RAMPEY

BASIC Operating Manual

for the HP 9826 Computer
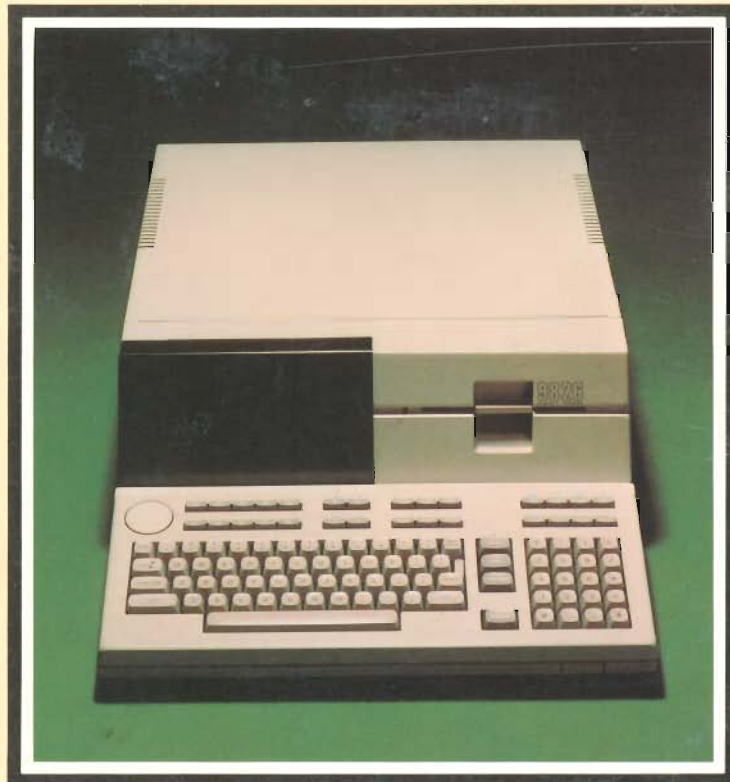
HEWLETT PACKARD

HP Computer Museum
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BASIC Operating Manual
for the
HP 9826 Computer

Manual Part No. 09826-90000
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Start Here

This manual shows how to install, test and operate your new HP 9826 Computer.

Printing History

Each new edition of this manual will incorporate all changes since the previous edition. Change sheets may be issued between editions to correct or add information. The manual printing date and part number indicate the current edition. The printing date changes with each new edition. (Minor corrections incorporated at reprint do not cause a new edition.) The manual part number changes when extensive technical changes are made.

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Chapter 1

Computer Installation

Introduction

Your HP 9826 Computer is both an extremely flexible system controller and an easy-to-use computational machine. Ease-of-use means you can automatically load and start running applications programs by merely pressing the power switch. Flexibility means the system designer can load one of many language systems, connect a wide variety of computer peripherals and measurement devices, and develop programs to control the entire system.

This manual first shows you how to properly set-up the computer, including power requirements, adding optional memory, loading the BASIC language system, and connecting interface cards. Chapters 2 thru 4 help you get acquainted with the computer's BASIC operator interface: the keyboard, the display and operator commands. Since we're all human and occasionally make a mistake, you may want to review chapter 5, In Case of Trouble, before going on to run applications programs or developing your own.

Language Systems

Just as we have a common set of words, or vocabulary, for communicating with one another, the computer has a set of words it recognizes and acts on to perform your operating and programmed tasks. Operating tasks include keyboard, display and disc drive controls. Programmed tasks include input/output operations, decision making and program debugging. The computer's set of words is called its language system. This manual describes operating your computer with the BASIC language system. BASIC is just that: an easy to learn, yet powerful language for both the keyboard and programming operations.

As with other programming languages, the BASIC language system assigns a unique "keyword" from its vocabulary to each computer instruction or task. For example, to start running a program in BASIC, you can either press the **RUN** key or type-in and **EXECUTE** the RUN keyword (by pressing the **EXECUTE** key). To list the files on a disc, just **EXECUTE** the CAT keyword. The language system interprets each key pressed or keyword executed and performs a complex set of internal instructions to accomplish the task.

Although BASIC is the computer's primary language, the computer is also available with HPL. This High Powered Language is custom designed for both instrumentation control and fast computation. Programs developed in HPL on the HP 9825 Desktop Computer are fully compatible with HP 9826 HPL.

The HPL system not only provides an alternative to the BASIC language, it also offers keyboard operating features not found with BASIC. If HPL is available with your computer, refer to the 9826 HPL Update Manual for more details.

As explained in the next section, you select and load the appropriate language system as the computer is powered up.

Soft-loaded vs Built-in Language Systems

The computer can be configured to automatically load a language system from a disc when you switch the computer on. Alternately, the language system can be built-in using read-only memory (called ROM). ROM technology allows HP to permanently store thousands of programmed instructions into a single integrated circuit. Regardless of whether BASIC is soft-loaded or built-in, it's the same language once loaded.

The soft-loaded system allows a programmer to load one of many languages from a disc into the computer memory. This allows the programmer the flexibility to select the programming language and associated keyboard operating system best suited to his or her needs.

The built-in (ROM) language system is just that, always available immediately after power-up or system reset. There are no delays or extra steps to ready the system. The ROM-based system is the most convenient choice for simply running applications programs. For maximum flexibility, more than one built-in language system can be installed at the same time.

Knowing whether your computer has a soft-loaded or built-in language system is important. If your computer is soft-loaded (the system is loaded from disc at power-up), you need to insert the system disc before switching the computer on. On rare occasions, an error message may require you to reload the system from disc again. If your computer has more than one built-in language system, you need to choose the language system during power-up. Be sure to follow the correct power-up procedure later in this chapter.

IMPORTANT

If you have a soft-loaded system, be sure to produce a backup copy of the system disc right after switching the computer on. Refer to Copying Discs in chapter 3 for more information.

Unpacking the Computer

Your HP computer was thoroughly tested and inspected before being shipped to you. All equipment should be in good working order. After removing the computer from its carton, carefully check it and the accessories for any damage caused by transit. You should also check the accessories against the packing list supplied. Notify your HP sales office if any damage is found. Also file a claim with the carrier. If any items are missing, use the reply card supplied to order the item(s) directly from the factory. HP sales office locations are listed at the back of this manual.

Now you're ready to install the computer.

Installation Procedure

Please follow this procedure to install and power-up your computer for the first time. If the computer doesn't power-up as expected, refer to the Computer Testing section in chapter 5.

1. Position the Computer .

Place the computer on any convenient work surface. Be sure to leave about 50 mm (two inches) free on each side for air flow through the computer. Do not operate the computer in an area with excessive dust or airborne particulates (smoke).
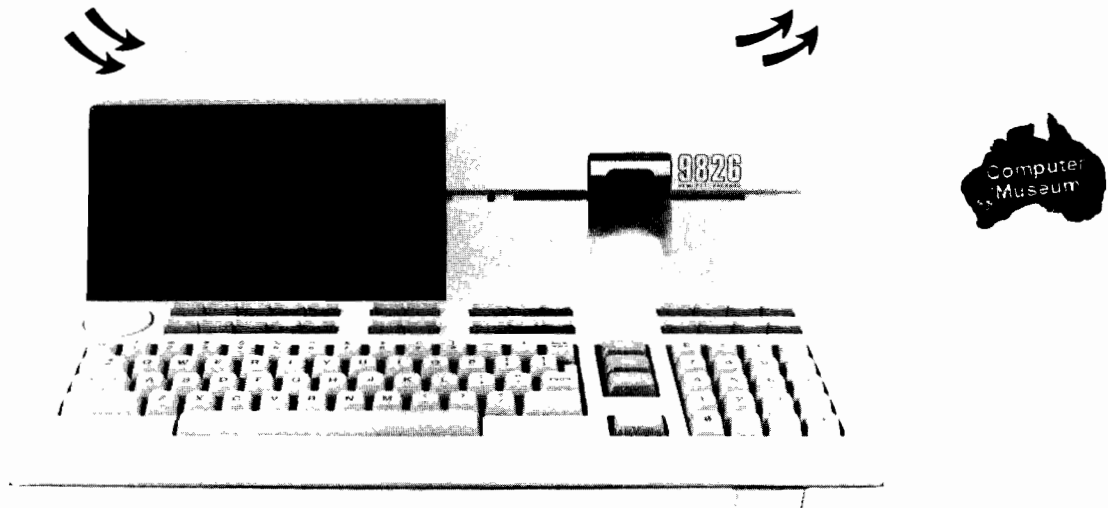
Position the Computer to Allow Free Air Flow

2. Check the Line-voltage Switches

CAUTION

The computer can be damaged if set for 100 Vac or 120 Vac and a higher voltage is applied. Check the line voltage switches before applying power.

The computer can be set to operate on one of four nominal line voltages: 100 Vac, 120 Vac, 220 Vac or 240 Vac. The switches on the back of the computer were set to the line voltage in your area when the computer was shipped from the factory. Check the switch settings to ensure they are set correctly:

| 100 Vac | 120 Vac | 220 Vac | 240 Vac |
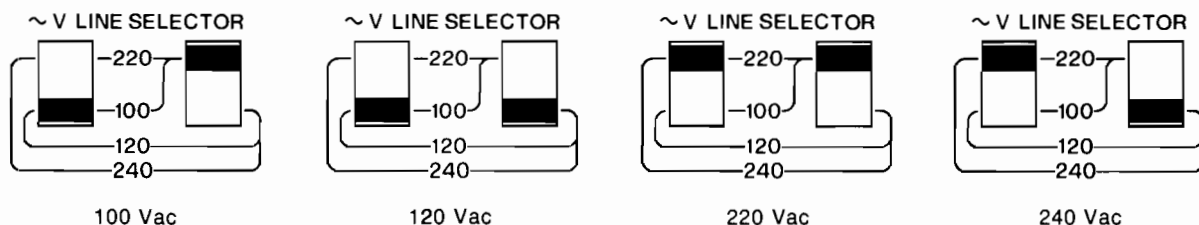
Line Voltage Switch Settings

3. Check the Fuses

WARNING

To avoid the possibility of serious injury, disconnect the power cord
before removing or installing a fuse.

The computer has two fuses accessible on the back panel. See the next photo. One fuse
protects the entire computer and should match the line voltage, either 100/120 Vac or 220/
240 Vac. (See the next table). The other fuse protects the internal power supply; its value is
the same for any line voltage: 15 A, HP part number 2110-0054.

Line Fuses

Line Voltage	Fuse Needed	HP Part Number
100, 120	4 A (slow blow)	2110-0055
220, 240	2 A (slow blow)	2110-0002
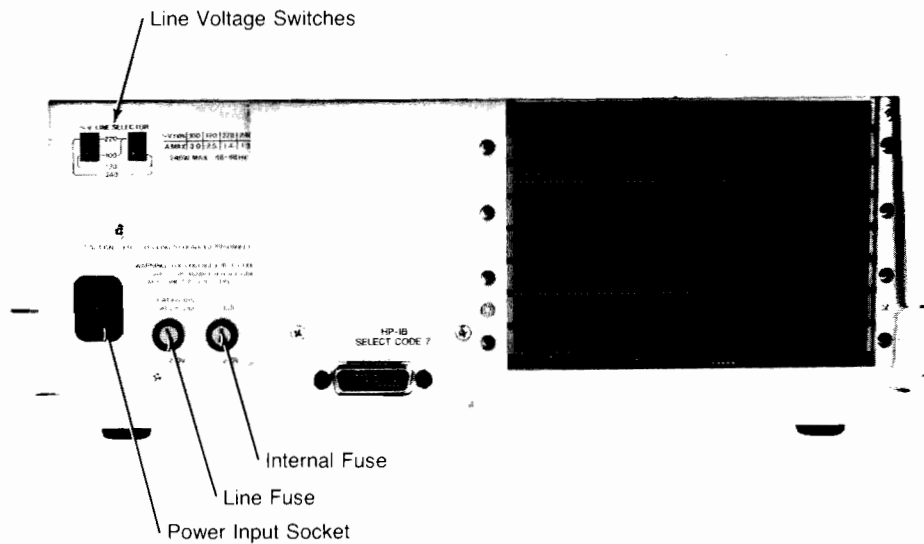
Computer Back Panel

4. Connect the Power Cord

The proper power cord was selected and packed with your computer when it was shipped from the factory. Each cord has a ground connector to protect the operator from electrical shock. Check to be sure you have the correct cord for your power outlet. The available cords are shown next.

WARNING
IF A REPLACEMENT POWER CORD IS NEEDED, IT MUST HAVE THE SAME POLARITY AS THE ORIGINAL. OTHERWISE, EITHER A SAFETY HAZARD FROM ELECTRICAL SHOCK TO PERSONNEL OR EQUIPMENT DAMAGE MAY RESULT.

.U.K.
8120–1351

Australia
8120–1369

Europe Grounded
8120–1689

Computer
Power-Input
Socket

U.S. Grounded
8120–1378[1]   8120–0698[2]

Swiss
8120–2104
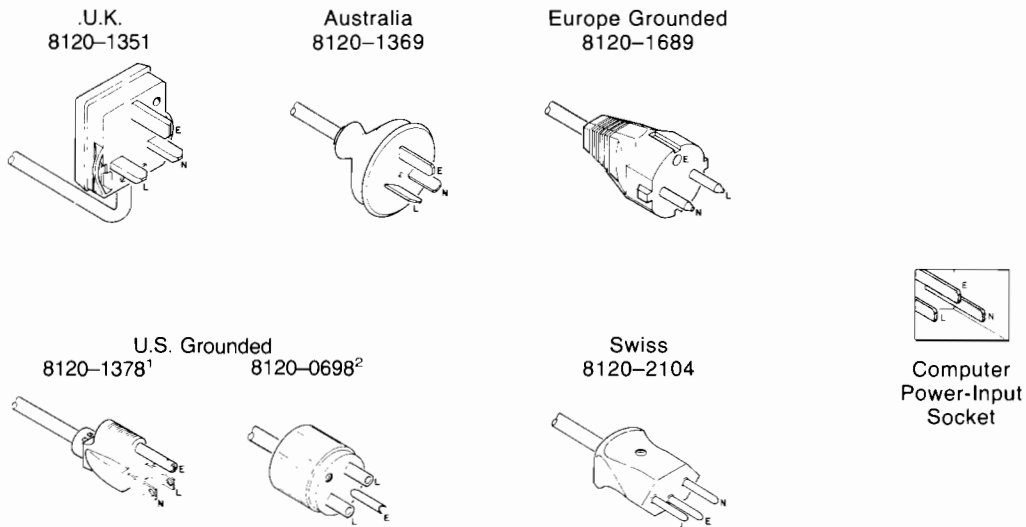
[1] UL and CSA approved for 100/120 Vac operation.
[2] UL and CSA approved for 220/240 Vac operation.

Available Power Cords

After connecting the power cord to the back panel and the power outlet, go ahead and switch the computer on as explained next.

5. Initial Power Up

Now that you've checked the line-voltage switches, checked the fuses, connected the power cord and know which language system you have (soft-load or built-in), you are ready to switch the computer on.

With a Built-in Language System:

If your computer has a built-in language system, first remove any disc in the drive and then press the power switch in. The computer display takes about 10 seconds to warm up. In the mean time, the computer tests its memory. Then a "READY" message is displayed. The computer is now ready for your use.


```
BASIC READY
```

If more than one language system is built-in, the computer allows you to select one. For example:

```
WHICH SYSTEM?
B  H
```

In this example the computer found two built-in systems, BASIC (B) and HPL (H). The computer will wait about 10 seconds for you to select the language system by pressing the appropriate key. (If you press the wrong key, the computer will just beep and continue waiting.) To select the BASIC system, press the **B** key.

If an appropriate key isn't pressed in time, the language system listed first (BASIC in our example) is automatically loaded.

With a Soft-loaded Language System:

If your computer has a soft-loaded operating system, open the disc drive door and insert the Language System disc. Be sure the disc is inserted with its label up and facing you, as shown below. Then close the door and press the power switch in.

The computer automatically looks for a SYSTM-type file on disc at power-up. If one is found, it's loaded into memory and then a "READY" message is displayed. For example:

```
BASIC READY
```

The soft-load routine takes a few seconds longer than if the language system were built-in.

When the Built-in System Does Not Load:

If the computer does not display the READY message after about 10 seconds, or if a system error is displayed, switch the computer off, wait a few seconds and switch it on again. If the READY message still doesn't appear, call HP for service. See the list of service locations at the back of the manual.

When the Soft-load System Does Not Load:

If the computer does not display the READY message after about 15 seconds, or if "UNABLE TO FIND SYSTEM" is displayed, try to re-load the system. First remove the disc and re-insert it in the disc drive. Then close the drive door and press (SHIFT)—(PAUSE). If the computer still doesn't load its system, either the system disc is defective or the computer requires service. Call HP for service. More information on handling system problems and a list of service locations are at the back of this manual.

After powering up the computer for the first time, you should verify its operation by running the computer tests explained in chapter 5. Once computer operation is verified, switch it off and install any additional accessories supplied. See the next sections.

6. Install Additional Read/write Memory

CAUTION
THE COMPUTER MUST BE SWITCHED OFF BEFORE ANY ACCESSORY BOARDS ARE REMOVED OR PLUGGED IN. PLUGGING OR UNPLUGGING BOARDS WITH THE POWER APPLIED WILL DAMAGE THE BOARD OR THE COMPUTER.

The computer's program and data-storage memory can be expanded by installing additional read/write memory boards. Each memory board can be plugged into any available accessory slot at the back of the computer.

Before installing a memory board, note the amount of available read/write memory by first switching the computer on.

```
Available memory = 123456  (bytes)
```

Now switch the computer off and remove the memory board from its anti-static plastic package.

CAUTION
STATIC DISCHARGE CAN DESTROY COMPONENTS ON A MEMORY BOARD. HANDLE THE BOARD BY USING ITS ANTI-STATIC ENVELOPE. DO NOT TOUCH THE ELECTRICAL TRACES OR SET THE BOARD ON ANY STATICALLY CHARGED SURFACE (E.G., A CLOTH).

Each 64 kbyte memory board must be set to a consecutive starting address, beginning with the lowest address of any memory board(s) currently installed. Each board has a mini-switch labelled SW-1 for this purpose. The following table and drawing show how to set the switch.

The standard computer is supplied with 64 kbytes of built-in memory. The first additional memory board should be assigned the starting hexadecimal address FF. Each additional 64 kbyte board must be set to the next-lowest hexadecimal address: FE, FD, etc. Memory boards must not be set to the same address.

64 kbyte Memory Board Starting Addresses

Memory Board	Starting Address	Switch Setting* 12345678
1st memory board	FF	11111111
2nd additional board	FE	01111111
3rd additional board	FD	10111111
4th additional board	FC	00111111
5th additional board	FB	11011111
6th additional board	FA	01011111
7th additional board	F9	10011111
8th additional board	F8	00011111

* "1" indicates switch is open; "0" indicates switch is closed.
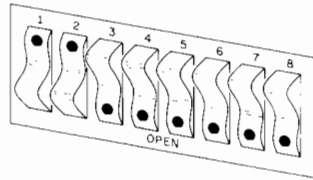
98254A Memory Board Starting Address Switch
(shown set to address FC)

After installing each memory board, switch the computer on and verify the new amount of available memory.

If the available memory does not increase with each added memory board, switch the computer off and verify that the board is properly seated in the accessory slot. Also check the setting of the starting address switch. If it's not set to the highest-available address, the computer cannot address the board.

If the computer still doesn't indicate an increase in available memory, or the computer does not power-up correctly when an additional memory board is installed, switch the computer off, remove the board and replace it in its anti-static envelope. Then call HP for details on replacing the board. Office locations are listed at the back of this manual.

7. Install Interface Cards

Now that your computer is installed and configured with any additional read/write memory, you can install interface cards and connect peripheral components to the computer. Be sure to switch the computer off before plugging in or removing any cards or memory boards.

The computer has eight accessory slots. Each can hold a memory board, while every other slot is designed to accept an interface card. This allow installing up to four interface cards and atleast four memory boards. The built-in BASIC language system is contained on two or three boards already installed. These boards must not be removed.
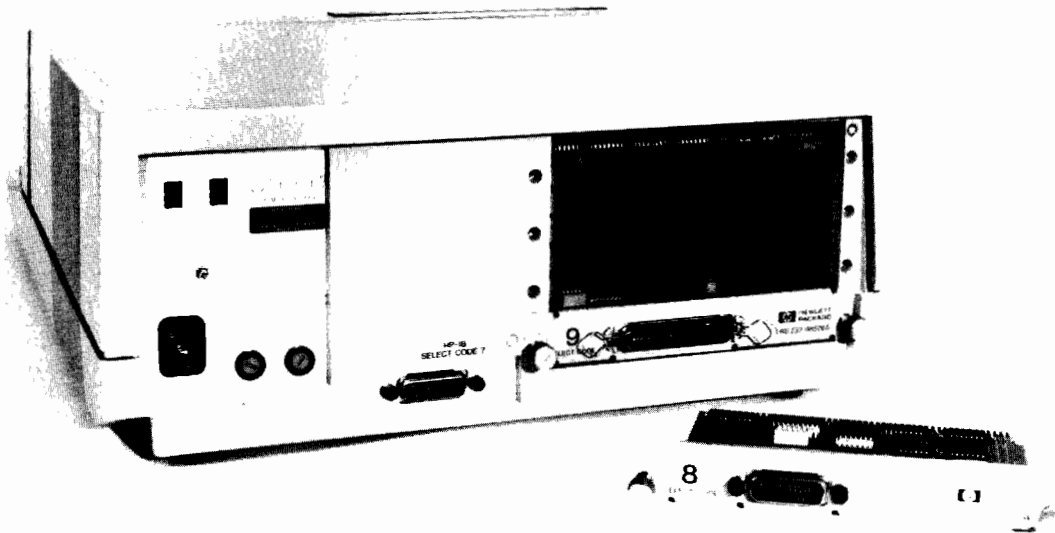
Installing Interface Cards

A manual provided with each interface card explains how to configure the card for your system. Follow those instructions carefully to ensure a smooth installation.

Be sure each interface card is set to a unique address or select code. A switch on each card sets its select code. These codes are already reserved by the computer:

BASIC Internal Select Codes

1   Display (alpha)
2   Keyboard
3   Display (graphics)
4   ⎫
5   ⎬ Reserved for future use
6   ⎭
7   HP-IB interface (built-in)

As shown, select codes 1 thru 7 are reserved for the computer's internal use. That leaves select codes 8 thru 31 for external interface cards.

System Printer Installation

Your computer system will probably include a printer connected via the built-in HP-IB interface. To connect the printer:

1. Attach the 2 metre HP-IB cable supplied with the computer to to the HP-IB connector on the computer back panel.
2. Connect the other end of the HP-IB cable to you printer's HP-IB connector. Gently tighten the locking screws on each connector.
3. Set the HP-IB device address switch (usually found on the back of the printer) to address 01. The next photo shows an HP 9876 Printer address switch set to 01. Refer to your printer's manual for details on setting its address switch.
4. Connect the printer power cord and switch the printer on, as covered in its manual.

Note

Each device connected via an HP-IB interface must be set to a unique device address. The recommended address for the system printer is 01.

Example printer operations as shown in chapter 4. You may wish to verify printer operation by running the printer test explained under System Tests in chapter 5.
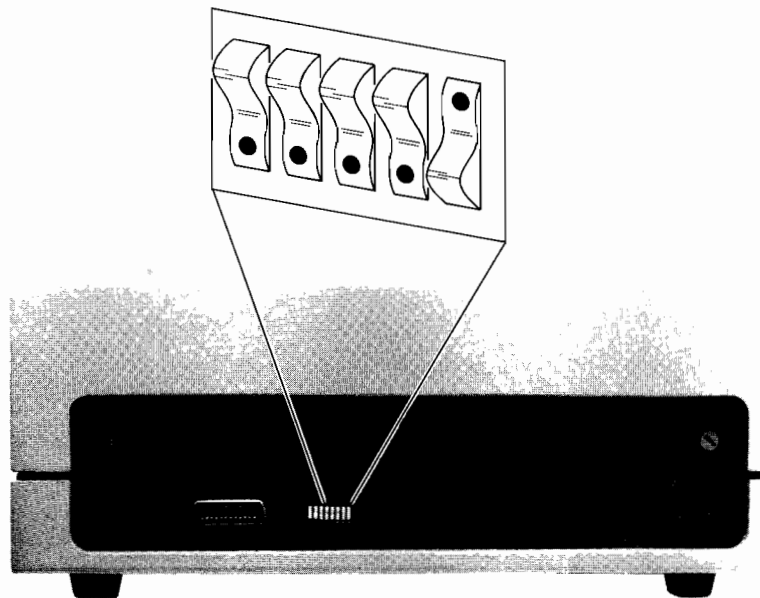
HP 9876 Printer Address Switch Set to 01

Maintaining Your Computer

Cleaning the Computer

The computer should be cleaned with a soft cloth lightly dampened either in clean water or a mild detergent. Don't allow water to get in the computer case. Don't use any abrasive cleaners.

Clean the Disc Drive Heads

The disc drive's read/write heads should be cleaned periodically to ensure trouble-free operation. A head-cleaning kit is available from HP for use with your computer. Order HP accessory number 92193A. HP does not recommend use of other head-cleaning discs or equipment.

CAUTION

DO NOT ATTEMPT TO CLEAN THE DISC READ/WRITE HEADS MANUALLY OR WITH MATERIALS OTHER THAN THOSE SUP-PLIED BY HP. OTHERWISE HEADS DAMAGE OR MIS-ALIGNMENT COULD OCCUR.

To clean the disc read-write heads:

1. Switch the computer off.
2. Insert the 9826 System Test Disc in the disc drive and close the drive door.
3. Switch the computer on. The system text program is automatically loaded.

4. When the initial System Test menu is displayed, press either CLEAN DISC softkey, **k2** or **k7**. Then follow the displayed instructions.

Chapter 2
Getting Acquainted

This chapter introduces many of the computer's operating features, including the keyboard functions, display-control keys, arithmetic operations and printer controls. Whether you plan to run prerecorded (canned) programs or develop your own, first take a few moments to get acquainted with the computer by reading the next few pages.

Durability is a built-in feature of this easy-to-operate computer, so don't be afraid to test it. After reading each section and trying the examples shown, try your own examples. Experiment. You cannot damage the computer by pressing the wrong keys. The worst that can happen is an error message will appear. These messages are programmed in to help you learn its language and needs by communicating with you. You'll find more about error messages in chapter 5. All error codes are listed at the back of this manual.

After the computer has been installed as covered in chapter 1, daily power-up is simply a matter of either switching the power on (if the language system is built-in) or inserting the System Disc and switching power on (if your system is soft-loaded). In either case, the computer automatically tests its memory and then loads its language system.

When "BASIC READY" is displayed, for example, the computer is ready to accept keyboard commands. Now you can load and run programs or develop your own BASIC language programs. If you're running pre-recorded programs, you may be able to let the computer automatically load and run a program by using the Autostart feature.

Program Autostart
You can have the computer automatically load and start running a program named AUTOST by inserting the disc in the disc drive before switching the computer on.

At power-on, the computer always checks for a disc in its drive. If a disc is inserted, the computer looks for a program file named AUTOST. If the right file isn't on the disc, the computer simply displays the BASIC READY message and awaits your command.

If your system is soft-loaded at power-up (700-series options), the autostart disc must have both the language system (SYSTM-type) file and an AUTOST file to automatically load and run both the language system and a program.

Computer Operating Features
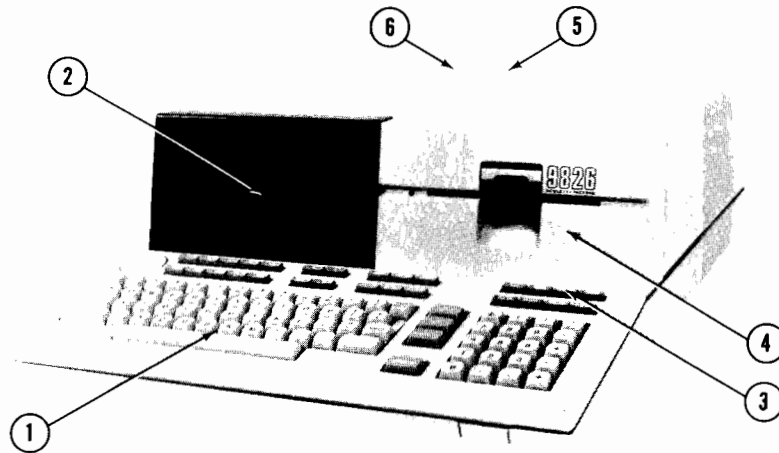
① **Easy-to-use Keyboard.**The keyboard is arranged into logical groups for your convenience: character-entry keyboard, number-entry pad, display controls, system command keys, and program-defined keys called softkeys.

② **An Organized Display.** The display is partitioned into defined areas for maximum useability. One area, for example, is reserved for entering and executing keyboard commands, as shown later.

③ **Graphics Display.** The display can be set to either of two modes, normal alpha or graphics. The computer automatically sets the graphics mode under program control to display bar charts, x-y plots, etc.

④ **Mini Disc Mass Storage.** The built-in disc drive uses standard 130mm (5-1/4 inch) discs for storing data, programs and other computer information. Each disc can hold about 1/4 million bytes (characters) of information.

⑤ **Standard HP-IB Interface.** A Hewlett-Packard Interface Bus (HP-IB) is built into the computer, allowing direct connection of up to 14 compatible instruments (printers, voltmeters, etc.). The programming language for controlling devices via the HP-IB is also built-in, allowing a program to control instrumentation systems and allows you to easily direct printouts, program listings, and displayed graphics to a printer or plotter via the bus.

⑥ **Expandable Memory and Interfacing.** In addition to the standard HP-IB connector, the computer has eight interfacing connectors on its backplane. Each connector can accept a memory board (for additional user memory), a language system board (for the operating system and add-on language ROMs) or an interface card. As explained in chapter 1, however, interface cards cannot be installed in adjacent connectors.

An interface card is needed to connect with each peripheral device or system. The HP-IB interface system, for example, allows connecting many devices via one HP-IB interface card. A remote terminal, on the other hand, requires its own interface card. Complete details on connecting and controlling peripherals are in the BASIC Interfacing Manual. If a printer is already connected to the computer, try the example printer operations covered in chapter 4.

Display Organization

The built-in display (CRT) has a 50-character wide by 25-line work area. The BASIC language system partitions the display into five areas:

Output Area

Blank Line

Display Line

Keyboard Area (two lines)

Message/Results Line

Softkey Labels (two lines)

Arrow
←→

Run Indicator
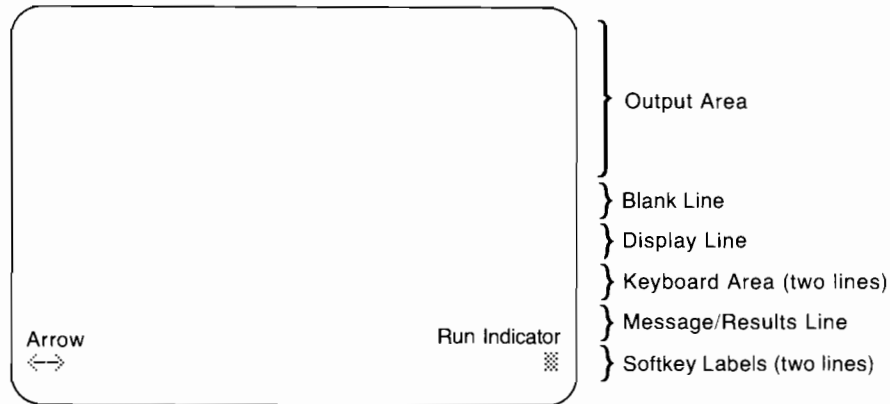
The **output area** can hold 39 lines of information, although only 18 lines appear on the display. Results of keyboard operations and program output appear in this area. When the 18-line area is filled, the top lines scroll off into a buffer (holding) area of memory. To view these lines, use the cursor-control keys and the cursor wheel to scroll through the page. When the entire output area is filled, each new line entered causes a line to be lost off the top of the buffer.

Output Area

18 Lines

39 Lines
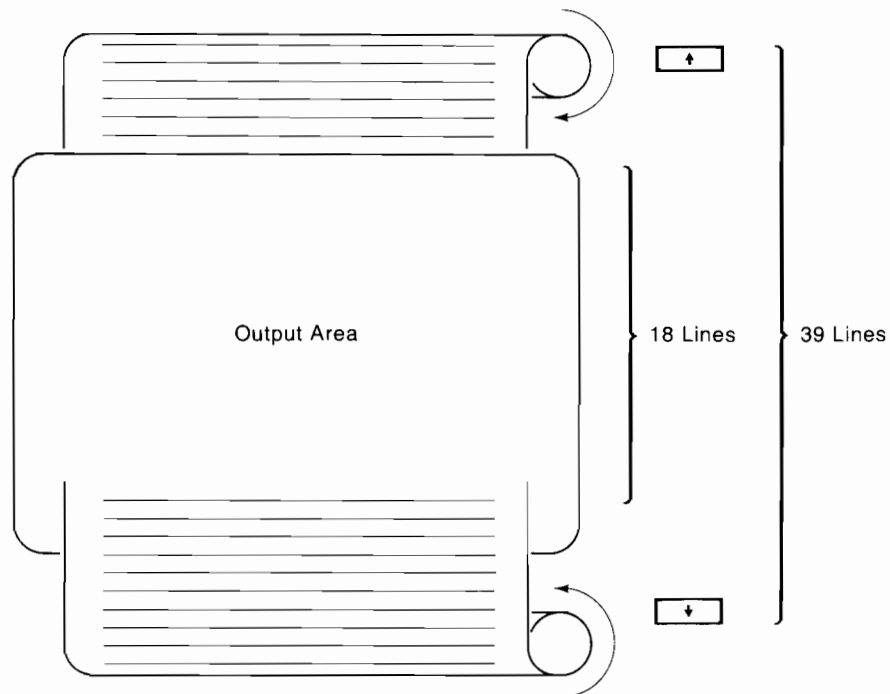
The Output Display Area and Buffer

The **display line** is reserved for instructions (prompts) from a program to the operator.

The **keyboard area** is where you enter responses to program prompts or type in commands. Press the **CLR LN** key to clear the keyboard area. Now do a simple arithmetic problem:

Type: 98 + 26

Press: (EXECUTE)

98+26

The operation is first entered in the keyboard area. When EXECUTEd, the result relaces the operation in the message/results line.

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Now try repeating the operation. Press (RECALL) and (EXECUTE).

To move the cursor back to the bottom of the keyboard area, press (CLR LN).

The results of keyboard operations always appear in the **message/results** line. The results of some keyboard commands, however, like CAT (cataloging a disc), appear in the display's output area. BASIC keyboard commands are covered in the chapter 4.

The **softkey labels** area is reserved for labels which appear when one or more of the softkeys (**k0** thru **k9**) are defined. A program displays these labels when the softkeys are defined, as explained later.

The **run indicator** tells you what state the computer is currently in. Here's a summary of run indications:

When the indicator is blank, the computer is free and awaiting your command.

Run Indicators

▓	Running a program.
–	Paused, waiting.
blank	Stopped.
?	Waiting for a keyboard input.
*	Keyboard execution.
IO	Waiting for an I/O operation to complete before pausing.

The **arrow** in the left-hand corner indicates the currently set direction of the cursor wheel, either up-and-down or back-and-forth. Use the wheel with the cursor-control keys to rapidly position the display cursor.

Graphics Mode

In addition to the normal 50-character by 25-line alpha mode, the display has a graphics mode for presenting charts, drawings and other pictorial representations. The graphics mode can be automatically set when a program outputs graphic data on the display. You can switch back and forth, between graphics and alpha modes, by using the **GRAPHICS** and **ALPHA** keys.

Keyboard Operations

The computer keyboard is arranged into functional groups for your convenience:
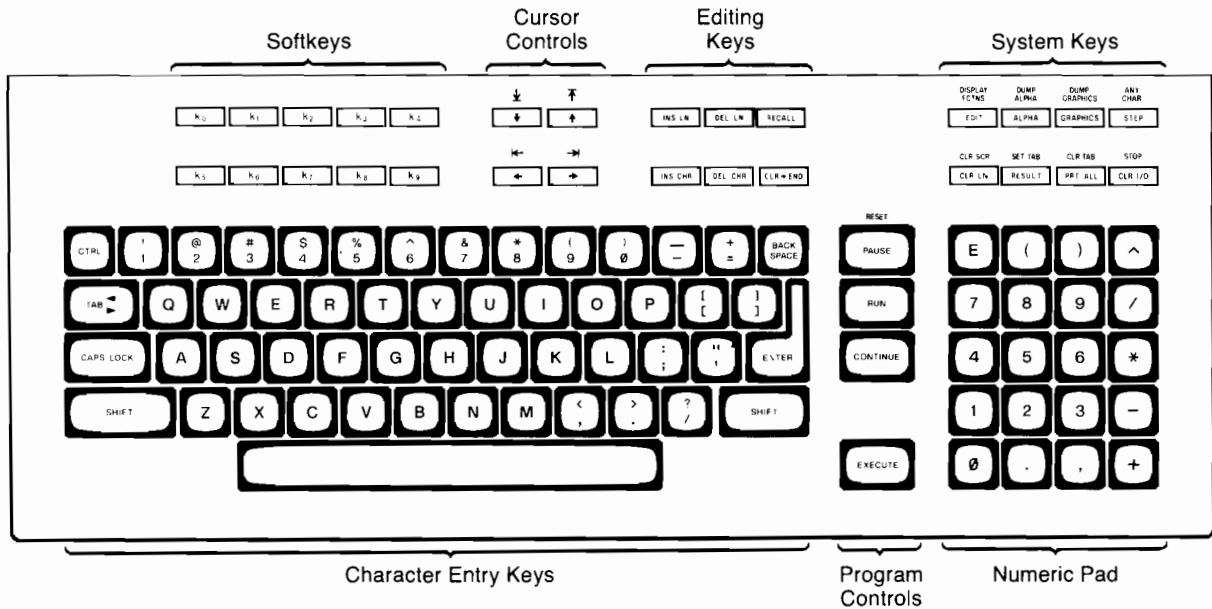
Character Entry Keys

The character-entry keys are arranged like a typewriter, but have some added features.

You can enter the standard upper-case and lower-case letters using the **SHIFT** key to access the alternate case.
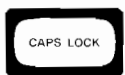
The **CAPS LOCK** key sets the unshifted keyboard to either upper case (for typing commands and programming) or lower case (for normal typewriter operation). The computer displays the mode set when you press the key.

The **ENTER** key has two functions: When a program is running, press **ENTER** to input data requested by the program. When a progam isn't running, the programmer uses **ENTER** to store each line of program code.

The **TAB** key moves the display cursor forward to preset tabs. Pressing **shift-TAB** moves the cursor back to preset tabs.

To set a tab, move the cursor to the desired position in the display line and press **shift-RESULT** (SET TAB). To clear a tab, move the cursor to the unwanted tab position and press **shift-PRTALL** (CLR TAB). All tabs are cleared at power-up.

The **CTRL** (control) key works like **SHIFT** to access a set of standard computer-control characters, such as line feed (LF) and form feed (FF). These characters are useful to the programmer for controlling some devices and when communicating with other computers. You probably won't need them when running programs. The available control characters are shown in the BASIC Language Reference.

Numeric Pad

The numeric pad provides a convenient way to quickly enter numbers and perform arithmetic operations. Once each arithmetic problem (expression) is typed in, press the **EXECUTE** key to calculate and display the result.

For more details and example arithmetic problems, see Arithmetic Operations later in the chapter.

Cursor Controls
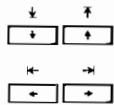
The cursor-control keys move the display cursor one space at a time. Press **SHIFT** and (←) or (→) to move the cursor to the end of the line. The (↓) and (↑) keys allow you to scroll information in the displayed output area up and down.

The cursor wheel allows you to rapidly move the cursor up and down or back and forth, depending on the position of the little arrow in the lower-left of the display. You can change direction by pressing an appropriate cursor-control key. Another way to change direction is by pressing the **SHIFT** key while rotating the wheel.

Take a few moments to move the cursor around using the keys and the wheel. Notice that the computer automatically sets the direction of the cursor-wheel arrow after some operations.

Editing Lines

The editing keys put easy character and line editing at your fingertips.

| INS LN | Inserts a blank line above the cursor's current position. (edit mode only).

| DEL LN | Deletes the line containing the cursor (edit mode only).

| RECALL | Recalls the last line entered, executed or deleted.

| INS CHR | Sets the insert mode, allowing you to insert characters to the left of the cursor. Press the **INS CHR** key again to cancel the insert mode.

| DEL CHR | Deletes the character under the cursor.

| CLR→END | Clears the end of the line, starting from the cursor position.

| CLR LN | Clears the entire line. Press **shift-CLR LN** to clear the entire display screen.

[EDIT] Enters the EDIT command, allowing the programmer to use an editting mode for entering and editting program lines.

When a program is in computer memory, the program editing mode displays the program lines and waits for the programmer to scroll through, line by line, using the cursor wheel and cursor-control keys. Program changes are made by editing each line and pressing the **ENTER** key.

To exit the program edit mode, press the **PAUSE** key. Again, refer to the BASIC Programming Techniques manual for details on entering and modifying programs using the edit mode.

```
10      !
20      ! This is a softkey guessing game.
30      !
40      RANDOMIZE
50      Key=INT(RND*10)
60      ON KEY Key LABEL " HIT ME" GOTO Hit
70         Miss=Miss+1
80      WAIT .75
81      !
90 Miss:   OFF KEY Key_

100        PRINT TABXY(1,18);Hit;" hits in ";Miss;" tries."
110        GOTO 40
111        !
120 Hit:   BEEP
130        OFF KEY Key
140        Hit=Hit+1
150        PRINT TABXY(1,18);Hit;" hits in ";Miss;" tries."
160        GOTO 40
170        END
```

Example Display During Program Edit Mode

An Editing Exercise

Now let's quickly type in a few lines and go back to make some corrections. To first clear the screen, press (SHIFT) (CLR LN).

Here's our first try:

Not bad, we only misspelled one word in the first line.

```
Using the editting keys makes
corecting lines as easy a pie,
```

Original Line

Move the cursor to the extra t in editting and press (DEL CHR) once.

The second line needs some characters inserted. First move the cursor to the r in corecting, press (INS CHR) and insert the missing r. While the insert mode is still set, insert an s after a to spell as. Then press (INS CHR) again to cancel the insert mode.

```
Using the editing keys makes
correcting lines as easy as pie,
```

Corrected Line

Please notice that this is only a practice exercise. You can't **EXECUTE** or **ENTER** the lines; the computer wouldn't recognize them as either a command or a program line. It would, however, beep and display an error message. Go ahead and try it. You'll find an explanation of error messages in chapter 5.

System Control Keys
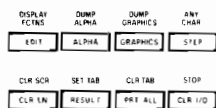
The keys in the upper-right corner control various system functions related to the display, printer and editing operations. Most of these keys execute their functions immediately, as the key is pressed.

EDIT — Enters the EDIT command. The programmer uses the edit mode when entering and editing programs (covered in the BASIC Programming Techniques manual).

shift- EDIT — Sets a display-functions mode, allowing you to see special control characters such as form feed (FF) and carriage return (CR) in the display output area. Press **shift-EDIT** again to cancel the display-functions mode. A complete set of display-functions characters is shown at the back of this manual.

ALPHA
GRAPHICS
— These keys allow you to view either one or both of the display modes, normal alpha or graphics. For example, if a program sets the graphics mode and outputs a graphics display, you can return to the alpha mode by pressing the **ALPHA** key. You can later return to the graphics mode by pressing the **GRAPHICS** key.

Pressing the **ALPHA** or **GRAPHICS** key once sets that mode but doesn't reset the other mode. Pressing the key a second time resets the other mode. So you can view both display modes simultaneously if you wish.

shift- DUMP ALPHA   Outputs a copy of the complete alpha display buffer to a printing device specified by the DUMP DEVICE IS command. See chapter 4 for details.

shift- DUMP GRAPHICS   Outputs a copy of the graphics display buffer to the device specified by a DUMP DEVICE IS command. Graphics programming is covered in the BASIC Programming Techniques manual.

STEP   Allows the programmer to step through a program, one line at a time. Using the **STEP** key to debug programs is covered in the BASIC Programming Techniques manual.

shift- ANY CHAR   Shows each avalable display character. First press **shift-STEP**. Then enter any three-digit number from 000 thru 255. The computer automatically displays the equivalent character. The programmer uses this function when developing programs. A table of characters and their decimal values is at the back of the BASIC Language Reference.

CLR LN   Clears the display input line and the message/result line.

shift- CLR SCR   Clears the entire alpha display buffer and input line.

RESULT   Returns the result of the last expression executed. For example:

(**CLR LN**)

23+45 (**EXECUTE**)   68

Now return the result to the keyboard line and add 123 to it:

(**RESULT**) + 123 (**EXECUTE**)   191

PRT ALL   Sets the printall mode on or off, allowing keyboard operations and displayed error messages to be copied to the system printer. Press the **PRT ALL** key once to set printall ON and again to set printall OFF. Since the display is automatically set as the system printer at power up, the printall mode can be used to log all keyboard operations in the display's output area. Setting the system printer is explained in chapter 4.

shift- SET TAB RESULT   Sets a tab at the cursor's current position. Press **TAB** to advance the cursor to a preset tab. Press **shift-TAB** to move the cursor back to a preset tab. Tabs are in effect in the alpha display until cleared by either **shift-PRT ALL** (CLR TAB) is pressed, SCRATCH A is executed or the computer is powered up. The SCRATCH commands are explained in chapter 4.

shift- `PRT ALL` Clears a tab previously set at the cursor's position.
(CLR TAB)

`CLR I/O` Cancels any current I/O (input/output) operation. If the program was running it's paused.

shift- `CLR I/O` Halts program execution after the current line is executed. To re-start the program, press the **RUN** key.
(STOP)

Softkeys

`k0` `k1` `k2` `k3` `k4`   The ten keys labelled **k0** through **k9** are defined under program control. The program may also display a label for each defined key. Pressing a defined key tells the computer to interrupt whatever it's doing and start running the appropriate part of the program.

`k5` `k6` `k7` `k8` `k9`

We call these keys "softkeys" because the program or "software" defines and displays a label for each key. Another ten softkeys (without displayed labels) can be defined at the same time and accessed by the **SHIFT** key. These shifted softkeys are identified as **k10** through **k19**.

Since the computer can offer a wide selection of operations with each set of defined softkeys, the set of labels is often called a menu. Here's one of the menus available with the System Test program:

```
System Test Program
Revision 2-21-81




















Do you want to log errors on an external printer?

 YES      NO                          EXIT
```

```
 k0   k1   k2   k3   k4
```

```
 k5   k6   k7   k8   k9
```
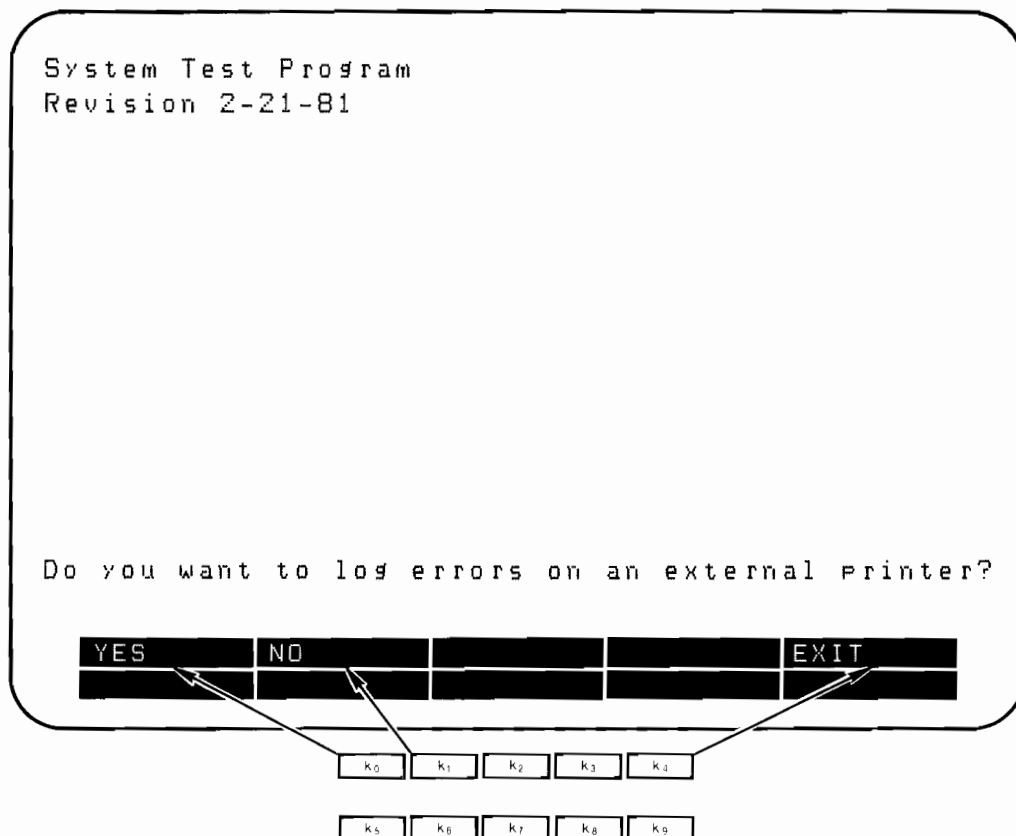
The program defines and labels each softkey via an ON KEY statement. The programmer can find details in the Program Flow chapter of the BASIC Programming Techniques manual.

Program Control Keys

The **PAUSE**, **RUN**, **CONTINUE** and **CLR I/O** keys allow you to control execution of the program stored in the computer's memory.

RUN Starts program execution from the beginning.

PAUSE Pauses program execution after the current line, returning computer control to the keyboard.

CONTINUE Resumes program execution from where it was paused.

shift- **RESET** **PAUSE** Stops program execution immediately without erasing the program or data memory. The BASIC RESET message indicates that the computer is ready for your command.

CLR I/O Pauses program execution when the computer is performing or trying to perform an I/O operation. Press the **CLR I/O** key instead of **PAUSE** when the computer is hung up at an I/O operation, since **PAUSE** works only after the computer finishes the current program line. Pressing the **CLR I/O** key cancels the I/O operation and pauses the program at the current line.
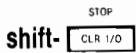
shift- **STOP** **CLR I/O** Stops program execution after the current line. You cannot continue running the program with the **CONTINUE** key. To restart the program, use the **RUN** key.

Arithmetic Operations

The arithmetic operators are located within the numeric keypad:

- ^   Exponentiation (raising a number to a power).
- /   Division.
- *   Multiplication.
- -   Subtraction.
- +   Addition.

If you prefer, you can also use the same characters found within the typewriter keyboard.

To perform arithmetic operations, first clear the display's "keyboard" area by pressing the **CLR LN** key. Then simply type-in the problem and press the **EXECUTE** key. Try these examples:

First, how many characters can be entered into the computer's complete 50-character wide by 39-line alpha-display area?

Enter: 50 * 39

Press: (EXECUTE)

50*39

1950   (characters)

Note

Do not insert spaces between digits of a number.

If you spend 3% of your time today reading this manual, how much of your eight-hour workday is left for work?

Enter: 8 - 8 * .03

Press: (EXECUTE)

8-8*.03

7.76   (hours left)

If the floor in your office is square, with each side measuring 6.2 metres, how many square metres of carpeting are needed to cover it? You can either multiply 6.2 * 6.2, or you can find the square of 6.2 by raising it to the second power (6.2^2):

Enter: 6.2 ^ 2 (EXECUTE)

6.2^2

38.44   (square metres)

Notice, in each case, that the computer displays the result in the line below where you entered the problem. This allows you to either recall the problem (press the **RECALL** key) and compare it with the result, or recall the result (press the **RESULT** key) and use it as part of another problem. For example:

Enter: 98 + 26 (**EXECUTE**)   124

Enter: 25 * (**RESULT**)   25*124

Press: (**EXECUTE**)   3100

Enter: (**RESULT**) / 37 (**EXECUTE**)   83.78378378378

So far, we've been working with relatively small numbers. The computer saves time by automatically using integer notation whenever you enter numbers without a decimal point or an "E" to indicate exponentiation. But integer notation has its limits (from -32768 to 32767). So if you executed an expression with results beyond the integer range, say:

Enter: 126 * 261 (**EXECUTE**)   126*261
          ERROR 20   (integer overflow)

The result is outside the integer range. To avoid the error, be sure to enter a decimal point in at least one of the numbers, causing the computer to use real notation:

Enter: 126. * 261 (**EXECUTE**)   32886.

Now let's multiply some really large numbers:

Enter: 6000000 * 90000 (**EXECUTE**)   5.4E+11

When the result cannot be shown in less than 12 digits, it is displayed in scientific notation. The number after the "E" is the exponent. It indicates how many places the decimal point must be moved to the right in the base number, or mantissa, to express the real number. In this case the number is 540,000,000,000.

Arithmetic Hierarchy

When an arithmetic operation having more than one operator is executed, the computer evaluates the expression according to a defined order or hierarchy:

      ^ (exponentiation)   performed first

      */ (multiplication and division)

      +- (addition and subtraction)   performed last

The computer scans each expression from left to right, comparing each operator to the one on its right. If the operator on the right is of higher priority, then it's compared with the next operator. This goes on until an operator of equal or lower priority is found. Then either the highest-priority operation or the first of the two equal-priority operations is performed. Then any lower-priority operations on the left are compared to the next operator to the right. This continues through the entire expression.

When you wish to be certain that one operation in an expression occurs before another, place that operation in parentheses. For example, this problem shown previously executed as expected:

Enter: 8 - 8 * .03 (**EXECUTE**)   7.76

The multiplication (8*.03) occurred first. But enclosing the subtraction operation in parentheses changes the operational order and the result:

Enter: (8 - 8) * .03 (**EXECUTE**)   0

For example, here is the order of execution for the expression:

                      2+3*6/(7-4)^2

1. evaluate parentheses: 2+3*6/(7-4)^2

2. exponentiation: 2+3*6/3^2

3. multiplication: 2+3*6/9

4. division: 2+18/9

5. addition: 2+2

            result: 4

You can even nest parentheses, causing the innermost operation to be evaluated first.

Whenever you're in doubt as to the order of execution, use parentheses to indicate the order. The computer will automatically strip out any unneeded parens before evaluating the expression. Using parens for "implied" multiplication, however, is not allowed. So the expression 4(5-2) must be entered as $4*(5-2)$.

Computing Range

The range of values which can be handled by your computer is from about 1.8×10^{-308} thru 2.2×10^{308}. More exact limits are:
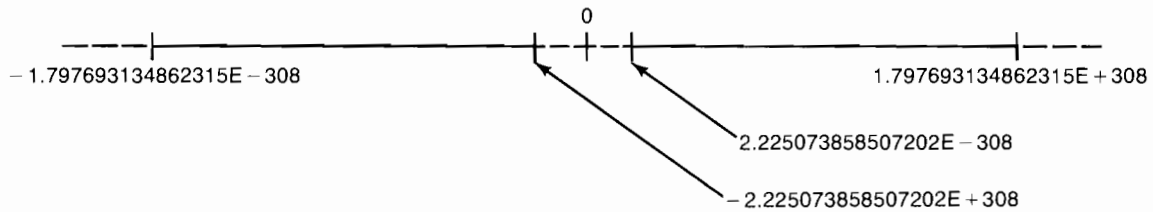
Significant Digits and Rounding

The computer can input, store and calculate numbers having 15 significant digits. Significant digits are those which determine a number's actual value; leading zeros are not counted. When you enter a number with more than 15 significant digits, the excess digits are truncated (dropped) before the number is accepted. The computer automatically rounds each final result to 12 digits before it's output. This can be changed to up through 15 digits by using the programmable USING output operations.

The computer rounds a number by first looking at the 13th digit. If it's 5 or greater, the 12th digit is incremented by one. If the 13th digit is less than 5, it's simply truncated from the number. This is called "rounding up".

BASIC functions are available for rounding numbers, allowing a program to accept a number and round it before processing. These functions are covered in the BASIC Programming Techniques manual.

Chapter 3
Using Flexible Discs

This chapter introduces you to the flexible disc media and explains how to copy (back up) the contents of one disc to another. BASIC operating commands are available for initializing discs, cataloging disc files and purging disc files. These and other commands are explained in the next chapter.

Flexible Discs

The built-in disc drive handles standard 5-1/4 inch flexible discs. The flexible disc, also called a mini-disc and a diskette, is a thin piece of plastic enclosed in a special plastic jacket. The disc is covered with a thin oxide coating on which your program and data information are stored.

When you insert the disc in the drive and close the door, the drive is ready to read information from or write information onto the disc. When the computer requests a read or write, the disc spins at a constant rate, like a phonograph record. The yellow light on the disc drive indicates when reading or writing is taking place. Do not attempt to remove the disc when the yellow light is on.

The built-in disc drive reads and writes on both sides of the disc and requires discs labelled as "double-sided" use. Be sure to use only media supplied or approved by HP. Boxes of ten discs are available by ordering HP part number 92190A. Other discs may not be of adequate quality or may damage the drive.

Disc Handling Precautions

Be sure to follow these guidelines to ensure trouble-free operation:

- Handle discs only by the labelled area. Never touch the disc surface which shows through the protective jacket.
- Always return the disc to its storage envelope after each use. The envelope not only protects the disc from physical damage, it's made of an anti-static material to prevent dust from accumulating.
- Write only on the disc label using only a felt-tip pen. Don't write on the disc jacket. Don't use a lead pencil or a ball-point pen.
- Although the disc is flexible, don't bend or fold it.
- Avoid using or storing discs in temperature extremes, or in areas with excessive smoke or dust. Even cigarette ash can damage the disc surface. Close the disc drive door when it's not in use.
- Do not place discs near sources of strong magnetism, such as an electric motor or toy magnet. This will destroy data on the disc and may prevent further use of the disc.
- Do not attempt to clean the disc or remove it from its protective jacket.
- Use only discs approved by HP. Others may impair data integrity or damage the disc drive.

Inserting and Removing Discs

Open the drive door by lifting the door handle up. Check to make sure there is not another disc in the drive already. Insert the disc as shown on the right. Close the door.

Be sure to return the disc to its storage envelope when not in use. This keeps dust from getting on the oxide surface. Also close the drive door when not in use.

Inserting a Disc

CAUTION
IF YOU ACCIDENTALLY INSERT ANOTHER DISC WHEN ONE IS ALREADY IN THE DRIVE, **REMOVE THE BOTTOM DISC FIRST.** OTHERWISE, THE READ/WRITE HEADS COULD BE DAMAGED.

Write Protection

Covering or uncovering a notch in the disc jacket determines whether the disc drive can write information on the disc. When the notch is covered, it's impossible for the drive to write on the disc; thus information already on disc is protected from being written over or erased. This is useful when a disc contains source information which should only be read.

Labels are supplied with discs to allow you to cover the write-enable notch.

Oxide
Surface

Write
Enable
Notch
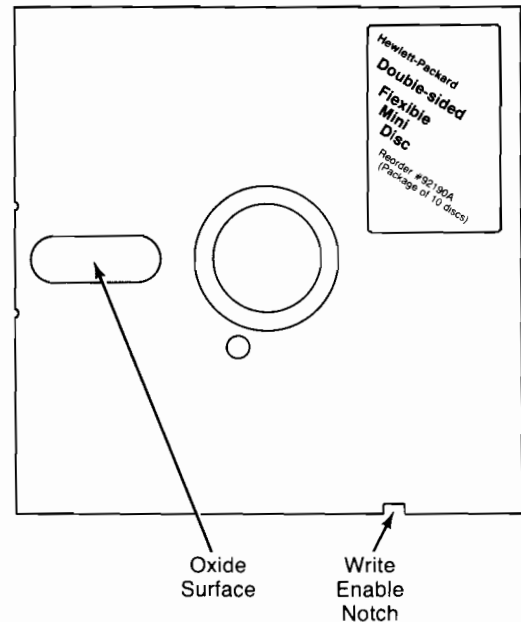
Data File Compatibility

The built-in disc drive initializes discs in a standard HP mass storage format, ensuring that files originated by one HP 9826 will be compatible with other 9826 computers. The standard (LIF) format also allows the computer to identify and read certain files from other HP computers and terminals. For example, type ASCII files (containing data and programs) originated by an HP 2642 Terminal can be read by the HP 9826. Type ASCII files originated by the HP 9826 Computer can be read by the HP 2642A Terminal. Other type files originated by the terminal may be identified (using CAT) but may not be read by the computer. The CAT (catalog) command is covered in chapter 4.

For details on mass storage compatibility with other HP equipment, contact you HP sales office. Locations are listed at the back of the manual.

Copying Discs

Although flexible discs are an extremely reliable storage media, like phonograph records, they do wear out. Since discs can also be damaged due to accidents or careless handling, you should keep a duplicate or back-up copy of each important disc. BASIC programs are provided in the Utilities Pack to copy the files from one disc to another. The CBACKUP (complete backup) program automatically copies all files from one disc to another. The FBACKUP (individual backup) program allows copying selected files to the same disc or a second disc.

The following instructions show you how to run the CBACKUP program. For details on running FBACKUP and the many other BASIC utilities, refer to the BASIC Utilities Manual.

The CBACKUP program can be used to copy all files from a disc originated by an HP 9826 Computer. Although the program runs on the BASIC language system, it copies disc files containing BASIC, HPL and other programs originated on an HP 9826. CBACKUP will also copy files from mini discs recorded on other HP equipment which comforms to LIF (Logic Interchange Format) standards. Your HP sales office can furnish a list of LIF-compatible equipment.

Follow these steps:

1. Switch the computer on and load the BASIC language system (see chapter 1). If the BASIC system is already loaded, execute this command to clear the computer memory:

   SCRATCH A (EXECUTE)

2. Insert the 9826 BASIC Utilities Disc in the drive and close the drive door.
3. Load and run the CBACKUP program:

   LOAD "CBACKUP" (EXECUTE)

   (RUN)

4. Follow the displayed instructions.

Note

Be sure to press the **CONTINUE** key when instructed, not the **RUN** key. If **RUN** is pressed once the program has started, the program must be stopped and restarted using the Utilities Disc. Return to step 1 above.

The CBACKUP program assumes the backup disc is an initialized disc containing either no files or no wanted files. If files are found, a catalog of the backup disc is displayed for you. To automatically purge the files and begin the disc copy, press the **CONTINUE** key. If the backup disc is not initialized, the program automatically initializes the disc before copying files from the master disc. The initialization routine takes about three minutes.

The CBACKUP program copies files from one disc to another by reading portions of the first (master) disc into computer memory and writing each portion onto the second (backup) disc. Since only one disc drive is available, the program asks you to exchange the master disc for the backup disc one or more times. After you insert the master disc, the program catalogs the files and determines how many disc exchanges will be needed to copy all files to the backup disc.

A catalog of the backup disc is displayed after the backup is complete. To backup another disc, using either the same master or another master disc, enter Y and press the **CONTINUE** key. To exit the program, enter N.

Chapter 4

BASIC Operating Commands

Introduction

The HP 9826 computer's language system is an enhanced form of the BASIC programming language. As with other programming languages, the BASIC system has a set of unique instructions called keywords. Most keywords can be combined with numbers, letters or other keywords to instruct the computer to perform an appropriate task. For example:

```
PRINT "Hello there"
```

is a complete BASIC instruction for printing that message.

Most BASIC keywords are used to write lines of program code. The programmer types in each line of code and stores it into program memory using the **ENTER** key. Many keywords can also be used to direct or command the computer from the keyboard. You simply type-in the keyword, followed by any appropriate number or name, and hit the **EXECUTE** key. Thus you have the power to load, run and erase programs by using the appropriate BASIC commands.

The following pages describe some of these keyboard commands. A summary of the commands is listed on the next page. Keep in mind that this is just a sampling of the BASIC language, typical commands which an operator uses while running applications programs. For details on the many other BASIC keywords, refer to either the BASIC Language Reference or the person supporting your programs.

Before continuing here, be sure your computer is installed correctly and powered up, as covered in chapter 1.

BASIC Operating Commands

Program Handling Commands:

LOAD or GET	Retrieve a program from disc to the computer memory.
RUN	Begin running the program in memory.
PAUSE	Halt program execution.
CONTINUE	Resume program execution from where it was PAUSEd.

Disc & Printer Commands:

INITIALIZE	Format a disc for use with the HP 9826 Computer.
CAT	Display a catalog of disc files.
PURGE	Eliminate unwanted files from a disc.
PRINT	Output text and data on the display or other printing device.
PRINTER IS	Assign an alternate printing device.
DUMP DEVICE IS	Assigns a printing device for DUMP ALPHA and DUMP GRAPHICS operations.

Initializing Discs

Before a blank disc can be used for the first time, it must be formatted or initialized for use with your computer. This process checks the disc for defects (areas where information cannot be stored) and then creates a file directory. The directory holds the name and location of each file on the disc. When a disc is first initialized, the directory is empty, so no files are listed when you catalog the disc, as explained later.

To initialize a new disc, or re-initialize (erase all files) an old disc:

1. Insert the disc in the drive and close the door. Be sure the disc is not write-protected by removing any label covering the write-enable notch as shown below.
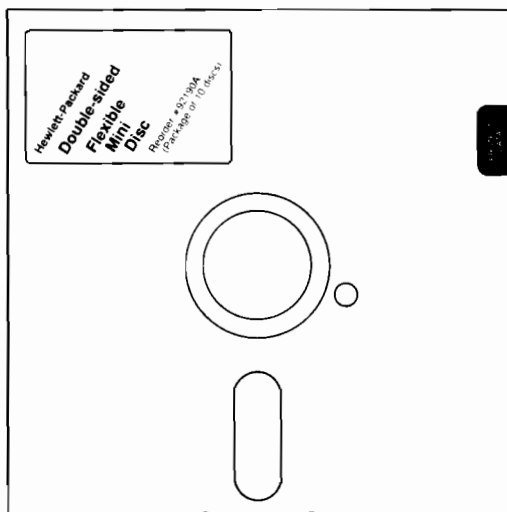
Write-protected Disc   **Disc Not Write-protected**
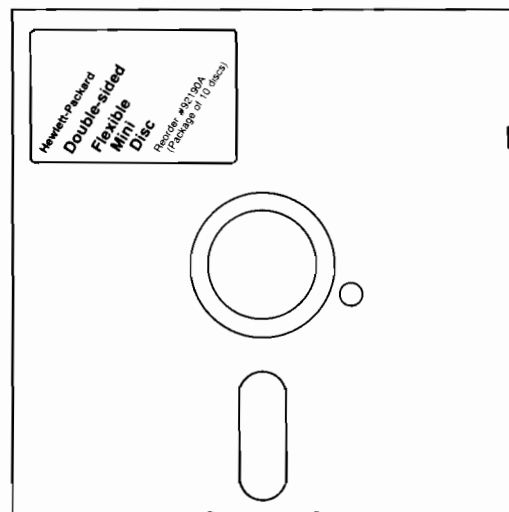
2. Type in the INITIALIZE command, specifying the internal disc:

```
INITIALIZE ":INTERNAL" (EXECUTE)
```

The initialization routine runs automatically and continually displays its progress initializing the disc. The routine takes about three minutes. A standard flexible disc has 33 tracks on each side, with 16 sectors (addressable storage areas) on each side of each track. If a defective track or sector is found, the computer automatically skips it and continues testing. The number of defective areas are listed at the end of the routine.

If less than five tracks are found defective, the test passes and a directory is created on the disc. The computer can automatically replace up to four bad tracks with spare ones, ensuring that you have 33 tracks. The final display indicates how many tracks were spared. When the display cursor returns, the disc is ready for use.

If more than four defective tracks are found, however, the routine is halted and a displayed message tells you how many tracks are bad. This disc cannot be used; you should return it to the supplier for a replacement.

To initialize another disc, first open the drive door, remove the previous disc, insert the new one and close the door. Then re-type and execute the INITIALIZE command. To save time, pressing the **RECALL** key will re-enter your last command into the display.

Identifying Disc Files (CAT)

Before you can run a program, you must load a copy of it from a mass storage device, such as the built-in disc drive. A program can be stored on disc in either of two forms. You can identify a stored program's form by knowing the type of file in which it's stored. The CAT command allows you to review the contents of a disc and identify the type of each file. For example, insert the BASIC Utilities Disc supplied with your computer, close the drive door and execute this command:

```
CAT (EXECUTE)
```

```
FILE NAME  PRO  TYPE   REC/FILE  BYTE/REC   ADDRESS

PHYREC          BIN         9                    16
FBACKUP      *  ASCII      42                    65
WRITEBLOCK      PROG       32                   387
CBACKUP         ASCII      56                   468
CAT          *  PROG       39                   527
ZAP             PROG       28                   781
```

The files listed as PROG hold programs which can be returned to computer memory using the LOAD command. The ASCII files, however, contain either programs or other information coded in a universal data format (so they can be read by other computers). To bring ASCII-coded programs back into the computer, use the GET command. But more about loading programs later.

An * next to a file name indicates that the file is protected from being recorded over or purged. A special protect code was specified when that file was originally placed on disc. To record over or purge that file, you must specify the code. See the example in the Purging Files section.

Other file types contain special programs and data used by the system:

- SYSTM files contain the computer's language system, which is automatically loaded during the power-up routine (you do not need a SYSTM file if the computer's language system is built-in).
- BIN files hold programs coded in an internal binary format.
- BDAT files contain data coded in a binary format.

You may occasionally need to check whether some of these files are on a disc, but you probably will never have to handle these files, since the system or programs automatically load them as needed.

If the file type is a number, rather than a word, it indicates a file not created by the HP 9826 Computer. These files can be cataloged, but the contents of the file cannot be read by the computer.

The file catalog tells you more than just each file's name and type; it also indicates each files size and location on the disc. A file's location generally indicates when the file was originally stored on the disc: new files are added to the end of the list. These file sizes and locations are of great use to the programmer, who must organize and support each file.

The Default Printer (PRINTER IS)

The file catalog is normally output on the internal display. The display is called the default printer, since output commands like CAT and PRINT automatically output to that device. If you wish to output the catalog on another device connected to the computer, like a printer, first change the default printer by using the PRINTER IS command. Then execute the CAT command. For example:

```
PRINTER IS 701  (EXECUTE)

CAT  (EXECUTE)
```

The number is called the device selector. It indicates the interface select code, in this case 7 for the built-in HP-IB interface and 01 for the device's address as set on the device. If the printer is connected via another type of interface, say an RS-232-C interface or GPIO interface, the device selector will be just the interface select code. For instance:

```
PRINTER IS 8  (EXECUTE)
```

Since the display is assigned select code 1, you can reset it as the default print device:

```
PRINTER IS 1 ( EXECUTE )
```

The display is automatically set as the default printer when the computer is switched on.

The Dump Device (DUMP DEVICE IS)

The DUMP ALPHA and DUMP GRAPHICS keys dump the appropriate display contents to a printing device specified by the DUMP DEVICE IS command. For example, if you wish to dump the graphics display to a printer set at device address 01 and connected via the built-in HP-IB:

```
DUMP DEVICE IS 701 ( EXECUTE )
```

Press: (SHIFT)-(GRAPHICS)

The number is the printer's device selector, as covered in The Default Printer above.

Purging Disc Files (PURGE)

When a file is no longer needed, it can be deleted or purged from the disc by using the PURGE command. This command should be used with caution, since it is just as easy to purge a file holding valuable data or a program as it is to purge an unwanted file.

Let's assume you have a disc containing these files:

```
FILE NAME PRO TYPE   REC/FILE BYTE/REC   ADDRESS

COM             PROG      4                    16
DEMOGRAPH       PROG      9                    20
GRDEMO          PROG     11                    41
DEMO            PROG     11                    52
WRITER          PROG     42                    66
MATINV          PROG     19                   108
```

Catalog Before Purging File WRITER

To purge the file named WRITER follow these steps:

1. Insert the disc containing the file WRITER and close the door.
2. Type-in and execute this command:
   ```
   PURGE "WRITER" ( EXECUTE )
   ```
3. You may verify that WRITER is indeed purged by CATaloging the disc again:
   ```
   CAT ( EXECUTE )
   ```

```
FILE NAME PRO TYPE  REC/FILE BYTE/REC   ADDRESS

COM            PROG      4                   16
DEMOGRAPH      PROG      9                   20
GRDEMO         PROG     11                   41
DEMO           PROG     11                   52
MATINV         PROG     19                  108
```

Catalog After Purging WRITER

If you wish to purge a file which is cataloged as having a protect code (indicated by * in the catalog), you must include the correct protect code with the PURGE command. This code was specified when the file was originally created. For example, if our unwanted file, WRITER, was protected by the code "HP", this PURGE command must be used:

PURGE "WRITER","HP" (EXECUTE)

Loading Program Files (LOAD and GET)

There are two ways to get programs into the computer memory. You can either enter each line from the keyboard or, much easier and faster, you can load a copy of it from a mass-storage device like the built-in disc. Before retrieving a copy of a program from disc, however, you must identify the type of file holding the program. As mentioned earlier, programs can be stored either in a PROG (for program) file or in an ASCII file. The sample catalog below lists files of each type.

```
FILE NAME PRO TYPE  REC/FILE BYTE/REC   ADDRESS

CHIP2          ASCII    58                   32
TESTR001       ASCII     2                   90
CYCLE          ASCII    62                   92
OUTATA         BDAT    100                  155
TEST002        PROG     49                  255
```

Programs stored in PROG files are already coded in the computer's unique internal format, allowing faster transfer between computer and disc. Programs stored in ASCII files are coded in a universal data format, allowing them to be read by other computers. Since ASCII files are also used to store information other than programs, like names and addresses, all of the ASCII-type files on a disc may not contain programs.

To retrieve a program stored in a PROG file, use the LOAD command. For instance, to retrieve the program named TEST002 from our sample disc, insert the disc and close the door. Then execute this command:

LOAD "TEST002" (EXECUTE)

The run indicator (*) goes out when the program is loaded.

To retrieve a program stored in an ASCII file, use the GET command. This command would load a copy of the CYCLE program from our sample disc:

GET "CYCLE" (EXECUTE)

Again, the run indicator goes out when the program is loaded.

Running Programs (RUN)

The RUN command instructs the computer to begin running a program from a specified point. To begin running a program from the start (the first program line), just press the **RUN** key. The run indicator on the lower-right of the display tells you when the computer is busy running the program.

If you wish to start running a program from any other point than its beginning, say at a certain line number or a labelled line, type-in and execute the RUN command. For example, to start running a program beginning with line 200, execute:

RUN 200 (EXECUTE)

If you want to start running a program from a point labelled "Start", execute this RUN command:

RUN Start (EXECUTE)

Once the computer has started running a program, it may define and label the softkeys and wait for you to select the next operation. Each label at the bottom of the display corresponds to one of the softkeys, **k0** thru **k9**. To run the labelled routine, simply press the indicated key. For example, softkeys **k0** thru **k4** are defined in the drawing below.

Select a function:

NEW DATA	PLOT	REPORT	more	EXIT
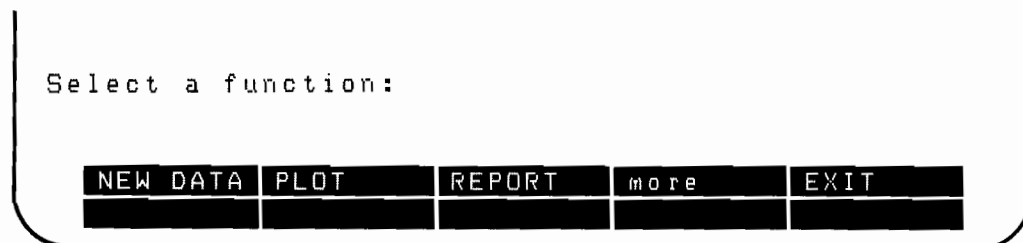
Pressing any of the other (undefined) softkeys merely causes the computer to beep.

Stopping a Program

In general, a program should not be stopped by operator intervention. It will complete its assigned tasks and stop by itself. Occasionally, however, you may be instructed to **PAUSE** the program, perhaps to collect data. Or you may be forced to **STOP** the program because a device is malfunctioning or some other unexpected event. Here are the commands available to stop program execution.

The PAUSE Command

When you wish to temporarily stop program execution, and then resume execution from where you left off, press the **PAUSE** key. The computer will stop after executing the current program line and display that line to show you where its at. When you are ready to resume execution with the next program line, press the **CONTINUE** key.

Note

Do not press the **RUN** key to resume program execution after pressing **PAUSE**. Pressing **RUN** always starts a program running from the begining.

The Clear I/O Command

When a program hangs up because it's waiting for a device to complete its operation, there are two ways for you to clear the problem. You can manually clear the device, thus allowing the program to continue running. Or you can tell the computer to clear its I/O channel by pressing the **CLR I/O** key. Pressing **CLR I/O** causes the computer to exit the current I/O operation and pause. Press the **CONTINUE** key to retry the I/O operation and continue with the program.

If the program reaches another I/O operation for that same device before it's ready to respond, however, the program will again hang up waiting for the device to resond. Again, press the **CLR I/O** key to pause the program and press the **CONTINUE** key to resume the program.

The STOP Command

When you wish to completely halt program execution, press **shift-CLR I/O** (STOP). Keep in mind when stopping a program, that data entered or calculated may be lost.

Erasing Computer Memory (SCRATCH)

The computer automatically handles erasing its memory when loading a program and during power-up. Occasionally, you may need to erase some or all of the memory for special jobs. To do this, use the SCRATCH command:

SCRATCH	Erases the contents of the program memory.
SCRATCH A	Erases the entire computer memory except for its language system. This places the computer in its power-up state.

Printer Control (PRINT)

The BASIC language has a wide variety of commands for controlling printing devices. As an operator, you're probably not concerned with learning full printer control, but you occasionally may want to print messages on the display or label a printout. To do simple printer operations, you need only remember two commands: PRINTER IS and PRINT. The PRINTER IS command assigns the default printer, as covered on page 4-4.

The PRINT command outputs specified information to the device currently assigned as the default printer. The computer sets the display as the default printer during power-up. Let's use it in the next examples.

To print a simple message on the display, such as:

        "DON'T TOUCH THIS COMPUTER!"

just type-in and **EXECUTE** this command:

    PRINT "DON'T TOUCH THIS COMPUTER!"

The message appears on the output (upper) portion of the display:

    DON'T TOUCH THIS COMPUTER!

If you printed another line to the display, such as:

    PRINT "Be back in 5 minutes."

it would appear on the next line.

    DON'T TOUCH THIS COMPUTER!
    Be back in 5 minutes.

Thus, each PRINT command outputs a complete line at a time.

If you wish to center your message on the display, just add the needed blank spaces to the beginning of the message. For example:
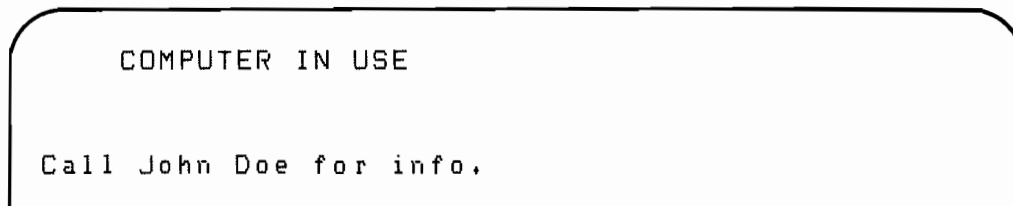
    PRINT "   BE RIGHT BACK"

                  BE RIGHT BACK

To print several lines seperated by blank lines, use the PRINT keyword to output blank lines:

```
PRINT "        COMPUTER IN USE"
PRINT
PRINT
PRINT "   Call John Doe for info."
```

```
   COMPUTER IN USE


Call John Doe for info,
```

That's just a sample of how to output messages on the display. For more details on using PRINT and the many other commands for outputting data on the display, see the BASIC Programming Techniques manual.

Chapter 5

In Case of Trouble

In the event your system becomes inoperative, you have the resources here to either pinpoint the problem yourself or determine who should be called for help. By checking the system yourself, you may be able to avoid calling for service. If service is needed, you can at least minimize down-time by knowing who to call.

This chapter contains error-recovery information, instructions on running system tests and a list of error messages. If you have determined that the computer or any HP peripheral device is not operating properly, contact an HP service office for help. Office locations are listed at the back of this chapter.

System Loading Errors

Soft-loaded Systems

If your computer has a soft-loaded language system (700-series options), the system disc should be inserted before the power is switched on. If the computer does not find a disc with a SYSTM type file during power-up, it displays the message "UNABLE TO FIND SYSTEM". To recover, insert the system disc (or a backup system disc, if you are in doubt about the one already inserted), close the drive door and press (SHIFT)-(PAUSE). The "READY" message will indicate that the system is loaded and ready for use.

Built-in Language Systems

A built-in language system is automatically loaded at power-up. If more than one language is built-in, you can either choose which language to load, or you can let the computer automatically load the first language listed. In either case, the "READY" message indicates a successful load.

If the "READY" message does not appear within a minute after switching power on, press (SHIFT)-(PAUSE). If a "RESET" message doesn't appear (like BASIC RESET), call HP for service.

Error Messages

The computer responds to an incorrect operation with an error message. The message is either a simple English statement telling you of a keyboard error or a more-complex statement describing an error encountered while running a program. The simple keyboard errors occur most often, so let's look at them first.

Keyboard Error Messages

The computer reminds you when you attempt to execute an incorrect command or arithmetic operation by beeping, displaying an error message and, in some cases, placing the cursor near the mistake in your operation. For example, if you wished to perform this calculation: $10/.03 = ?$

But you typed:

10 / .0 (EXECUTE)

```
10/.0
ERROR 31
```

The computer cannot divide by 0 and reminded you with an error code. Refer to the list of error codes under the keyboard or at the back of this manual.

As another example, suppose you wish to display a catalog of disc files but type this command instead of CAT:

CAR (EXECUTE)

```
CAR
ERROR 910 IDENTIFIER NOT FOUND
IN THIS CONTEXT
```

The computer didn't recognize the command CAR, so it positioned the cursor under the unknown keyword and displayed an error message. This error makes sense to the programmer, who knows the computer assumes you are referring to a variable name, a place in memory where information is stored. The computer calls a variable name an "identifier". In this case, it couldn't find a variable named Car.

Now suppose you wanted to print your name, John Doe. Try this command:

PRINT "John Doe" (EXECUTE)

```
John Doe
```

Now that you know PRINT "John Doe" works, press the **RECALL** key, delete the last quotation mark and press **EXECUTE** again:

```
PRINT "John Doe
ERROR 985 INVALID QUOTED STRING
```

The computer showed you the mistake with a message and placed the cursor under the first quotation mark.

But what if both quotes were missing from the command? Try to execute this command:

```
PRINT John Doe ( EXECUTE )
```

```
PRINT John Doe
ERROR 949 THIS SYMBOL NOT
ALLOWED HERE
```

In addition to printing quoted strings, the PRINT command can be used to print the contents of variables. Each variable name must be a single word. In our example, the computer assumed that you incorrectly specified two words for a variable name. The cursor was positioned under the second word.

The point to remember when encountering keyboard errors is to analyze the error as the computer sees it, not, neccesarily as you expected it. If you're not a programmer, an error message usually means you made a mistake while either typing the command keyword (CAR instead of CAT) or typing in a parameter within the command (like omitting both quotation marks). When these or other errors occur, carefully check your spelling and punctuation; then make any corrections and execute the command again. Remember that the computer has strict rules governing its language so you can give it precise instructions. Don't let error messages bother you; it's normal for every computer user to encounter keyboard errors while learning the language.

Program Errors

Just as the computer has rules on how keyboard commands must be composed, it applies the same rules, and many more, when running a program. When an error occurs during execution of a program, the computer stops, beeps and displays an error message like this:

```
ERROR 31 IN LINE 90
```

This error code (31) refers to an attempted division by 0 in program line 90.

When you encounter a program error, first look up the error code at the back of this manual or on the pull-out card under the keyboard. You may be able to correct the problem and continue running the program. If the error doesn't make sense to you, however, jot down the error code and line number. Then call the person supporting that program.

Boot ROM Errors

An internal Boot ROM controls loading a language system at power-up. The following error messages indicate problems which occur while the Boot ROM is attempting to load a language system from disc or when a system error occurs.

Error Message	Description / Recovery Action
MEMORY FAILURE AT nnnnnnnn	Indicated memory failed power-up test. Check for more than one memory board set at the same starting address.[1]
INSUFFICIENT USABLE MEMORY	Not enough read/write memory for Boot ROM use. Call HP for service.
NOT ENOUGH MEMORY FOR SYSTEM	Insufficient read/write memory to load language system from disc. Check memory boards[1]. Then press SHIFT-PAUSE (reset) to load system. If error is repeated call HP for service.
KEYBOARD FAILED SELF TEST	Power-up test failed. Switch computer off and call HP for service.
UNABLE TO FIND SYSTEM RESET TO RETRY	Language system not found in ROM or on disc (SYSTM type file). Insert a language system disc, close the drive door and press SHIFT-PAUSE (reset).
	If error is repeated or computer cannot find ROM system, switch computer off and call HP for service.
FATAL FLOPPY ERROR 90,11 DRIVE NOT RESPONDING	Disc drive hardware failure. Switch the computer off and call HP for service.
FLOPPY ERROR code , nn ... RESET TO RETRY	Disc drive error occurred during system load. Refer to explanation of indicated BASIC error code and the displayed explanation. After remedying the problem, press SHIFT-PAUSE (reset) to load system. If error is repeated, call HP for service.
UNEXPECTED USE OF nnnnnn RESET TO RETRY	Memory addressing error. Press SHIFT-PAUSE (reset) to reload the language system. If the error is repeated, call HP for service.

[1] Refer to "Install Additional Read/write Memory" in your BASIC or HPL Operating Manual.

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Appendix A
For More Information.

BASIC Manual Kit

The standard BASIC Manual Kit provides the following publications along with this BASIC Operating Manual. Additional manual kits can be ordered from your HP Sales Office; specify HP part number 09826-87902.

BASIC Programming Techniques (09826-90010). Introduces the beginning or intermediate programmer to the varied tasks of programming in BASIC language. Starting with how to enter program lines and ending with information to help you get the most from your computer, this manual will help you write and debug your first BASIC programs.

BASIC Interfacing Techniques (09826-90020). This manual introduces the general input/output operations available for controlling peripheral devices, and shows how to connect and control devices via each interface card. For details on controlling HP printers, plotters and mass-storage devices, however, see the BASIC Programming Techniques manual.

BASIC Language Reference (09826-90055). This is the A-to-Z technical reference of the BASIC language. It's structured and written for quick access to details on any BASIC keyword, parameter or error code.

Service Manual Kit

The HP 9826 Service Manual Kit, 09826-90030, provides a copy of this BASIC Operating Manual and the Service Manual, 09826-90035, to aid a qualified technician in servicing your 9826 Desktop Computer.

The service manual explains how to troubleshoot and repair a 9826 Computer by replacing defective assemblies. The diagnostic tool is the 09826-66541 Test Stimulus Board, which contains many computer system tests in ROM. This manual can be ordered either from your HP Service Office or directly from Computer Supplies Operation, P.O. Box 60008, Sunnyvale, CA 94088.

Interface Hardware Manuals

A technical manual supplied with each interface card shows you how to install and configure the card. Circuit diagrams and parts lists are provided to aid in servicing the card. These manuals are currently available:

Interface	Manual Part No.
98620A DMA Interface*	98620-90000
98622A GPIO Interface	98622-90000
98623A BCD Interface*	98623-90000
98624A HP-IB Interface	98624-90000
98626A RS-232 Interface	98626-90000

* Currently used only with the HPL language system.

HPL Manual Kit

The optional HP 9826 HPL operating system is almost identical to HPL on the HP 9825 Computer. The few differences between HP 9826 HPL and 9825 HPL are covered by these manuals. The HPL Manual Kit is available under part number 09825-87903.

HPL Operating Manual and Programming Update (09826-90040). This manual covers computer installation, HPL keyboard operations, HPL operating commands and lists all HPL error messages.

HPL Quick Reference (09826-90045). An A-to-Z listing of HPL statements, functions, commands and error codes for the 9826 computer.

The HPL Manual Kit also provides a complete set of 9825 HPL manuals:

- 9825 Operating & Programming Reference (09825-90200)
- 9825 I/O Control Reference (09825-90210)
- 9825 Disc Programming (09825-90220)
- 9825 Matrix Programming (09825-90022)
- Interfacing Concepts Guide (09825-90060)

Appendix B
BASIC Error Codes

System Errors

Certain conditions are considered "fatal" to the computer's language system. These include a keyboard hardware failure, power-up memory failure and other internal computer problems. A system error is indicated by SYSTEM ERROR displayed near the bottom of the screen.

To recover from a system error, press **shift-PAUSE** (reset). If keyboard control is not returned, switch the computer off and on again. (If you have a soft-loaded system, insert the language system disc in the drive and close the door before powering up.)

If keyboard control is still not available after pressing **shift-PAUSE** and powering up, call HP for service.

BASIC Error Codes

1   Missing ROM or configuration error. The program needs to have ROM(s) or a language system loaded into memory.

2   Memory overflow. Not enough memory for the task at hand.

3   Line not found in this context. The specified line may have been deleted from the program, or the line identifier may be misspelled.

4   Improper RETURN. A RETURN statement is encountered but there is no prior GOSUB, or RETURN from a function with no return value specified.

5   Improper context terminator.

6   Improper FOR/NEXT matching. A NEXT statement is encountered without a corresponding FOR. Also improper FOR/NEXT nesting.

7   Undefined function or subprogram. Misspelled function or subprogram name. Calling a function or subprogram that isn't in memory.

8   Improper parameter matching. Specifying inconsistent parameter lists in a CALL statement.

9   Improper number of parameters. Specifying the wrong number of parameters in a CALL statement.

10   String value required. Returning numeric data when string data was expected.

11   Numeric value required. Returning string data when numeric data was expected.

12   Attempt to redeclare variable. Dimensioning the same variable name twice.

13 Array dimensions not specified. Attempting to access an array variable which hasn't been dimensioned or referenced.

14 OPTION BASE not allowed here.

15 Invalid bounds. Dimensioning an array where the lower bound is greater than 32 767 or less than -32 767.

16 Improper dimensions. Using an array with the wrong subscripts. For example, if A is a 5x7 array, you can't use A(4). Also, dimensioning an array of more than 32 767 elements.

17 Subscript out of range. Specifying an array element out of the array's bounds.

18 String overflow or substring error. Either the receiving string is too short or the specified string subscripts don't match the string's current length.

19 Improper value or out of range.

20 INTEGER overflow. The specified number must be in the range -32 768 thru 32 767.

22 REAL overflow. The specified number must be in the range of about $1.8E+308$ thru $2.2E\text{-}308$.

24 Trig argument too large.

25 Magnitude of ASN or ACS argument is greater than 1.

26 Zero to non-positive power.

27 Negative base to non-integer power.

28 LOG or LGT of a non-positive number. The result would be a complex number.

29 Illegal floating point number.

30 SQR of a negative number. The square root of a negative number would give a complex number.

31 Division by 0 or X MOD 0. Neither is allowed.

32 String does not represent a valid number. Reading a numeric value in a READ statement, but a string is being accessed in the DATA statement. Improper argument for a VAL function.

33 Improper argument for NUM.

34 Referenced line not an IMAGE statement.

35 Improper IMAGE. The string expression in a PRINT USING or DISP USING isn't a valid IMAGE.

36 Out of data in READ. READ statement requesting data after DATA list is exhausted.

38 TAB or TABXY not allowed here.

40 Improper DEL or REN.

41 First line number greater than second line number.

46   No binary in STORE BIN or no program in SAVE.

47   Bad COM declaration.

49   Branch destination not found.

51   File not currently assigned.

52   Bad mass storage unit specifier.

53   Improper file name.

54   Duplicate file name. Specified file name already exists on the medium.

55   Directory overflow. Not enough room in file directory for new files.

56   File name is undefined. Specified file not on disc.

58   Improper file type.

59   End of file found.

60   End of record found in random mode.

62   PROTECT code violation.

64   Mass storage medium overflow. Not enough contiguous space on medium to store data.

66   INITIALIZE failed. Too many bad tracks on medium, or door opened during IN-ITIALIZE.

67   Bad mass storage parameter.

68   Syntax error occurred during GET.

73   Bad device type in mass storage unit specifier (msus).

77   File open on PURGE.

78   Bad mass storage volume label.

80   Medium changed or not in drive.

81   Mass storage hardware failure. Call HP for service.

83   Write protected.

84   Record not found. Specified record not on mass storage volume.

87   Record address error. The medium is probably damaged or worn out. Attempt to re-read data. Copy all files to a new medium.

88   Read data error. May indicate drive, medium or hardware failure.

90   Mass storage system error.

100   Numeric IMAGE for string item.

101   String IMAGE for numeric item.

102   Numeric field > printer width.

103 Item has no corresponding IMAGE.

105 Numeric IMAGE field too small.

106 IMAGE exponent field too small.

107 IMAGE sign specifier missing.

117 Too many nested structures.

118 Too many structures in context.

120 Not allowed while program running.

121 Line not in main program.

122 Program is not continuable.

125 Program not running.

126 Quote (") in unquoted string.

128 Line too long during GET.

131 Bad non-alphanumeric keycode.

132 Keycode buffer overflow.

133 DELSUB of non-existent or busy subprogram.

134 Improper SCRATCH statement.

136 REAL underflow.

140 Too many symbols in the program.

141 Variable cannot be allocated.

142 Variable not allocated.

143 Reference to missing OPTIONAL parameter.

145 May not build COM at this time.

146 Duplicate label in context.

150 Bad select code or device selector.

152 Parity error.

153 Insufficient data for ENTER.

154 String > 32767 bytes in ENTER.

155 Bad interface register number.

156 Bad expression type in list.

157 No ENTER terminator found.

158 Improper IMAGE specifier.

159 Numeric data not received.

160 Too many digits in number.

163 I/O Interface not present.

165 IMAGE specifier > string DIM length.

167 I/O Interface status error.

168 I/O timeout.

170 I/O operation not allowed.

171 Illegal I/O addressing sequence.

172 I/O device failure.

173 Must be bus controller.

174 Nested I/O prohibited.

177 Unidentified I/O name.

178 Trailing ',' or ';' in ENTER.

347 Structures improperly matched.

700 Bad plotter specifier.

702 CRT graphics hardware missing.

704 Upper bound < lower bound.

705 Hard clip limits exceeded.

902 Must use DEL or DELSUB.

903 No room to renumber.

906 SUB or DEF FN not allowed here.

909 May not replace SUB or DEF FN.

910 Identifier not found in this context.

920 Numeric constant not allowed.

921 Numeric identifier not allowed.

922 Numeric array element not allowed.

923 Numeric expression not allowed.

924 Quoted string not allowed.

925 String identifier not allowed.

926 String array element not allowed.

927 Substring not allowed.

928 String expression not allowed.

929 File name not allowed.

930 Numeric array not allowed.

931 String array not allowed.

935 Name is too long: no more than 15 characters allowed.

936 Unrecognized character.

937 Invalid OPTION BASE.

939 OPTIONAL appears twice.

940 Duplicate formal parameter name.

942 Invalid I/O name.

943 Invalid function name.

946 Dimensions are inconsistent.

947 Invalid array bounds.

948 Multiple assignment prohibited.

949 This symbol not allowed here.

950 Must be a positive integer.

951 Incomplete statement or command.

962 Programmable only: cannot be executed from the keyboard.

963 Command only: cannot be stored as a program line.

977 Statement is too complex.

980 Too many symbols in this context.

982 Too many subscripts.

983 Wrong type or number of parameters.

985 Invalid quoted string.

987 Invalid line number: must be an integer from 1 thru 32 766.

HEWLETT
PACKARD