.

Message/Condition	Cause	Correcting Action
Host not receiving data.	Modem handshake off.	Establish a modem handshake.
	Baud rate incorrect.	Set correct baud rate.
	Output separator sequence incorrect.	Set correct output separator sequence.
CRT displays gibberish	Host is sending 7 character bits plus 1 parity bit while terminal is set for 8 character bits.	Change the number of character bits and the parity via interface edit mode.
Data characters are underscored (HP-85) or highlighted (HP-86/87).	One or more framing parameters are incorrect.	Change the number of character and/or stop bits, change baud rate, and/or parity via interface edit mode.
Host fails to recognize input after changing parameters.	You failed to sign off before changing parameters.	Reset old parameters and sign off.
MODEM CARRIER LOST	Communications link has been broken.	Re-establish modem handshake and activate Restart.
Double characters displayed on CRT.	Host automatically echoes data.	Switch Echo to OFF.
Typed characters not displayed on terminal screen.	Host does not echo data.	Switch Echo to ON.
During downloading the listing does not resume after the file access is completed.	Host fails to recognize DC1 characters.	If you are certain the host implements DC1/DC3 handshaking, use the XON(DC1) key to send further DC1 characters to the host. Decrease baud rate. Limit file to maximum transfer file file size (refer to page 38).

Message/Condition	Cause	Correcting Action
PROGRAM VARIABLE OVERFLOW (data lost).	Intermediate program variable has overflowed. Program cannot process input data fast enough. Host does not use handshake.	Decrease baud rate or have host perform a slowing task.
NO FILE TRANSFER! Program Input Buffer Over-run (data lost). Data comm link broken.	Program input buffer used for downloading has been over-run. Host does not use handshaking during downloading.	Re-establish modem handshake. Decrease baud rate. Limit file to maximum transfer file size (refer to page 38).
INPUT BUFFER OVER-RUN! DATA LOST! Data comm link broken.	Interface receiver buffer is over-run. Host does not use handshaking.	Re-establish modem handshake. Decrease baud rate.

Notes

Appendix A

Program Documentation

Introduction

If you wish to obtain a program listing, you must press (LIST) or (PLST) after both the TERMEM program and its supporting binary program, IPBIN, are present in memory. You cannot obtain a program listing while the programs are running. Pressing the (LIST) key while the program is active will cause the Series 80 terminal to beep and otherwise ignore the command.

There are two ways to obtain a program listing. While the TERMEM program is running, press (RESET) and then press (LIST) or (PLST). Or, you can load the TERMEM program, and then manually load the IPBIN program by executing the appropriate statement:

```
LOADBIN "IPBIN"
LOADBIN "IPBIN87"
```

Assumes the mass storage medium (tape or disc) is at the default mass storage location.

Once the binary program has been loaded, use (LIST) or (PLST) to obtain the listing of the BASIC program. You cannot obtain a listing of the binary program.

Display Cursor Control

The following BASIC statements and functions in the TERMEM program call upon binary routines in the IPBIN program to provide cursor control while the computer is functioning as a terminal. To understand how they work, you must first have some knowledge of the design of CRT memory.

The HP-85 CRT can display 512 characters at a time (32 characters × 16 lines = 512). The CRT memory is able to store 2,048 characters, corresponding to four display screens or 64 lines (64 lines × 32 characters = 2,048). The HP-86/87 CRT can display 1,280 characters with `PAGESIZE 16` (16 lines × 80 characters) and 1,920 characters with `PAGESIZE 24` (24 lines × 80 characters). CRT memory can hold up to 4,300 characters in *alpha* mode or 16,320 characters in *alpha-all* mode.

Since only a portion of the CRT memory can be displayed at any one time, the CRT has a display window that can be moved through the CRT memory. The position of the window is completely independent of the position of characters in the CRT memory.

CCURSOR *numeric expression*

The CCURSOR statement establishes the position where the next character will be placed and turns off the old cursor wherever it was. The current display window is unaffected. The numeric expression can range 0 through 2047. Display memory can be considered as 2048 characters with wrap around.

CLINE *numeric expression*

The CLINE statement establishes where the CRT display window starts within the CRT display memory. Automatic wrap-around is provided when the window is positioned toward the end of display memory.

The numeric expression can be in the range:

0 through 63	HP-85
0 through 53	HP-86/87 using *alpha* mode.
0 through 203	HP-86/87 using *alpha-all* mode.

CCPOS

CCPOS is a function that returns a numeric value indicating the current cursor position in display memory. Values can range:

0 through 2,047	HP-85
0 through 4,319	HP-86/87 using *alpha* mode.
0 through 16,309	HP-86/87 using *alpha-all* mode.

CLPOS

The CLPOS function returns a numeric value indicating the line position of the current display window in the CRT memory.

CCHR$ (*character position*, *number of characters*)

The CCHR$ function returns a string of characters present in CRT memory, starting at the specified character position. The length of the returned string equals *number of characters*. The maximum value of either statement

parameter is equivalent to the maximum number of characters that can be stored in CRT memory. The function is independent of current cursor position.

```
CDISP string variable
```

The CDISP statement places the specified string variable in CRT memory starting at the current cursor position. Cursor position is updated by removing the current cursor from the screen before the string is placed in CRT memory, and then replacing the cursor after the last string character. The statement provides for moving the display window through CRT memory if characters are written below the current window. If the string contains control characters NUL, BEL, BS, LF, FF, or CR, those characters are interpreted.

```
CWRITE string variable
```

The CWRITE statement places the specified string variable in CRT memory starting at the current cursor position, which is updated. CWRITE differs from CDISP in that characters are placed into CRT memory without interpretation and that the display window is unaffected.

```
LINPUT [prompt string expression ,] string variable
```

This statement allows any combination of characters (maximum of 95) to be input from the keyboard and assigned to a string or substring. The optional prompt string expression will appear on the display screen whenever the LINPUT statement occurs during program execution. The default prompt is ? (a question mark).

Keyboard Control

The following BASIC statements and functions use binary routines in the IPBIN program to implement keyboard control of the terminal.

```
ON KBD GOTO / GOSUB statement number
```

The ON KBD statement enables end-of-line branching when keys are pressed on the keyboard. The first keystroke causes an end-of-line branch to the specified line number and no further end-of-line branches will occur until another ON KBD statement is executed. Execution of an ON KBD statement overrides any previous ON KBD and also overrides any other keyboard control statements (for example, ON KEY#).

The keystroke initiating the end-of-line branch and any additional keystrokes are stored in a buffer and can be accessed by the program.

If program execution halts for any reason, the system regains control of the keyboard.

```
OFF KBD
```

The OFF KBD statement cancels the end-of-line branches due to keystrokes. Keyboard control is returned to the main system.

```
KBD$
```

The KBD$ function returns the contents of the buffer created by the ON KBD statement. The buffer is emptied when KBD$ is executed.

Two CONVERT KEYBOARD statements provide for converting characters received from the keyboard using the KBD$ function:

```
CONVERT KEYBOARD PAIRS string variable
```

The CONVERT KEYBOARD PAIRS statement interprets the string variable as pairs of characters. The first chracter of each pair is the character received from the keyboard. Typing this character causes the second character of each pair to be placed into the keyboard buffer.

```
CONVERT KEYBOARD INDEX string variable
```

The CONVERT KEYBOARD INDEX statement uses the character received from the keyboard as an index into the string variable. For instance, typing the character A (decimal code 65) causes the 66th character in the string variable to be placed into the keyboard buffer.

Notes

Appendix B

Glossary of Data Communications Terms

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 to signal 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 characters—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 the computer with which the terminal is communicating.

Mainframe—This term is often used to refer to a large computer system to which a number of 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.

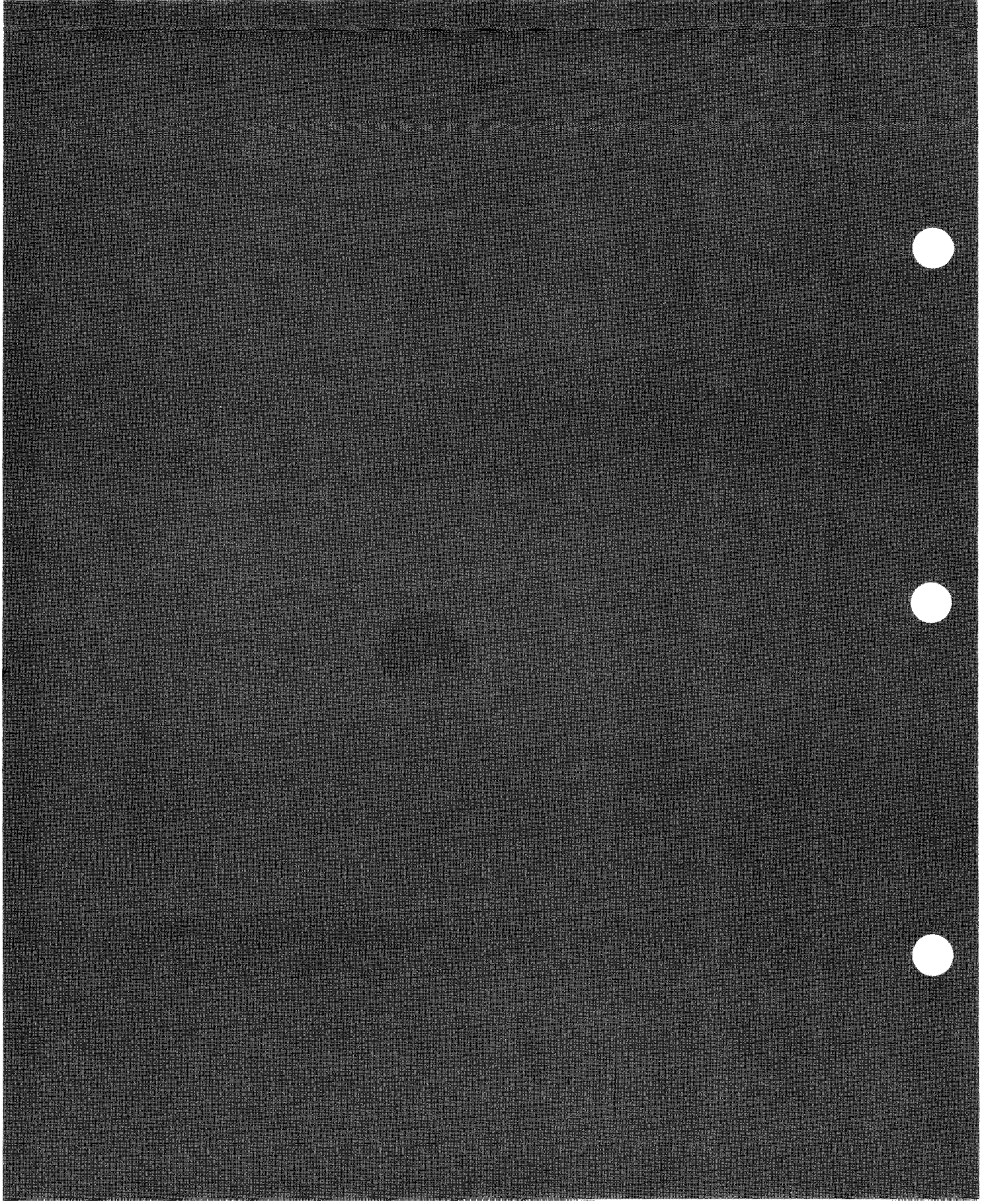
Simplex—Pertains to a communications link in which data can be transmitted in one direction only.

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.

Notes



Appendix C

Time-sharing Checklist

Use this page to maintain a record of the requirements of the host computer with which the Series 80 terminal will be communicating.

Host _____

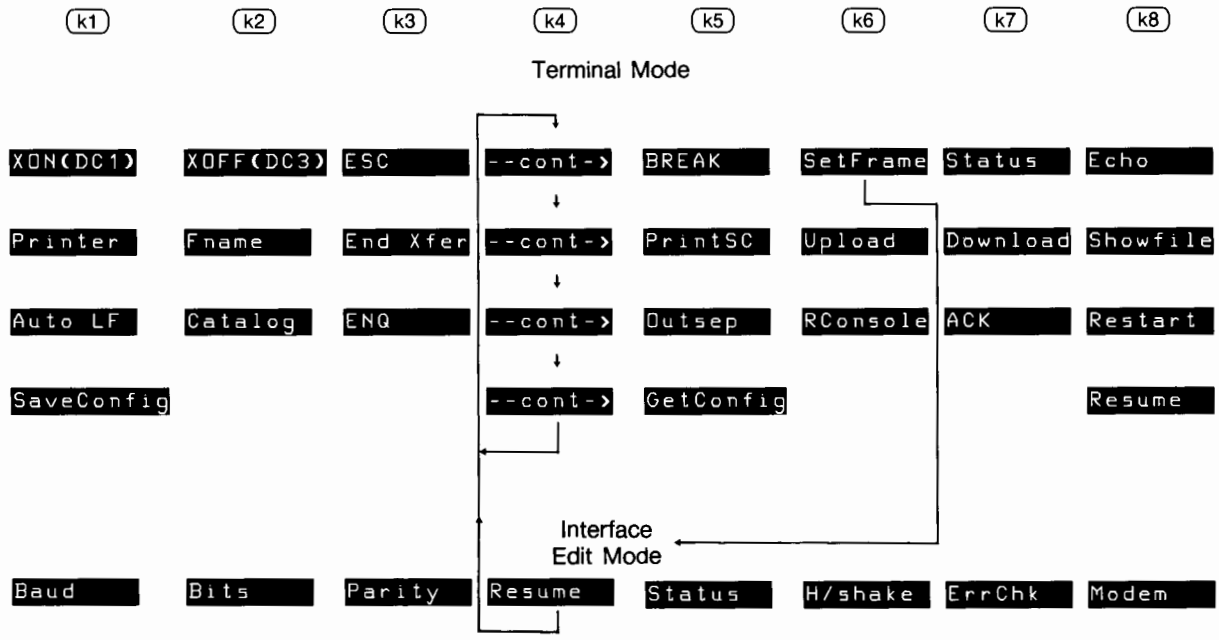
Type of data transmission	serial and asynchronous
Line type	full duplex
Handshake (default is none)	_____
Baud rate (default is 300)	_____
Parity requirements (default is odd)	_____
Number of data bits (default is 7)	_____
Number of stop bits (default is 1)	_____
Modem or hard-wired connection (default is modem OFF)	_____
Output separator sequence sent to the host at the end of each line (default is CR)	_____
Character echo (default is echo OFF)	_____

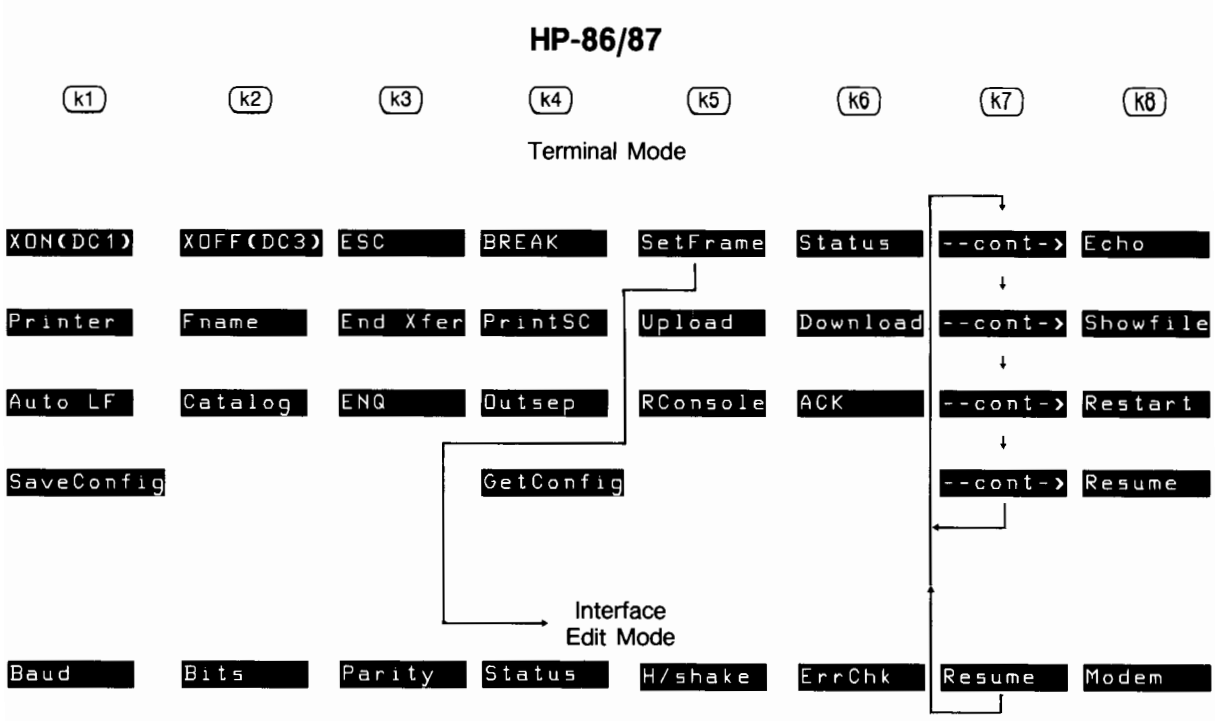
Appendix D

Special Function Keys

This appendix contains a listing of the special function keys available in both the terminal mode and the edit mode. The structure of the entire command tree is presented first; each *page* or level is then discussed individually.

HP-85





Terminal Mode

1st Level

Command	Section	Function
Break	3	Sends a break to the host causing an interrupt in current operations.
--cont->	1	Selects the 2nd level of special function keys in the terminal mode.
Echo	3	Switches the echo function. When it is off, the host is expected to display the transmitted data on the screeen by transmitting it back.
ESC	3	Sends CHR$(27) to the host as part of an instruction sequence.
SetFrame	2	Enters the edit mode and displays the corresponding labels.
Status	2	Prints the current status of various operational parameters.
XOFF(DC3)	3	Sends CHR$(19) to the host to halt transmission.
XON(DC1)	3	Sends CHR$(17) to the host to request resumption of transmission that was previously halted with XOFF(DC3) key.

2nd Level

Command	Section	Function
--cont->	1	Selects the 3rd level of special function keys in terminal mode.
Download	4	Writes incoming data to the transfer file.
End Xfer	4	Terminates uploading or downloading with DC1/DC3 handshaking.
Fname	4	Specifies the transfer file for mass storage operations.
Printer	3	Switches the selected printing device on/off.
PrintSC	3	Permits designation of a terminal printer and causes characters normally displayed on the CRT to be output to this device.
Showfile	4	Causes the transfer file to be displayed locally on the CRT and/or a printer.

3rd Level

Command	Section	Function
ACK	3	When ENQ/ACK handshaking is implemented, sends CHR$(6) to the host.
Auto LF	3	Changes the output separator to CR-LF sequence (carriage return/line feed).
Catalog	4	Lists the mass storage directory on the CRT.
--cont->	1	Selects 4th level of spcial function keys in the terminal mode.
ENQ	3	When ENQ/ACK handshaking is implemented, sends CHR$(5) to the host.
Outsep	3	Used to change the output separator characters sent from terminal to host.
RConsole	5	Enables and disables remote console mode.
Restart	3	Switches the restart option, which automatically restarts the terminal emulator program and resets the configuration parameters if the program was stopped due to loss of carrier or mass storage error.

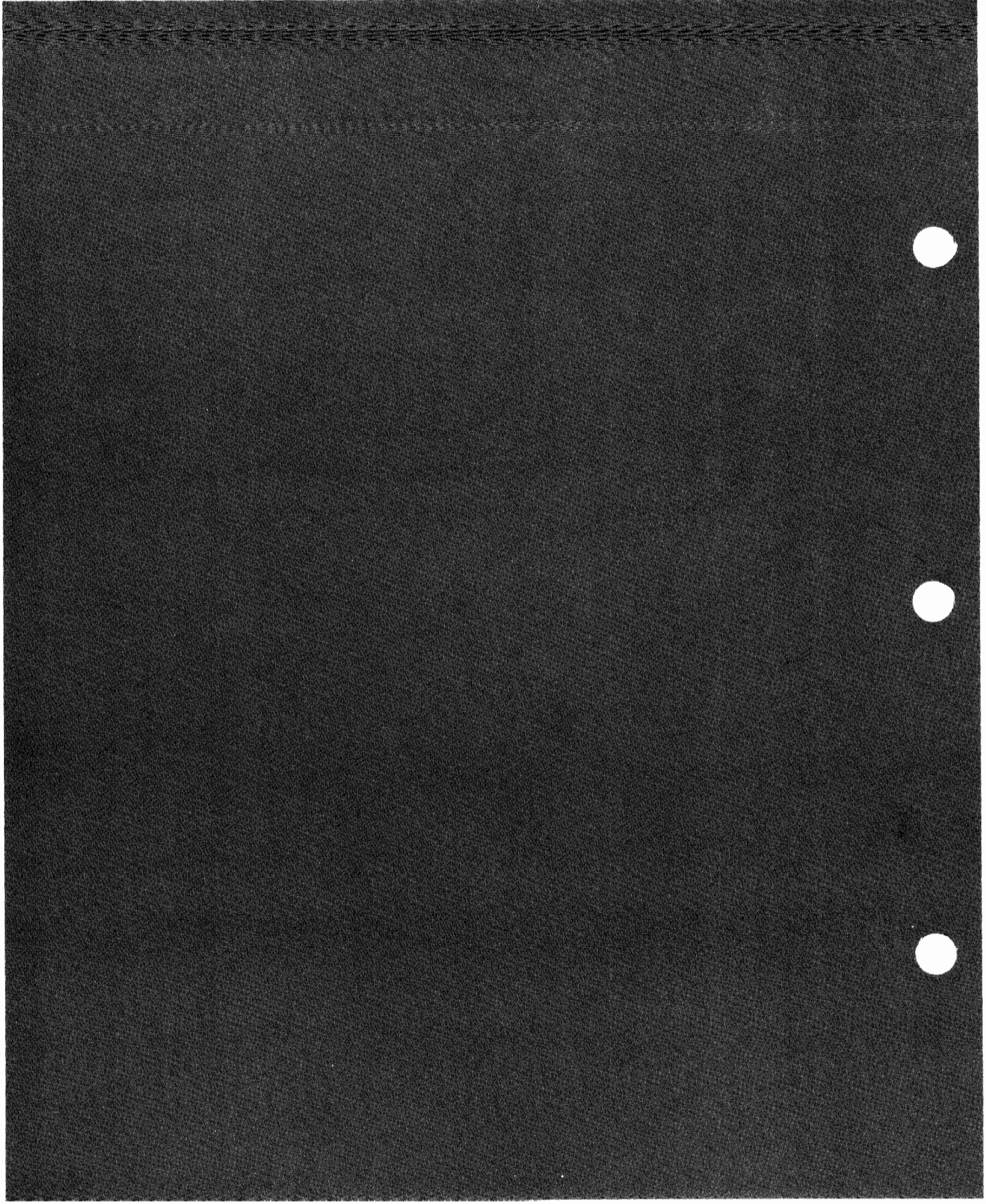
4th Level

Command	Section	Function
--cont->	1	Selects 1st level of special function keys in terminal mode.
Get Config	3	Retrieves parameters previously stored with SaveConfig into the program and serial interface.
Resume	2	Causes the program to resume terminal emulation.
SaveConfig	3	Permits permanent storage of the terminal configuration in a file on the mass storage device.

Edit Mode

Command	Section	Function
Baud	2	Prompts for a new rate of data exchange. Any standard value between 50 and 9,600 is permissible.
Bits	2	Prompts for the number of bits per character (excluding parity) and the number of stop bits.
Err Chk	3	Switches the underline (HP-85) or highlight (HP-86/87) feature caused by a parity error on and off.
H/shake	2	Switches between DC1/DC3, ENQ/ACK, and no handshaking.
Modem	2	Switches the modem handshake on and off.
Parity	2	Prompts for parity selection.
Resume	2	Resumes terminal emulation.
Status	2	Lists the status of relevant data communications parameters on the system printer.

Notes



Application Note

The following log on procedures are examples to assist you in getting your data communcations system operating quickly. Although specific procedures may change from time to time, the principles involved are similar for most systems.

Logging On to The Source[SM] via TELENET

To log on the The Source[SM] you should have:

- Source ID Number—TCD123 *(example).*
- Personal Password—HIDE *(example).*
- TELENET Host Address—C 30147 *(example).*
- TELENET telephone access number—(503) 295-3000 *(example)*

Now follow these steps carefully:

1. LOAD "TERMEM" and press (RUN).
2. When the key labels appear, press SetFrame.
3. When the edit mode key labels are displayed, press Modem.
4. Press Resume and see:

```
Awaiting modem carrier detect ...
```

5. Now dial your TELENET telephone access number and place the handset in the acoustic coupler, or if you have a data set/modem, switch from voice to data mode after the high-pitched tone is received.

   The CRT should now display:

```
Connection established
```

* The Source is a service mark of Source Telecomputing Corporation, a subsidiary of The Reader's Digest Association, Inc.

6. Now press (END LINE) twice. When the screen displays:

   ```
   TELENET
   XXX XX
   TERMINAL =
   ```

   press (END LINE) once more, and the terminal will respond:

   ```
   @
   ```

7. Type your host address exactly as it was given to you.

   ```
   C 30147 (example)
   ```

8. The terminal will respond with a message followed by:

   ```
   PLEASE SIGN ON
   >
   ```

9. Type your personal ID account number and password and press (END LINE).

   ```
   ID TCD123 HIDE (END LINE) (example)
   ```

10. You should now be logged on the The Source[SM].

Logging On to Dow Jones[TM]

The procedure for logging on to Dow Jones NEWS/RETRIEVAL® service is similar to that for The Source[SM]. The telephone access number will probably be the same. However, you will need the proper host address and password. Perform steps 1 through 6 above and then use the following procedure:

7. After the @ appears, type the host address:

   ```
   C 60942 (example)
   ```

8. When "WHAT SERVICE PLEASE" appears, type:

   ```
   DJNS
   ```

9. After "ENTER PASSWORD" type your password, e.g.:

   ```
   NOAHSARK
   ```

Dow Jones is a trademark of Dow Jones and Company, Inc.

Dow Jones NEWS/RETRIEVAL is a registered trademark of Dow Jones and Company, Inc.

10. If you have logged on correctly, the screen should display ENTER QUERY.

    Type:

    ```
    ,1HWP
    ```

    You should receive the stock quote for Hewlett-Packard Co. on the New York Stock Exchange.

To log off from any host, follow the specific procedures required by that host or simply hang up the telephone set.

Logging On to an HP-3000 Computer

To log on to an HP-3000:

1. Load the TERMEM (or TERMEM87) program and press (RUN).
2. Set the frame parameters for the connection you will be using. Select the XON/XOFF (DC1/DC3) handshake.
3. Establish a hardwired connection or a modem handshake.
4. When the connection is established, type:

   (CTRL) (Q) (END LINE)
   (CTRL) (F)

The HP-3000 should return the colon (:) prompt.

5. Log on with your normal log-on sequence. Specify terminal option 18. For example, respond to the prompt with:

   ```
   :HELLO USER,NAME.DEPT;TERM=18.
   ```

This establishes an XON/XOFF handshake between the Series 80 terminal and the HP-3000.

6. Proceed with a normal session.

Logging On to an HP-1000

To log on to an HP-1000:

1. Ensure that your system meets the hardware and software requirements described on page 17. This configuration is necessary in order to perform file transfer operations. If necessary, consult your system manager.
2. Load the TERMEM (TERMEM87) program and press (RUN).
3. Establish the frame parameters for the connection you will be using. Select the ENQ/ACK handshake.
4. Establish a hardwired connection or a modem handshake.
5. Log on and proceed with a normal session.