

# **Software Reference Manual**

## **HDOS SYSTEM**

### *Chapter 1* **System Configuration**

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Technical consultation is available for any problems you may encounter in verifying proper operation of this product. We are sorry, but we are not able to evaluate or assist in the debugging of any programs you may develop with this product. For technical assistance, call:

(616) 982-3860

Consultation is available between 8:00 am and 4:30 pm (EST), on normal business days.

## INTRODUCTION

HDOS, or Heath Disk Operating System, is a sophisticated library of programs which control and facilitate the many and diverse applications of your computer. The H8/H89/HDOS system has set a new standard in the hobby computer industry. This is the first hobby system to offer many of the functions of large commercial computer systems. The satisfaction you will derive from the system is limited only by your imagination.

This chapter will introduce you to the H8 and H89 computer systems and show you how to set up and run your computer's software. It will also explain in detail the procedures that you will be using. But before you perform this "System Set-Up Procedure," be sure to read the "System Configuration" section, which describes the minimum requirements for the operating system and any peripheral devices you may have. Even if this is your first use of an H8 or H89, you will be able to set up your system quickly. Immediately following the "System Set-Up Procedure" and the "Summary" is a section entitled "Utility Optimization." This "Utility Optimization" portion of Chapter One provides theoretical background and enumerates options for the utility programs that you will have used in the "System Set-Up Procedure."

In addition to the Heath-supplied diskettes, to perform the steps in the "System Set-Up Procedure;" you will need two blank diskettes, two diskette labels, and a felt-tip pen. **Please don't insert or remove any diskette until you are instructed.**

Follow the instructions in Procedures A and B in sequence. The responses that you should give are printed in bold type. Messages from the computer are shown in quotes. Check off each step after you have completed it. A complete description of the program's activity and an explanation of other options within the program are given in the "Utility Optimization" section.

It will take you about three hours to complete the "System Set-Up Procedure." Don't be afraid to stand up and stretch or get a drink if you have to, even if you are in the middle of a copying operation. The computer will still be waiting when you return.

If in the course of following the instructions you mistype a word or command, and you notice it before you have pressed the RETURN key, you can instruct HDOS to ignore the entry. To do this, hold down the CTRL key while simultaneously typing U. "U" will appear on the screen, HDOS will automatically execute a carriage return, and you can then retype the line.

If you do not notice a mistyped word until after you have pressed RETURN, don't panic. HDOS will attempt to make sense of your word (STSGEN, for example), and when it cannot, it will print an error message. The prompt ">" will be redisplayed. Just enter the word again.

Please bear in mind that you must type a carriage return after typing in a line. If you type a line and do not enter a carriage return afterwards, the computer will not receive your command.

You may find it reassuring to know that it is impossible to damage the computer by typing in the wrong word or command. Unless you have a substantial understanding of assembly language, it is also impossible to damage the operating system.

Most importantly, remember that the computer is patient. It will wait for you to type a command correctly, no matter how long it takes. And while it will not reward you for getting the proper syntax on the first try, the computer will nevertheless not begrudge you many unsuccessful trials.

## Notation Conventions

- Ø** = Zero (Used where the numeral zero may be confused with the letter "O.")
- Δ** = Required space.
- ®** = Carriage return, produced by depressing RETURN.
- <xxxx>** = The default response. If you type ® after this message, HDOS assumes that you intend the reply which is enclosed in <>.
- CTRL** = Symbol for the CTRL (CONTROL) key on the console keyboard.
- SYn:** = The primary boot drives, where n is the number at which each primary boot drive is hardware configured.
- DKn:** = The secondary boot drives, where n is the number at which each secondary boot drive is hardware configured.
- nn** = Used to indicate a numeric message that will vary from system to system.

## CTRL Sequences

You can execute all of the following control codes except DELETE, RUBOUT, and SHIFT-RESET are executed by holding down the CTRL key while typing the letter. Thus, to execute CTRL-U, hold down the CTRL key while simultaneously typing U.

### **DELETE,**

**RUBOUT** If you press either of these keys, the system will remove the character to the left of the cursor from the screen so you can retype it. HDOS will echo each deleted character so you can see which characters have been deleted.

### **CTRL-D**

You can use this code to exit from a utility program, such as ONECOPY, back to the HDOS command mode.

### **CTRL-G**

This code will cause the computer to beep.

### **CTRL-U**

When you mistype a line and notice the error before you enter a carriage return, CTRL-U instructs HDOS to ignore the line so that you can retype it.

### **CTRL-Z**

When you strike these keys twice in succession, any ongoing HDOS activity is cancelled. You will generally use this code when all else fails to return to the HDOS command mode from a utility program, ASM, or BASIC.

### **SHIFT**

### **RESET**

When you press these two keys simultaneously, the H89 will return to the beginning of the Bootstrap procedure. This sequence should be used only in the event that CTRL-Z will not work, since there is some risk of data loss.

### **RST/ø**

### **ø**

When you press these two keys simultaneously, the H8 will return to the beginning of the Bootstrap procedure. This sequence should be used only in the event that CTRL-Z will not work, since there is some risk of data loss.

## SYSTEM CONFIGURATION

The following paragraphs and tables describe the minimum requirements of your operating system. This section contains only information about software configuration. Refer to the "System Configuration" section of your Operations Manual for instructions on how to configure your hardware.

You must have an H8 or H89 computer system with a minimum 32K bytes of operational memory. Moreover, this memory must operate continuously from decimal location 8192 (i.e., 2000H, 040.000A) to the available upper memory limit of your computer. Note that the lower 8192 bytes of memory are reserved.

Table 1-1 outlines the port allocation scheme used on the H89 computer system. Table 1-2 lists port allocation for the H8. Both tables list the device and the device name used in the software. The software device name is a special name by which the software recognizes various physical devices. For example, the software recognizes commands that involve the line printer only if the software device name for the line printer, LP:, is specified along with the command.

In the following tables, addresses are given both in octal, indicated by "Q", and hexadecimal, indicated by "H". Thus, 320Q is port 320 octal, and 0D0H is port D0 hex.

The operating system does not use any ports below 100 octal (040H). These ports are available for your use.

**Table 1-1**  
Port Allocation for the H89

<u>Device</u>	<u>Software Device Name</u>	<u>Interface Card</u>	<u>Port Address</u>	<u>Interrupt Level</u>
Console Terminal	TT:	---	350-357Q (0E8-0EFH)	3
Line Printer	LP:	H88-3 Serial	340-347Q (0E0-0E7H)	---
Alternate Terminal	AT:	H88-3 Serial	320-327Q (0D0-0D7H)	---
5-1/4-inch Floppy Disk	SY:, DK:	Special	174-177Q (07C-07FH)	---
8-inch Floppy Disk	SY:, DK:	H89-47 Serial	170-173Q (078-07BH)	5
Reserved			360-361Q (0F0-0F1H)	---
Reserved			376-377Q (0FE-0FFH)	---

Notes:

1. If you are using an H36 DECWRITER as a line printer, you must connect it as device AT:.
2. An H14 line printer must be connected as device LP:.

**Table 1-2**  
Port Allocation for the H8

<u>Device</u>	<u>Software Device Name</u>	<u>Interface Card</u>	<u>Port Address</u>	<u>Interrupt Level</u>
Console Terminal	TT:	H8-5 Serial	372-373Q (0FA-0FBH)	3
	TT:	H8-4 Serial	350-357Q (0E8-0EFH)	3
Line Printer	LP:	H8-4 Serial	340-347Q (0E0-0E7H)	---
Alternate Terminal	AT:	H8-5 Serial	374-375Q (0FC-0FDH)	---
		H8-4 Serial	320-327Q (0D0-0D7H)	---
Front Panel 5-1/4-inch	None	None	360-361Q (0F0-0F1H)	---
Floppy Disk	SY:, DK:	Special	174-177Q (07C-07FH)	---
8-inch Floppy Disk	SY:, DK:	H8-47 Serial	170-173Q (078-07BH)	5
Reserved			376-377Q (0FE-0FFH)	---

#### Notes

1. If you are using an H36 DECWRITER as a terminal, connect it as device TT:. If you are using an H36 as a line printer, connect it as device AT:.
2. An H14 line printer must be connected as device LP:.

In addition to port assignments, these tables list the interface card(s) normally used with each device. You will need to install jumpers on the interface card in order to select the appropriate address.

Both the console terminal and the 8-inch floppy disk drive require the use of interrupts. You will therefore have to jumper the interface cards of both devices for the proper level interrupts.

HDOS supports up to five disk drives, with a maximum of three 5-1/4-inch minifloppy drives and two 8-inch floppy drives.

If you have only one type of drive in your system, the drive which is hardware configured to be drive  $\emptyset$  is normally called SY $\emptyset$ : (system unit zero). Other devices of the same type are numbered sequentially from zero using the format SYn:, with the "n" corresponding to the number at which the drive has been configured in the hardware. If you have not altered your hardware, the SY: (primary boot) drives are the 5-1/4-inch drives.

If you have drives of two different types in your system, HDOS assigns names in the format SYn: to all drives that have been hardware configured as the primary boot drives. The "n" in the SYn: format typically corresponds to the hardware number of each primary boot drive. Those drives in the system which have been hardware configured as secondary boot drives are assigned names in the format DKn:. Again, the "n" in the DKn: format corresponds to the hardware number of each secondary boot drive. If you have not altered your hardware, the 8-inch drives are the DK: (secondary boot) drives.

SY0: is the "system" drive unit. This drive must always contain a diskette which contains HDOS system files. At present, only your distribution diskette contains system files. After completing the "System Set-Up" procedure, you will have created a SYSTEM VOLUME, which will contain copies of all the files on the distribution diskette. This SYSTEM VOLUME should always be mounted in SY0: for normal operation.

NOTE: Use the distribution diskette only to transfer files to other disks. Therefore, do not use the distribution diskette to run programs other than those specified in this Software Reference Manual. If you try to use the distribution diskette to run other programs, such as BASIC, you will cause unpredictable results.

The distribution diskette is write-protected to guarantee that you will always have an accurate copy of the operating system. Do not remove the write-protect tab from a 5-1/4-inch disk, or attempt to write-enable an 8-inch distribution disk. Heath may refuse to support a system if the distribution diskette has been write-enabled or the write-protect tab removed.

Under normal conditions, you will probably need extra diskettes for storing data and programs. We recommend that you have at least two copies of your system volume, as well as a spare copy of any important information. The process of creating system volumes and "backup" disks will be discussed within the "System Set-Up Procedure"

## SYSTEM SET-UP PROCEDURE

At this point, your computer, disk drives, and any peripherals should be assembled and the "Rotational Speed Test" in your Operations Manual should have been successfully completed for any 5-1/4-inch disk drive(s). If the "Rotational Speed Test" failed, do not attempt to perform the "System Set-Up Procedure". Instead, refer to the troubleshooting guide in your hardware Operations Manual.

The purpose of this section is twofold: to acquaint you with the procedure for generating diskettes that contain the HDOS system, and to test your diskettes and disk drives to ensure that they are operating properly. Please read through the following sections before actually performing any of the operations. You will use these procedures frequently.

Note that there are two different procedures for setting up your system. Procedure A will assist you in setting up a system with 5-1/4-inch disk drives, and Procedure B (starting on Page 1-37) will assist you in setting up a system with 8-inch disk drives. If you have both types of drives, perform the Procedure that concerns itself with the type of drive you will be using as your primary boot drive. Then refer to Appendix B, "Creating System Volumes for Secondary Boot Drives."

A word about our terminology: Throughout this "System Set-Up Procedure" we will refer to steps, such as Step 1 (Bootstrap), Step 2 (INIT) and so on. These "Steps" refer to sections that have a boldface title and heading next to that title, such as:

### H89 BOOTSTRAP

### Step 1A

When you are instructed to proceed to Step 3, proceed to the section that begins with a boldface title and heading. The word "Step", then, always refers to an entire section, NOT to an individual instruction such as:

3. Press the SHIFT and RESET keys.

In the event that you are unable to complete the entire "System Set-Up Procedure", you can safely remove the disk and turn off the power after completing any of the following sections:

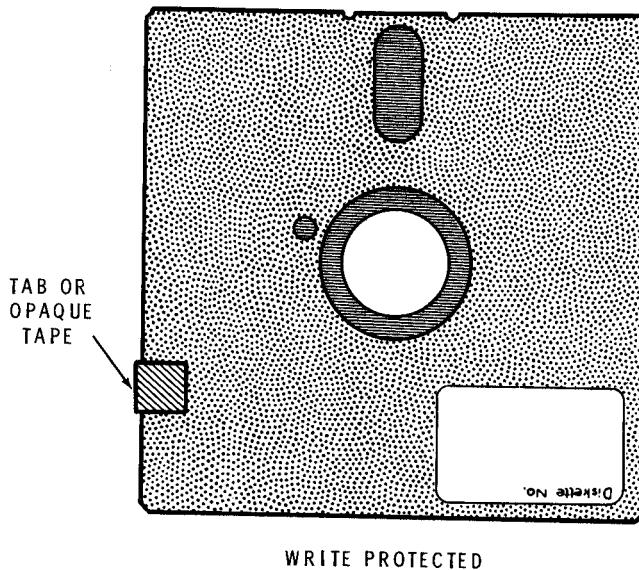
- Step 2 INIT
- Step 3 TEST17 or TEST47
- Step 4 INIT II
- Step 5 SYSGEN
- Step 6 ONECOPY

If you do not finish the entire procedure, mark where you have left off. To continue with the procedure later, perform Bootstrap (Step 1A or 1B), and then enter any of the steps at the point in the instructions marked by \*.

## Procedure A

### Setting Up a System with 5 1/4-inch Disk Drives

You should have three diskettes: one labeled SOFTWARE TOOLS, one labeled DEVICE DRIVERS, and one labeled HEATH DISK OPERATING SYSTEM. This HEATH DISK OPERATING SYSTEM disk is the distribution disk. The distribution disk contains all the files which are essential to running programs, and it is from it that you will generate your system volume.



**Figure 1-1**  
5-1/4- Inch Distribution Diskette

The distribution disk contains all the essential HDOS system files, including the files SY.DVD (the primary boot disk driver), HDOS system utilities, and Heath BASIC.

In addition to the Heath-supplied diskettes, you will need at least two blank diskettes which do NOT have write-protect tabs installed. Do not remove the tab from the SOFTWARE TOOLS, DEVICE DRIVERS, or distribution disk.

The SOFTWARE TOOLS diskette contains the Heath assembler, assembler common decks, XREF, the HDOS device drivers, Heath Text Editor, Console Debugger, and other HDOS utilities. To copy the files on this disk, you will probably want to use either ONECOPY (if you have a single-drive system) or PIP. Both ONECOPY and PIP are discussed in Chapter Two of this Manual.

The DEVICE DRIVER SOURCE disk contains source code for the HDOS device drivers. If you are an experienced assembly-code programmer, and wish to modify the standard device drivers, you will find this disk useful.

Procedure A will not use the DEVICE DRIVER SOURCE disk.

If you have an H8, omit this section and go on to Step 1B, H8 Bootstrap.

#### H89 BOOTSTRAP

#### Step 1A

One of the primary functions of a computer operating system is to enable the various physical parts of the computer to cooperate toward the execution of your commands. In order for this cooperation to take place, there must be communication between HDOS (software) and the physical parts of the computer (hardware). The computer cannot execute any command unless HDOS is communicating with the hardware.

Bootstrap is a small program stored within the hardware which serves to establish a communications link between HDOS and the various physical parts of the computer. The bootstrap procedure is so named because, by means of this procedure, you will be causing HDOS to "pull itself up by its bootstraps" -- that is, the responses you give in this procedure will enable HDOS to lift itself off the diskette and into the computer's memory. Having been installed in memory, HDOS can then issue instructions to and coordinate the actions of the appropriate parts of the computer in response to your commands.

**This procedure will be referred to several times throughout the HDOS Manuals.  
Be sure to perform the sequence correctly.**

NOTE: Do not insert any diskette before applying power to the disk drives.

- ( ) 1. Make sure the off-line key is up. This connects the terminal keyboard to the computer.
- ( ) 2. Turn on the power to the computer and all disk drives. You should hear one or two beeps and see "H:" in the upper left-hand corner of the terminal screen. Press the right **SHIFT** key and the **RESET** key simultaneously and note how the "H:" reappears after you type these keys. **SHIFT** and **RESET** will always return you to this "H:" at the beginning of the Bootstrap procedure.
- ( ) 3. Insert the distribution diskette into the drive that has been hardware configured as primary boot drive *Ø*; See Figure 1-2. Close the door of the drive unit after you have inserted the diskette.

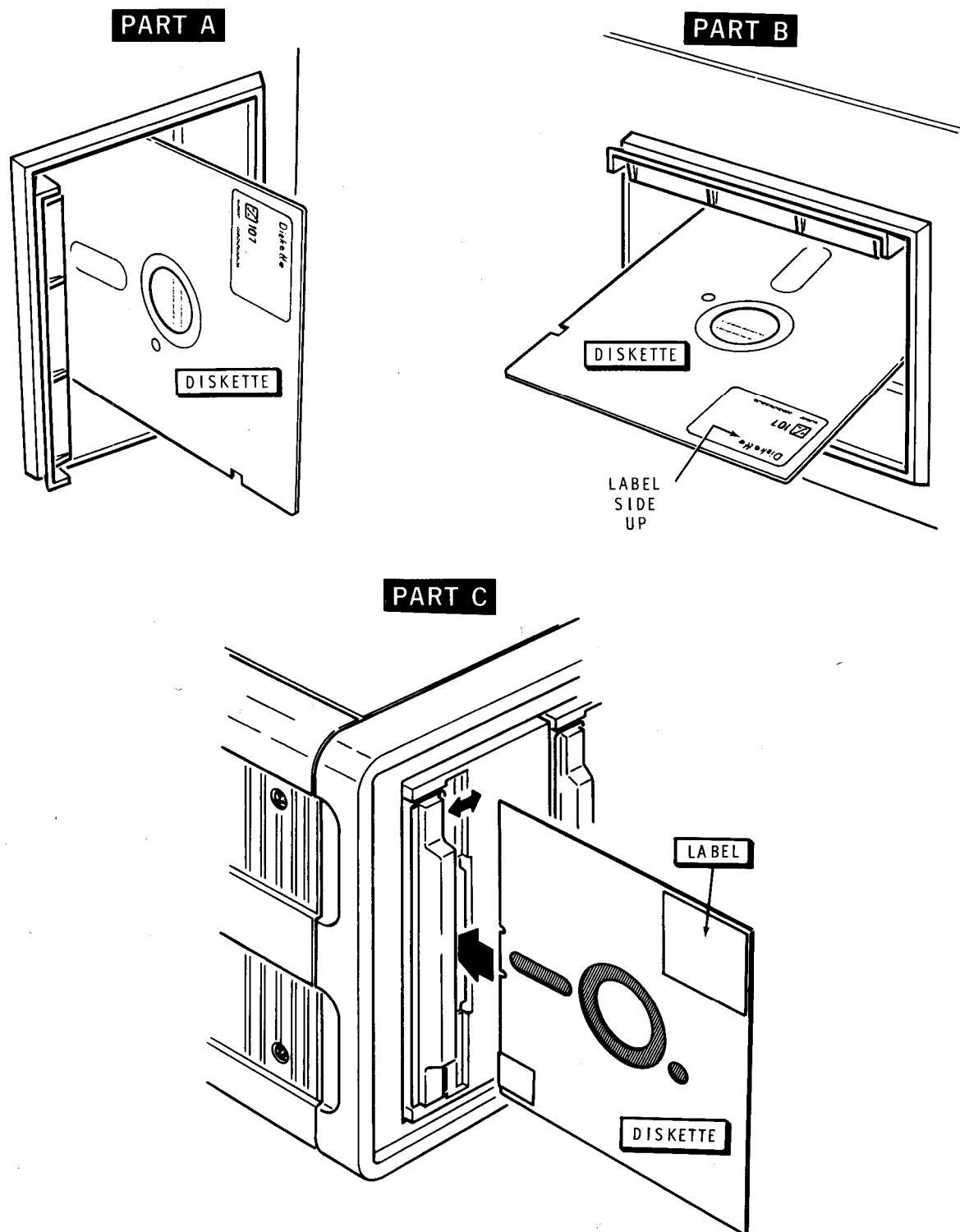


Figure 1-2  
Inserting Diskettes

- ( ) 4. Type the letter **B**. The computer will print "oot".
- ( ) 5. Press the **RETURN** key. (**RETURN** will hereafter be referred to as **@**). You should hear some hissing and clicking noises from the disk drive. This is normal. You will hear such sounds whenever the disk drive unit reads from or writes to the diskette.
- ( ) 6. If you are using the MTR-88 ROM with your H89, HDOS will now print the message:

TYPE SPACES TO DETERMINE BAUD RATE.

Regardless of whether the terminal displays the message, press the **space bar** until the message "ACTION? <BOOT>". is printed. Don't be concerned if you get some "ACTION? <BOOT> HELP" messages. You haven't damaged anything.

- ( ) 7. Type a **@**. The computer will print "BOOT" next to "ACTION? <BOOT>"
- ( ) 8. HDOS will print the message "SYSTEM HAS NNK OF RAM". The number preceding the "K" tells you how many kilobytes of random access memory your computer has. Then the system will print:

HDOS VERSION 2.0  
ISSUE #50.06.00  
DATE (17-DEC-80)?

- ( ) 9. Enter today's date in the format DD-MMM-YY. DD is a two-digit "day", MMM is a three-letter "month", and YY is a two-digit "year". Separate day, month, and year with hyphens. Thus, if today's date were September 3, 1981, you would enter:

DATE (17-DEC-80)? 03-SEP-81

After entering the date, type **@**. If you make a mistake in entering the date, the computer will print:

ENTER DATE AS DD-MMM-YY (I.E., 02-JUL-77)

If you receive this message, just type the correct date after it and type **@**.

( ) 10. The system will print:

VOLUME 000, MOUNTED ON SY0:  
LABEL: HEATH HDOS 2.0 ISSUE #50.06.00  
(COPYRIGHT(C) HEATH CO 1980)890-64

A ">" will appear. This means that HDOS awaits your instructions.

Leave the diskette in the drive and go on to Step 2, "INIT" on Page 1-21.

## H8 BOOTSTRAP

## Step 1B

One of the primary functions of a computer operating system is to enable the various physical parts of the computer to cooperate toward the execution of your commands. In order for this cooperation to take place, there must be communication between HDOS (software) and the physical parts of the computer (hardware). The computer cannot execute any command unless HDOS is communicating with the hardware.

Bootstrap is a small program stored within the hardware which serves to establish a communications link between HDOS and the various physical parts of the computer. The bootstrap procedure is so named because, by means of this procedure, you will be causing HDOS to "pull itself up by its bootstraps" -- that is, the responses you give in this procedure will enable HDOS to lift itself off the diskette and into the computer's memory. Having been installed in memory, HDOS can then issue instructions to and coordinate the actions of the appropriate parts of the computer in response to your commands.

**This procedure will be referred to several times throughout the HDOS Manuals.  
Be sure to perform the sequence correctly.**

NOTE: Do not insert any diskette before applying power.

- ( ) 1. Apply power to your H8 and your terminal.
- ( ) 2. Apply power to your disk drives.
- ( ) 3. Install the distribution diskette in the disk drive unit that has been hardware configured as primary boot drive 0; See Figure 1-2. Close the door of the drive unit after you have inserted the diskette.
- ( ) 4A. If you are using the XCON8 ROM with your H8, press the **1** key on the H8 front panel. The front panel LEDs will display:

Pri H17

- B. If you are using the PAM-8 GO ROM with your H8, press the **GO** key. Drive 0 of the H17 should be selected.
- C. If you are using the PAM-8 ROM with your H8, use the front panel to load 030 000 into the program counter register. To do this:
  - I. Press the **REG** button.
  - II. Press the **PC** button.
  - III. Press the **ALTER** button.
  - IV. Enter the numbers **030 000**
  - V. Press the **ALTER** button again.
  - VI. Press the **GO** button.

If you make a mistake in entering the numbers, press **RST/Ø** and **Ø** and repeat instructions I through VI. When you have finished, drive 0 of the H17 will be selected.

Regardless of what you enter at the H8 front panel, after drive 0 has been selected the H8 front panel LEDs will display:

SPACE

if you have an H8-4 card installed.

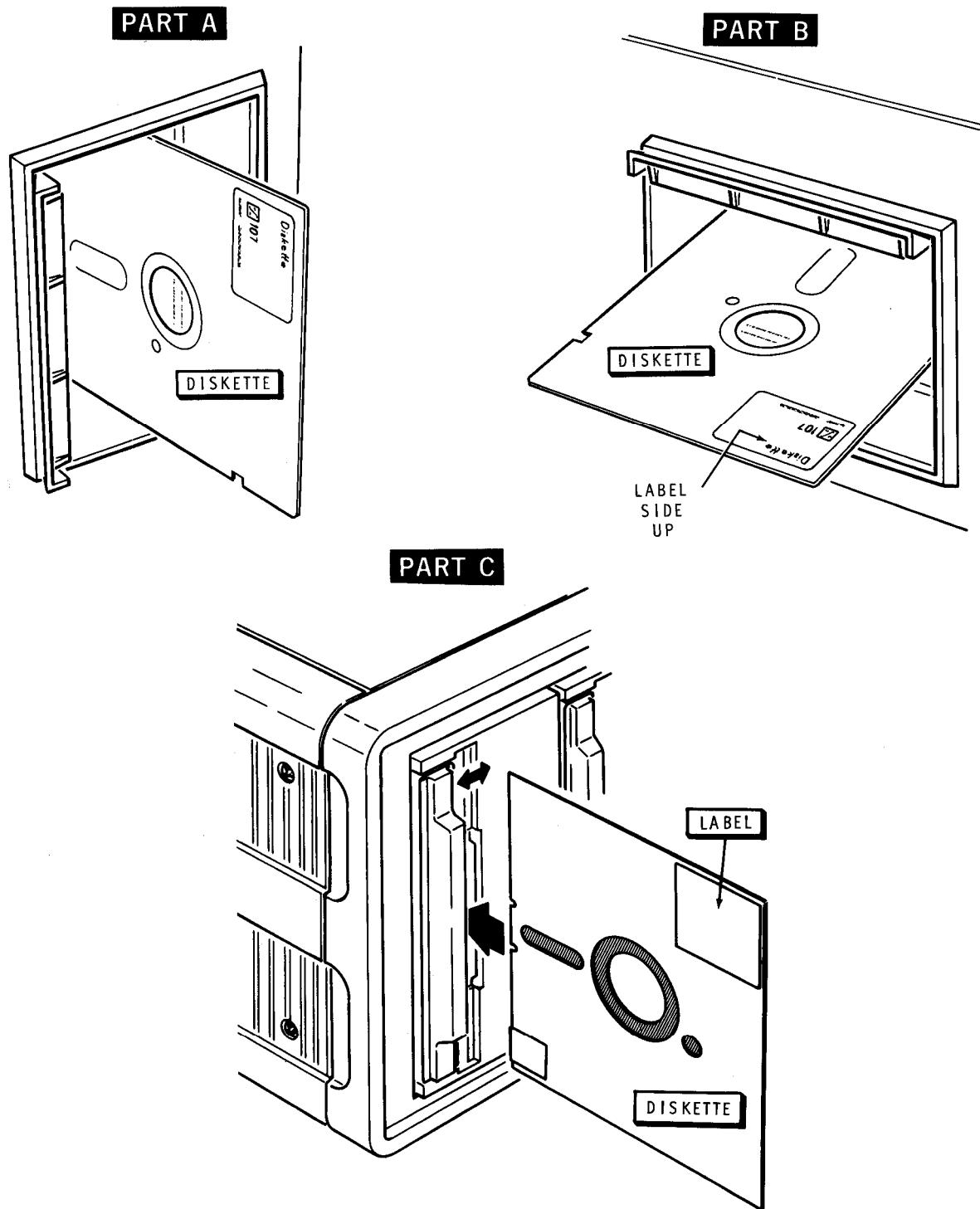


Figure 1-2  
Inserting Diskettes

- ( ) 5. Press the space bar until the message "ACTION? <BOOT>" is printed on the terminal screen. Don't be concerned if you get some "ACTION? <BOOT> HELP" messages. You haven't damaged anything.
- ( ) 6. Type a **⑧**. The computer will print "BOOT" next to "ACTION? <BOOT>". You should hear some hissing and clicking noises from the disk drive. This is normal. You will hear such sounds whenever the disk drive unit reads from or writes to the diskette.
- ( ) 7. HDOS will print the message "SYSTEM HAS nnK OF RAM". The number preceding the "K" tells you how many kilobytes of random access memory (RAM) your computer has. Then the system will print:

HDOS VERSION 2.0  
ISSUE #50.06.00  
DATE (17-DEC-80)?

- ( ) 8. Enter today's date in the format DD-MMM-YY. DD is a two-digit "day", MMM is a three-letter "month", and YY is a two-digit "year". Separate day, month, and year with hyphens. Thus, if today's date were September 3, 1981, you would enter:

DATE (17-DEC-80)? 03-SEP-81

After entering the date, type **⑧**. If you make a mistake in entering the date, the computer will print:

ENTER DATE AS DD-MMM-YY (I.E., 02-JUL-77)

If you receive this message, just enter the correct date next to it and type **⑧**.

- ( ) 9. The system will print:

VOLUME 000, MOUNTED ON SYD:  
LABEL: HEATH HDOS 2.0 ISSUE #50.06.00  
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A ">" will appear. This means that HDOS awaits your commands.

Leave the diskette in the drive and go on to Step 2, "INIT," which follows immediately.

**INIT****Step 2**

INIT is an abbreviation for initialization, a program designed to write a "map" on the diskette which HDOS will use to locate, store, and retrieve files. Since HDOS needs this map to locate files, it is necessary to initialize all blank diskettes and those diskettes that have been run through the TEST17 procedure (Step 3). In SYSGEN (Step 5), you will copy the file that contains the INIT program onto your system volume. Thereafter, you will be able to substitute a system volume for the distribution diskette throughout this procedure. For now, however, you should have the distribution diskette installed in SY0:.

INIT is a conversational program in that it will ask you questions to help you decide what you want to do. If this is your first time through INIT, you will doubtless find the questions helpful. If you are an experienced INIT user, refer to "INIT Options" on Page 1-75.

- ( ) 1. At the HDOS prompt ">", type INIT **⑧**.
- ( ) 2. INIT will display a description of itself. Below this description, the message "PROCEED (YES/NO) <NO>?" will be printed. Type YES and **⑧**. The following will be displayed:

DISMOUNTING ALL DISKS:

VOLUME 000, DISMOUNTED FROM SY0:  
LABEL: HEATH HDOS 2.0 ISSUE #50.06.00  
(COPYRIGHT(C) HEATH CO 1980)890-64

REMOVE THE DISK(S). HIT RETURN WHEN READY:

- ( ) 3. Remove the distribution diskette and type **⑧**.
- ( ) 4. When the query "DEVICE<SY0:>?", is displayed, press **⑧**. The system will now print:

INSERT THE VOLUME YOU WISH TO INITIALIZE INTO  
SY0:; REMEMBER, ANY DATA ON THIS VOLUME WILL  
BE DESTROYED.

HIT RETURN WHEN READY.  
READY?

- ( ) 5. Insert one of the blank diskettes and type **Q**. The computer will print:

THE VOLUME NOW IN THE DRIVE . . .  
APPARENTLY HAS NOT BEEN INITIALIZED BEFORE

TYPE NO TO CANCEL, TYPE YES TO ERASE AND INITIALIZE THE  
DISK. (YES/NO) ?

- ( ) 6. Type **YES** and **Q**.

- ( ) 7. The computer will now ask you to enter a volume serial number. Type **1** and **Q**.

- ( ) 8. When asked to enter a volume label, type **SYSTEM VOLUME** and **Q**.

- ( ) 9. When the question "SECTOR?" has been printed, type **Q**. The system will then print:

DISK INITIALIZATION COMPLETE.

INSERT THE VOLUME YOU WISH TO INITIALIZE INTO  
**SY0:**; REMEMBER, ANY DATA ON THIS VOLUME WILL  
BE DESTROYED.

HIT RETURN WHEN READY:  
READY?

- ( ) 10. Remove the disk you have just initialized. With a felt-tip pen (not pencil or ballpoint pen) write the volume number (1) and name (SYSTEM VOLUME) on a label and affix the label to the diskette.

- ( ) 11. Insert the other blank diskette and type **④**.
- ( ) 12. When you are asked whether you want to cancel or initialize, type **YES** and **④**.
- ( ) 13. When you are prompted for a serial number, type **10** and **④**.
- ( ) 14. When you are prompted for a label, type **WORKING DISKETTE** and **④**.
- ( ) 15. When the message "SECTOR?" has been printed, type **④**.
- ( ) 16. You will again be instructed to insert a disk. Instead, hold down the **CTRL** key and type the letter **D**.
- ( ) 17. When the message "DEVICE<SY<sup>0</sup>:>?" appears, type **CTRL** and **D** again.
- ( ) 18. When asked if you have any more disks to initialize, type **④**.
- ( ) 19. Remove the disk. With a felt-tip pen (not pencil or hard-tipped pen), write the volume number (10), and name (WORKING DISKETTE) on some type of label, and affix the label to the diskette.

Insert the distribution diskette into SY<sup>0</sup>:, and go on to Step 3, "TEST17", which follows immediately.

**TEST17****Step 3**

- ( ) 1. After the message "INSTALL A BOOTABLE DISK IN SY0: . HIT RETURN TO REBOOT:", type **CR**.
- ( ) 2. Press the space bar until the message "ACTION<BOOT>" appears.
- ( ) 3. Type **CR**. The computer will print "BOOT" next to "ACTION? <BOOT>".
- ( ) 4. When the date is printed, just type **CR**.
- \*( ) 5. At the HDOS prompt (>), type **TEST17** and **CR**.
- ( ) 6. The TEST17 program will execute and instruct you to remove the disk. Remove the diskette and type a **CR**.
- ( ) 7. TEST17 will explain itself and ask if you wish to proceed. Type **YES** and **CR**.
- ( ) 8. When asked which drive you want tested, type **0** (zero) and **CR**.
- ( ) 9. A list of TEST17 options will be displayed. You will test the drive rotational speed first. To do this, type **T** and a **CR**.
- ( ) 10. When you are asked to insert a diskette, insert the diskette labeled **SYSTEM VOLUME** and type **CR**.
- ( ) 11. The computer will begin printing numbers on the screen. These numbers should range between 0.990 and 1.010. If you have an H8, TEST17 will display the numbers on the front panel LEDs. Examine the numbers for about 30 seconds, then hold down the **CTRL** key and type **C**.

If the numbers are not in this range, you will need to adjust the drive speed. Your "Operations Manual" describes the procedure for adjusting drive speed in the section entitled "Rotational Speed Test". This information is also given in "TEST17" in the section entitled "Drive Speed" (see Page 1-79).

- ( ) 12. The list of options will be displayed again. Request the seek-time test by typing an **S** and **CR**.

- ( ) 13. When asked if you wish to proceed, type YES and a **Q**.

The seek time test will take from three to fifteen minutes. The computer will print the message "TRYING NN MILLISECONDS PER TRACK" as it attempts to read from the diskette at various speeds. If the drive is able to read the diskette on a given pass, the computer will print "OK" after the "TRYING NN MILLISECONDS PER TRACK" message, and will then attempt another speed. When this test is complete, the computer will substitute a number for "nn" in the message "DRIVE PERFORMS RELIABLY AT NN MILLISECONDS PER TRACK". Write this number on the following line:

Fastest reliable step time is  
12 milliseconds/track.

NOTE: If the seek-time test manages to attempt a seek rate of 10 milliseconds per track or higher (e.g., 8 milliseconds/track), it may not print the "DRIVE PERFORMS RELIABLY AT NN MILLISECONDS PER TRACK" message, but instead may simply stop execution. If the test attempts a speed of 10 milliseconds per track or higher, but fails to print the "DRIVE PERFORMS RELIABLY AT NN MILLISECONDS PER TRACK" message, then the fastest reliable seek time is 12 milliseconds/track. If the test stops executing without printing any message, type CTRL-C before proceeding to Instruction 14.

- ( ) 14. The list of options will be displayed again. Select the media check option by typing **M** and a **Q**.

The media check will take about 10 minutes. When this test is complete, a list of bad sectors will be displayed. Write the number of each bad sector on the following line:

Bad sectors on SYSTEM VOLUME:20

- ( ) 15. The list of options will be displayed again. This time, you will run the general drive checkout. Type **D** and a **⑨**.

The general drive checkout will take about 40 minutes, and should be allowed to run completely. At the end of each pass, (there are 3), it will print the following message:

ABCDEFG END OF PASS n

If there are any numbers printed between the letters in this message, you had some errors. Refer to "TEST17" (Page 1-77) for further information.

- ( ) 16. When the list of options is redisplayed, type **U** and a **⑨**. This will restart the program, so you can switch diskettes at a later step.
- ( ) 17. When asked if you wish to proceed, type **YES** and a **⑨**.
- ( ) 18. You will be asked which drive you want tested. Type **0** (zero) and a **⑨**.
- ( ) 19. When the list of test options is given, type **M** and a **⑨**. This is the media check option. It is good practice to run the media check on every diskette that you use. It tells you which sectors on the diskette, if any, are bad. Later, in INIT, you can instruct HDOS not to write to those sectors.
- ( ) 20. When you are instructed to insert the disk you want to use for this test, remove the diskette in the drive and replace it with the diskette labelled WORKING DISKETTE. Then type **⑨**.
- ( ) 21. If the media check discovers any bad sectors, the list of them will be displayed. Write each sector number here for later use:

Bad sectors on WORKING DISKETTE: \_\_\_\_\_

- ( ) 22. When the list of test options is redisplayed, type **E** and a **⑨**. This will exit you from the TEST17 program.
- ( ) 23. Remove the diskette and replace it with the distribution diskette.

Go on to Step 4, "Re-initialization."

**Re-Initialization****Step 4**

Since TEST17 destroyed the formatting on the diskette, it is necessary to reinitialize the diskettes before you progress. Using TEST17 was nevertheless a worthwhile precaution, since the tests confirmed the quality of the diskette.

- ( ) 1. After the message "INSTALL A BOOTABLE DISK IN SY<sub>0</sub>: HIT RETURN TO REBOOT", type a **CR**.
- ( ) 2. Press the space bar until the message "ACTION? <BOOT>" appears.
- ( ) 3. Type **CR**. HDOS will print "BOOT" next to "ACTION? <BOOT>".
- ( ) 4. When the date has been printed, type **CR**.
- \* ( ) 5. At the HDOS prompt (>), type INIT SY<sub>0</sub>: and a **CR**.
- ( ) 6. When you are asked to insert the volume you wish to initialize into SY<sub>0</sub>: , insert the SYSTEM VOLUME into SY<sub>0</sub>: and type **CR**.
- ( ) 7. HDOS will identify the volume and ask if you wish to proceed. Type **YES** and **CR**.
- ( ) 8. When asked for a volume number, type **1** and **CR**.
- ( ) 9. When you are asked for a volume name, type **SYSTEM VOLUME** and **CR**.
- ( ) 10. When the question "SECTOR?" has been printed, enter the numbers of any bad sectors that were discovered during the M option of the TEST17 program. End each entry with **CR**. If the test discovered no bad sectors on the SYSTEM VOLUME, just type **CR**.
- ( ) 11. After the message "DISK INITIALIZATION COMPLETE" has been printed, remove the SYSTEM VOLUME and replace it with the WORKING DISKETTE. Then type **CR**.
- ( ) 12. INIT will identify itself and ask if you wish to proceed. Type **YES** and **CR**.

- ( ) 13. When asked for a volume number, type **10** and **CR**.
- ( ) 14. When asked for a volume label, type **WORKING DISKETTE** and **CR**.
- ( ) 15. When the question "SECTOR?" is printed, enter the numbers of any bad sectors on the WORKING DISKETTE that were discovered during the M option of the TEST17 program. If the test discovered no bad sectors on the WORKING DISKETTE, just type **CR**.
- ( ) 16. You will again be asked to insert a disk. Instead, type **CTRL** and **D**.
- ( ) 17. When the message "DEVICE<SYN:>?" appears, type **CTRL** and **D** again.
- ( ) 18. When asked if you have any more disks to initialize, type **NO** and **CR**.

Remove the disk and go on to Step 5, "SYSGEN."

**SYSGEN****Step 5**

SYSGEN is an abbreviation for "System Generation". In this procedure, you will copy HDOS system files from the distribution diskette to your SYSTEM VOLUME. After performing this procedure, you will be able to substitute the SYSTEM VOLUME into any of the preceding steps that formerly required the distribution diskette. If you have performed this procedure before, refer to "SYSGEN Options", on Page 1-88.

- ( ) 1. Insert the distribution diskette into SY0: and perform Bootstrap. Refer to Step 1A or 1B if you need help.
- \*( ) 2. After the HDOS prompt (>), type **SYSGEN△\*.\*** and **⑧**. HDOS will print:

SYSGEN  
VERSION: 2.0  
ISSUE: #50.06.00

DESTINATION DEVICE <SY0:>?

- ( ) 3. Type **⑧** after the "DESTINATION DEVICE <SY0:>?" message. The system will print:

DISMOUNTING ALL DISKS:

VOLUME 000, DISMOUNTED FROM SY0:  
LABEL: HEATH HDOS 2.0 ISSUE #50.06.00  
(COPYRIGHT(C) HEATH CO 1980)890-64

REMOVE THE DISK(S). HIT RETURN WHEN READY:

- ( ) 4. Ignore this instruction to remove the disk and type **④**. The screen will display:

INSERT THE SOURCE DISKETTE IN SY<sub>D</sub>: HIT  
RETURN WHEN READY:

- ( ) 5. Just type **④**. The distribution diskette is the source diskette.

When you are asked to insert the destination diskette, insert the SYSTEM VOLUME. You do not need to type **④**. SYSGEN will continue copying when you close the drive door. However, if you do type **④** after inserting the disk, don't worry. You haven't damaged anything.

When asked to insert the source, insert the distribution diskette.

SYSGEN is complete when the computer prints the message

| 3 "NN FILES COPIED".

- ( ) 6. At the message

INSTALL A BOOTABLE DISK IN SY<sub>D</sub>: HIT RETURN TO REBOOT

leave the SYSTEM VOLUME installed, press RETURN, and then perform the bootstrap procedure.

Go on to Step 6, "SET".

**SET****Step 6**

NOTE: Perform this step only if you have a video terminal capable of lower-case display and backspacing, such as the H19 or H89 computer.

Otherwise, proceed to Step 7, "Preparing a WORKING DISKETTE".

This section will enable you to communicate effectively with HDOS by using some special features of your computer.

- \*( ) 1. At the HDOS prompt ">", type **SETATT:ABKS** and **⑧**. This instructs the system to allow you to backspace (using the BACKSPACE, DELETE, or RUBOUT key) in order to delete characters.
- ( ) 2. At the next ">", type **SETATT:NOMLI** and **⑧**. This instructs the system to allow you to input lower case letters as well as upper case.
- ( ) 3. At the next prompt, type **SETATT:NOMLO** and **⑧**. This tells HDOS to display all lower case input as lower case output.

For more information about the SET command and SET options, refer to the SET section of Chapter Two.

Leave the SYSTEM VOLUME in the drive and go on to Step 7, "Preparing a WORKING DISKETTE."

**PREPARING A WORKING DISKETTE****Step 7**

In this section you will prepare a system volume which will contain only the most essential HDOS system files, BASIC, error messages, and the Help files. This disk will not contain INIT, SYSGEN, and TEST, but by excluding such programs, you will be able to use the space they would have occupied for storing BASIC programs. Since this disk will contain the essential HDOS system files, you will be able to use it to perform Bootstrap.

- ( ) 1. At the HDOS prompt ">", type **SYSGEN** and **@**.
- ( ) 2. When the message "DESTINATION DEVICE <SYD:>?" is printed, just type **@**.
- ( ) 3. The system will instruct you to remove the disks. Instead, type **@**.
- ( ) 4. When you are instructed to insert the source diskette, just type **@**. The SYSTEM VOLUME is the source diskette.

When asked to insert the destination, insert your WORKING DISKETTE. You do not have to type **@**. SYSGEN will continue copying when you close the drive door.

When asked to insert the source, insert your SYSTEM VOLUME.

You should finish with the destination (WORKING DISKETTE) installed.

- ( ) 5. Remove the WORKING DISKETTE and insert the SYSTEM VOLUME.

- ( ) 6. Type **@** and reboot the system. You will not need to press the space bar this time. You will only need to type spaces when you boot from a write-protected disk, or from a newly-created disk.
- ( ) 7. At the HDOS prompt ">", type **ONECOPY** and **@**.
- ( ) 8. The system will again instruct you to remove the disk. Do not remove the disk. Just type **@**.
- ( ) 9. When asked to insert the source disk, just type **@**.
- ( ) 10. The prompt ":OC:" will appear. Type **BASIC.ABS** and **@**.

When the program tells you to insert the destination, insert the WORKING DISKETTE. You do not need to type **@**. ONECOPY will begin copying when you close the drive door.

When the program tells you to insert the source, insert the SYSTEM VOLUME.

You should finish with the source (SYSTEM VOLUME) installed and the ":OC:" prompt displayed.

- ( ) 11. At the ":OC:" prompt, type **CTRL-D**.

This finishes the System Set-Up Procedure.

If you have an H14, H24, or H44 line printer, remove the disk and go on to Step 8, "Configuring Line Printers." Otherwise, leave the diskette in the drive and go on to Step 9, "Power-Down."

**Configuring Line Printers****Step 8**

If you have an H14, H24, or H44 line printer, this section will instruct you how to incorporate it into your system.

- ( ) 1. Make certain that the jumpers on your serial I/O card are configured for address 340Q (0E0H). If you have a WH-89, these jumpers are preset. If you need to set the jumpers, turn off the power, set the jumpers, and then continue this procedure.
- ( ) 2. Insert your SYSTEM VOLUME and boot-up the system.
- ( ) 3. At the HDOS prompt ">", type **ONECOPY** and **@**.
- ( ) 4. ONECOPY will instruct you to remove the disk(s). Remove the SYSTEM VOLUME and type **@**.
- ( ) 5. ONECOPY will describe itself and ask you to insert the initial source disk. Insert your SOFTWARE TOOLS disk and type **@**.
- ( ) 6. At the :OC: prompt, type **LPH???.DVD/L/S** and **@**. The following will be printed:

NAME	EXT	SIZE	DATE	FLAGS
LPH14	.DVD	7	7-OCT-80	S
LPH24	.DVD	7	7-OCT-80	S
LPH44	.DVD	7	7-OCT-80	S

3 FILES, USING 21 SECTORS (0 FREE)

This is a directory listing of all the line-printer device driver files. HDOS uses these files to communicate with peripherals. Which of these files you need will depend upon what kind of line printer you have. For instance, if you have an H14, you need file LPH14.DVD. If you have a Diablo printer, you will use file LPH44.DVD.

- ( ) 7. If you have an H14 line printer, type **LPH14.DVD** and **@**.  
If you have an H24 line printer, type **LPH24.DVD** and a **@**.  
If you have an H44 line printer, type **LPH44.DVD** and **@**.

- ( ) 8. ONECOPY will now instruct you to insert a destination disk. Insert your WORKING DISKETTE. You do not need to type **⑧**.
- ( ) 9. When you are instructed to insert the source, insert your SOFTWARE TOOLS DISK. After you have done this, ONECOPY should display the message "1 FILES COPIED".
- ( ) 10. The :OC: prompt will be redisplayed. At the :OC: prompt, type **CTRL-D**.
- ( ) 11. After the message "INSTALL A BOOTABLE DISK IN SY<sub>D</sub>: HIT RETURN TO REBOOT", has been displayed, remove the SOFTWARE TOOLS disk.
- ( ) 12. Insert your WORKING DISKETTE, type a **⑧** and reboot the system.
- ( ) 13. When the HDOS prompt (>) is displayed:
  - If you have an H14 line printer, type  
**RENAME △ LP.DVD=LPH14.DVD** and **⑧**.
  - If you have an H24 line printer, type  
**RENAME △ LP.DVD=LPH24.DVD** and **⑧**.
  - If you have an H44 line printer, type  
**RENAME △ LP.DVD=LPH44.DVD** and **⑧**.

- ( ) 14. At the HDOS prompt (>), type **BYE** and **⑧**.

HDOS will now recognize commands to LP:. For more information about configuring line printers and other peripherals, refer to the "Peripherals" section of Chapter Two.

Leave the diskette in the drive and go on to Step 9, "Power-Down."

**Power-Down****Step 9**

Part of the operating system resides in memory at all times, and part of it resides on the diskette. Any alterations you have made to the portion of the system that is being stored in memory may or may not have been written to the diskette. Thus, whenever you are finished using your computer, use one of the following procedures to ensure that any configuration changes you have made to the system are written back to the disk.

If the message "INSTALL A BOOTABLE DISK IN SY0: HIT RETURN TO REBOOT" is displayed on the terminal, it is always safe to remove the diskette and turn off the power. Be sure that you remove all diskette(s) before turning off the power, since diskettes left in the drives during power-down may be magnetically damaged.

If the HDOS prompt (>) is displayed on the terminal:

1. Type **BYE** and **@@**.
2. When the message "INSTALL A BOOTABLE DISK IN SY0: . HIT RETURN TO REBOOT" has been printed, remove all disks.
3. Turn off the power to the computer and drives.

Go on to "Summary" on Page 1-60.

## Procedure B

### Setting Up a System with 8-inch Disk Drives

NOTE: Procedure B assumes you have your hardware configured so that 8-inch drives are primary.

You should have four disks: two of your own, a disk labeled DEVICE DRIVERS, and another disk labeled HEATH DISK OPERATING SYSTEM. This HEATH DISK OPERATING SYSTEM disk is the distribution disk. The distribution disk contains all the files necessary to run HDOS, and it is from it that you will generate your system volume.

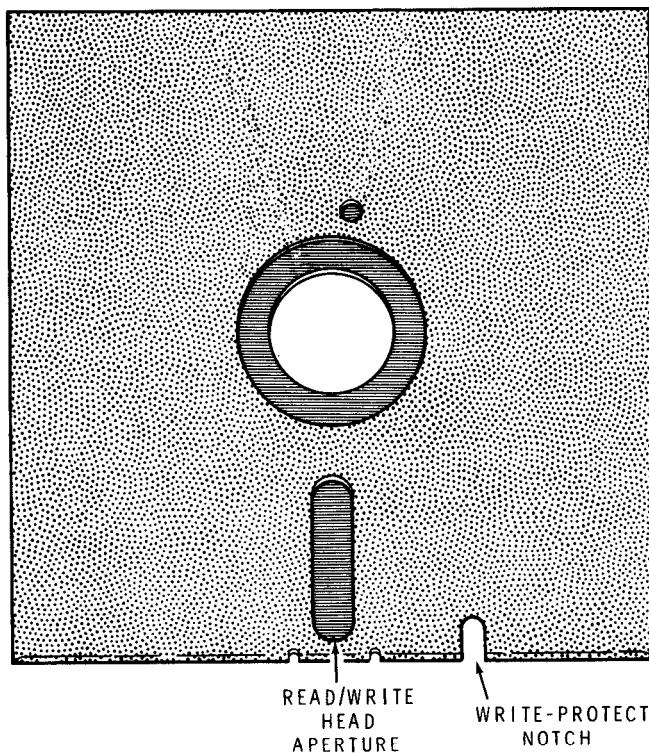


Figure 1-3  
8-Inch Distribution Disk

The DEVICE DRIVERS disk contains the source code for the Heath device drivers and the HDOS assembler common decks. You will not need the device driver source disk to perform the steps in Procedure B, so it would probably be a good idea to put it in some safe place.

In addition to the two Heath-supplied disks, you will need at least two write-enabled blank disks of your own. To write-enable an 8-inch disk, place a tab or piece of opaque tape over the write-protect notch (see Figure 1-3, above). Do NOT write-enable either the DEVICE DRIVERS or distribution disk.

If you have an H8, omit this section and go on to Step 1B, H8 Bootstrap.

**This procedure will be referred to several times in the HDOS Manuals. Be sure to perform the sequence correctly.**

### H89 BOOTSTRAP

### Step 1A

One of the primary functions of a computer operating system is to enable the various physical parts of the computer to cooperate toward the execution of your commands. In order for this cooperation to take place, there must be communication between HDOS (software) and the physical parts of the computer (hardware). The computer cannot execute any command unless HDOS is communicating with the hardware.

Bootstrap is a small program stored within the hardware which serves to establish a communications link between HDOS and the various physical parts of the computer. The bootstrap procedure is so named because, by means of this procedure, you will be causing HDOS to "pull itself up by its bootstraps" -- that is, the responses you give in this procedure will enable HDOS to lift itself off the diskette and into the computer's memory. Having been installed in memory, HDOS can then issue instructions to and coordinate the actions of the appropriate parts of the computer in response to your commands.

NOTE: Do not insert any diskette before applying power to the disk drives.

- ( ) 1. Make sure the off-line key is up. This connects the terminal keyboard to the computer.
- ( ) 2. Turn on the power to the computer and all disk drives. You should hear one or two beeps and see "H:" in the upper left-hand corner of the terminal screen. Press the **right SHIFT** key and the **RESET** key simultaneously and note how the "H:" reappears after you type these keys. **SHIFT** and **RESET** will always return you to this H: at the beginning of the Bootstrap procedure.
- ( ) 3. Insert the distribution diskette into the drive that has been hardware configured as primary boot drive **8** (see Figure 1-2). Close the door of the drive unit after you have inserted the diskette.

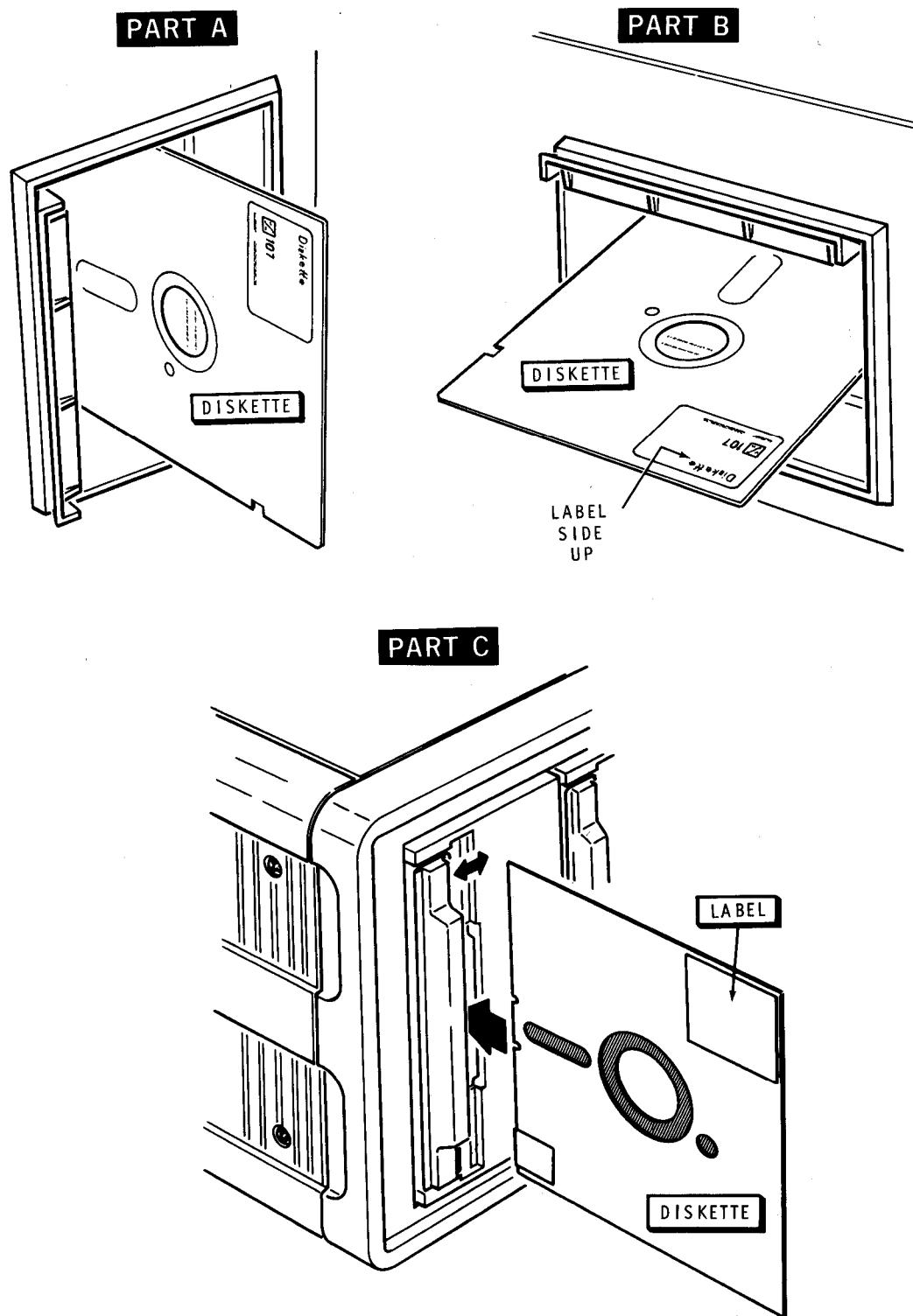


Figure 1-2  
Inserting Diskettes

- ( ) 4. Type the letter **B**. The computer will print "Boot".
- ( ) 5. Press the **RETURN** key. (**RETURN** will hereafter be referred to as **@**). You should hear some hissing and clicking noises from the disk drive. This is normal. You will hear such sounds whenever the disk drive unit reads from or writes to the diskette.
- ( ) 6. Press the space bar until the message "ACTION? <BOOT>" is printed. Don't be concerned if you get some "ACTION? <BOOT> HELP" messages. You haven't damaged anything.
- ( ) 7. Type a **@**. The computer will print "BOOT" next to "ACTION? <BOOT>".
- ( ) 8. HDOS will print the message "SYSTEM HAS NNK OF RAM". The number preceding the "K" tells you how many kilobytes of Random Access Memory your computer has. Then the system will print:

HDOS VERSION 2.0  
ISSUE #50.06.00  
DATE (17-DEC-80)?

- ( ) 9. **Enter today's date** in the format DD-MMM-YY. DD is a two-digit "day", MMM is a three-letter "month", and YY is a two-digit "year". Separate day, month, and year with hyphens. Thus, if today's date were September 3, 1981, you would enter:

DATE (17-DEC-80)? 03-SEP-81

After entering the date, type **@**. If you make a mistake in entering the date, the computer will print:

ENTER DATE AS DD-MMM-YY (I.E., 02-JUL-77)

If you receive this message, just type the correct date after it and type **@**.

- ( ) 10. The system will print:

VOLUME 000, MOUNTED ON SYD:  
LABEL: HEATH HDOS 2.0 ISSUE #50.06.00  
(COPYRIGHT(C) HEATH CO 1980)890-105

A “>” will appear. This means that HDOS awaits your instructions.

Leave the diskette in the drive and go on to Step 2, “INIT.”

This procedure will be referred to several times in the HDOS Manuals. Be sure to perform the sequence correctly.

## H8 BOOTSTRAP

### Step 1B

One of the primary functions of a computer operating system is to enable the various physical parts of the computer to cooperate toward the execution of your commands. In order for this cooperation to take place, there must be communication between HDOS (software) and the physical parts of the computer (hardware). The computer cannot execute any command unless HDOS is communicating with the hardware.

Bootstrap is a small program stored within the hardware which serves to establish a communications link between HDOS and the various physical parts of the computer. The bootstrap procedure is so named because, by means of this procedure, you will be causing HDOS to "pull itself up by its bootstraps" -- that is, the responses you give in this procedure will enable HDOS to lift itself off the diskette and into the computer's memory. Having been installed in memory, HDOS can then issue instructions to and coordinate the actions of the appropriate parts of the computer in response to your commands.

NOTE: Do not insert any diskette before applying power.

- ( ) 1. Apply power to your H8 and your terminal.
- ( ) 2. Apply power to your disk drives.
- ( ) 3. Install the distribution diskette in the disk drive unit that has been hardware configured as primary boot drive 0 (see Figure 1-2). Close the door of the drive unit after you have inserted the diskette.

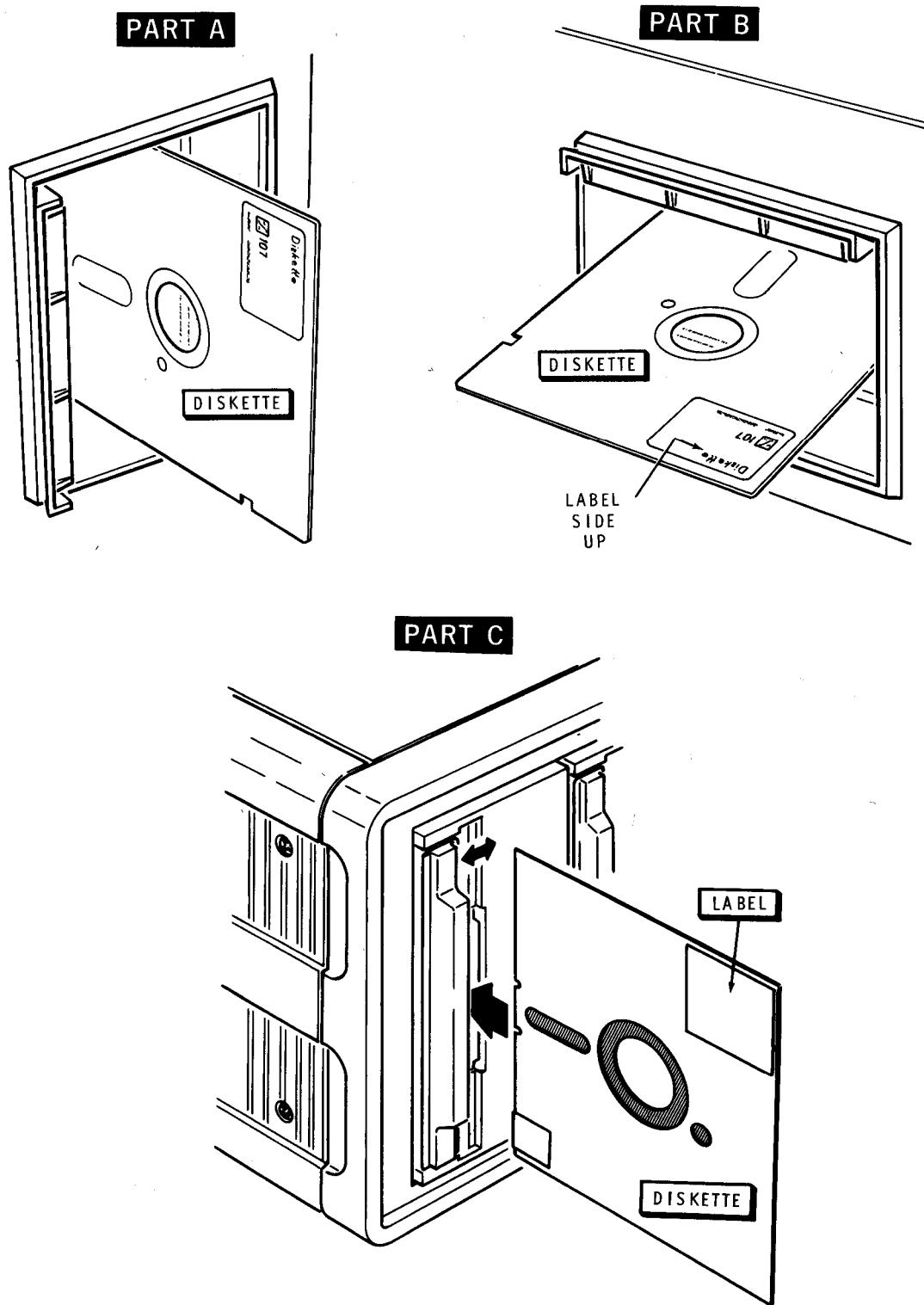


Figure 1-2  
Inverting Diskettes

- ( ) 4. Press the **1** key on the H8 front panel. The LEDs will display:

Pri H47

- ( ) 5. **Press the space bar** until the message "ACTION? <BOOT>" is printed on the terminal screen. Don't be concerned if you get some "ACTION? <BOOT> HELP" messages. You haven't damaged anything.
- ( ) 6. Type a **2**. The computer will print "BOOT" next to "ACTION? <BOOT>". You should hear some hissing and clicking noises from the disk drive. This is normal. You will hear such sounds whenever the disk drive unit reads from or writes to the diskette.
- ( ) 7. HDOS will print the message "SYSTEM HAS nnK OF RAM". The number preceding the "K" tells you how many kilobytes of random access memory (RAM) your computer has. Then the system will print:

HDOS VERSION 2.0  
ISSUE #50.06.00  
DATE (17-DEC-80)?

- ( ) 8. Enter today's date in the format DD-MMM-YY. DD is a two-digit "day", MMM is a three-letter "month", and YY is a two-digit "year". Separate day, month, and year with hyphens. Thus, if today's date were September 3, 1981, you would enter:

DATE (17-DEC-80) ? 03-SEP-81

After entering the date, type **@**. If you make a mistake in entering the date, the computer will print:

ENTER DATE AS DD-MMM-YY (I.E., 02-JUL-77)

If you receive this message, just enter the correct date next to it and type **@**.

- ( ) 9. The system will print:

VOLUME 000, MOUNTED ON SY<sub>D</sub>:  
LABEL: HEATH HDOS 2.0 ISSUE #50.06.00  
(COPYRIGHT(C) HEATH CO 1980)890-105

A ">" will appear. This means that HDOS awaits your commands.

Leave the diskette in the drive and go on to Step 2, "INIT," which follows immediately.

## INIT

## Step 2

INIT is an abbreviation for initialization, a program designed to write a "map" on the diskette which HDOS will use to locate, store, and retrieve files. Since HDOS needs this map to locate files, it is necessary to initialize all blank diskettes and those diskettes that have been run through the TEST47 procedure (Step 3). In SYSGEN (Step 5), you will copy the file that contains the INIT program onto your system volume. Thereafter, you will be able to substitute a system volume for the distribution diskette throughout this procedure. For now, however, you should have the distribution diskette installed in SY $\emptyset$ :

INIT is a conversational program in that it will ask you questions to help you decide what you want to do. If this is your first time through INIT, you will doubtless find the questions helpful. If you are an experienced INIT user, refer to "INIT Options" (Page 1-75).

- ( ) 1. At the HDOS prompt ">", type INIT and  $\textcircled{R}$ .
- ( ) 2. INIT will describe itself. Below this description program, the message "PROCEED (YES/NO) <NO>?" will be printed. Type YES and  $\textcircled{R}$ .

The following will be printed on the terminal:

DISMOUNTING ALL DISKS:

VOLUME 000, DISMOUNTED FROM SY $\emptyset$ :  
LABEL: HEATH HDOS 2.0 ISSUE #50.06.00  
(COPYRIGHT(C) HEATH CO 1980)890-105

REMOVE THE DISK(S). HIT RETURN WHEN READY:

- ( ) 3. Remove the distribution diskette and type  $\textcircled{R}$ .

- ( ) 4. When the query "DEVICE <SY<sub>D</sub>:>" is displayed, type **②**. The system will now print:

INSERT THE VOLUME YOU WISH TO INITIALIZE INTO  
SY<sub>D</sub>:; REMEMBER, ANY DATA ON THIS VOLUME WILL BE DESTROYED.

HIT RETURN WHEN READY.  
READY?

- ( ) 5. Insert one of the blank diskettes and type **②**. Make sure you have write-enabled the disk with a tab or opaque tape. After you have inserted the disk, the computer will print:

THE VOLUME NOW IN THE DRIVE ...  
APPARENTLY HAS NOT BEEN INITIALIZED BEFORE

TYPE NO TO CANCEL, TYPE YES TO ERASE AND  
INITIALIZE THE DISK. (YES/NO)?

- ( ) 6. Type **YES** and **②**.

- ( ) 7. The computer will now ask you to enter a volume serial number. Type **1** and **②**.

- ( ) 8. When asked to enter a volume label, type **SYSTEM VOL-**  
**UME** and **②**.

- ( ) 9. The system will now ask whether you want the initialized disk to be double density. Check the manufacturer's label on the blank diskette to determine whether it is single or double density. If the blank diskette is double density, and you want it formatted that way, type **②**. Otherwise, type **NO** and **②**.

- ( ) 10. When you are asked to enter the numbers of bad sectors, just type **②**. The system will then print:

DISK INITIALIZATION COMPLETE.

INSERT THE VOLUME YOU WISH TO INITIALIZE INTO  
SY<sub>D</sub>:; REMEMBER, ANY DATA ON THIS VOLUME WILL  
BE DESTROYED.

HIT RETURN WHEN READY:  
READY?

- ( ) 11. Remove the disk you have just initialized. With a felt-tip pen (not pencil or ballpoint pen) write the volume number (1) and name (SYSTEM VOLUME) on a label and affix the label to the diskette.
- ( ) 12. Insert the other blank diskette and type **Q**.
- ( ) 13. When you are asked whether you want to cancel or initialize, type **YES** and **Q**.
- ( ) 14. The computer will now ask you to enter a volume serial number. Type **10** and **Q**.
- ( ) 15. When asked to enter a volume label, type **WORKING DISKETTE** and **Q**.
- ( ) 16. The system will now ask whether you want the initialized disk to be double density. Check the manufacturer's label on the blank diskette to determine whether it is single or double density. If the blank diskette is double density, and you want it formatted that way, type **Q**. Otherwise, type **NO** and **Q**.
- ( ) 17. When the message "SECTOR?" has been printed, type **Q**.
- ( ) 18. You will again be instructed to insert a disk. Instead, hold down the **CTRL** key and type the letter **D**.
- ( ) 19. When the message "DEVICE<SYN:>?" appears, type **CTRL** and **D** again.
- ( ) 20. When asked if you have any more disks to initialize, type **NO** and **Q**.
- ( ) 21. Remove the disk. With a felt-tip pen (not pencil or hard-tipped pen), write the volume number (1), and name (WORKING DISKETTE) on some type of label, and affix the label to the diskette.

Go to Step 3, "TEST 47".

## TEST47

## Step 3

- ( ) 1. At the message "INSTALL A BOOTABLE DISK IN SY<sub>0</sub>: . HIT RETURN TO REBOOT:", insert the distribution disk in the left drive (SY<sub>0</sub>:) and type **②**.
- ( ) 2. Press the space bar until the message "ACTION? <BOOT>" is displayed.
- ( ) 3. Type **②**. The computer will print "BOOT" next to "ACTION? <BOOT>"
- ( ) 4. When the date is printed, just type **②**.
- \*( ) 5. At the HDOS prompt (>), type **TEST47** and **②**.
- ( ) 6. The TEST47 program will execute and instruct you to remove the disk. Remove the diskette and type a **②**.
- ( ) 7. TEST47 will explain itself and ask if you wish to proceed. Type **YES** and **②**.
- ( ) 8. When asked which drive you want tested, type **0** (zero) and **②**.
- ( ) 9. A list of TEST47 options will be displayed. You will run the media check first. To do this, type **M** and a **②**.
- ( ) 10. When you are asked to insert a diskette, insert the diskette labeled SYSTEM VOLUME and type **②**.
- ( ) 11. The media check will take about 20 minutes. When this test is complete, a list of bad sectors will be displayed. Write the number of each bad sector on the following line:

Bad sectors on SYSTEM VOLUME: \_\_\_\_\_

- ( ) 12. The list of options will be displayed again. This time, you will run the general drive checkout. Type **D** and a **@**.

The general drive checkout will take about 1 hour, and should be allowed to run completely. At the end of each pass, (there are 3), it will print the following message:

ABCDEFG END OF PASS n

If there are any numbers printed between the letters in this message, you had some errors. Refer to "TEST47" (Page 1-83) for further information.

- ( ) 13. When the list of options is redisplayed, type **U** and a **@**. This will re-start the program, so you can switch diskettes at a later step.
- ( ) 14. When asked if you wish to proceed, type **YES** and a **@**.
- ( ) 15. You will be asked which drive you want tested. Type **0** (zero) and a **@**.
- ( ) 16. When the list of test options is given, type **M** and a **@**. This is the media check option. It is good practice to run the media check on every diskette that you use. It tells you which sectors on the diskette, if any, are bad. Later, in INIT, you can instruct HDOS not to write to those sectors.
- ( ) 17. When you are instructed to insert the disk you want to use for this test, remove the diskette in the drive and replace it with the diskette labeled WORKING DISKETTE.
- ( ) 18. If there are any bad sectors, the list of them will be displayed. Write each sector number here for later use:

Bad sectors on WORKING DISKETTE: \_\_\_\_\_

- ( ) 19. When the list of test options is redisplayed, type **E** and a **@**. This will exit you from the TEST47 program.
- ( ) 20. Remove the diskette and replace it with the distribution diskette.

Go on to Step 4, "Re-Initialization."

**Re-Initialization****Step 4**

Since TEST47 destroyed the formatting on the diskette, it is necessary to reinitialize the diskettes before you progress. However, this step is a worthwhile precaution, since these tests confirmed the quality of the diskette.

- ( ) 1. After the message "INSTALL A BOOTABLE DISK IN SY0: HIT RETURN TO REBOOT", type a **⑧**, then type spaces and reboot the system.
- \*( ) 2. At the HDOS prompt (>), type **INIT SY0:** and a **⑧**.
- ( ) 3. When you are instructed to insert the volume you wish to initialize into SY0:, insert the SYSTEM VOLUME into SY0: and type **⑧**.
- ( ) 4. HDOS will identify the volume and ask if you still wish to proceed. Type **YES** and **⑧**.
- ( ) 5. When asked for a volume number, type **1** and **⑧**.
- ( ) 6. When you are asked for a volume name, type **SYSTEM VOLUME** and **⑧**.
- ( ) 7. The system will now ask whether you want the initialized disk to be double density. Check the manufacturer's label on the diskette to determine whether it is single or double density. If the diskette is double density, and you want it formatted that way, type **⑧**. Otherwise, type **NO** and **⑧**.
- ( ) 8. When the question "SECTOR?" is printed, enter the numbers of any bad sectors on the SYSTEM VOLUME that were discovered during the M option of the TEST47 program. Type **⑧** after each entry. If the test discovered no bad sectors on the SYSTEM VOLUME, just type **⑧**.
- ( ) 9. After the message "DISK INITIALIZATION COMPLETE" has been printed, remove the SYSTEM VOLUME and replace it with the WORKING DISKETTE. Then type **⑧**.
- ( ) 10. INIT will identify the diskette and ask if you wish to proceed. Type **YES** and **⑧**.

- ( ) 11. When asked for a volume number, type **10** and **CR**.
- ( ) 12. When asked for a volume label, type **WORKING DISKETTE** and **CR**.
- ( ) 13. The system will now ask whether you want the initialized disk to be double density. Check the manufacturer's label on the diskette to determine whether it is single or double density. If the diskette is double density, and you want it formatted that way, type **CR**. Otherwise, type **NO** and **CR**.
- ( ) 14. When the question "SECTOR?" is printed, enter the numbers of any bad sectors on the WORKING DISKETTE that were discovered during the M option of the TEST47 program. If the test discovered no bad sectors on the WORKING DISKETTE, just type **CR**.
- ( ) 15. You will again be asked to insert a disk. Instead, type **CTRL** and **D**.
- ( ) 16. When the message "DEVICE<SY0>??" appears, type **CTRL** and **D** again.
- ( ) 17. When asked if you have any more disks to initialize, type **NO** and **CR**.

Go on to Step 5, "SYSGEN."

**SYSGEN****Step 5**

SYSGEN is an abbreviation for "System Generation". In this procedure, you will copy HDOS system files from the distribution diskette to your SYSTEM VOLUME. After performing this procedure, you will be able to substitute the SYSTEM VOLUME into any of the preceding steps that formerly required the distribution diskette. If you have performed this procedure before, refer to "SYSGEN Options", on Page 1-88.

- ( ) 1. Insert the distribution diskette into SY<sub>0</sub>: and perform Bootstrap. Refer to Step 1A or 1B if you need help.
- \*( ) 2. After the HDOS prompt (>), type **SYSGEN△\*.\*** and **⑧**. HDOS will print:

```
SYSGEN
VERSION: 2.0
ISSUE: #50.06.00
```

DESTINATION DEVICE <SY<sub>0</sub>:>?

- ( ) 3. When the "DESTINATION DEVICE <SY<sub>0</sub>:>?" message is displayed, type **SY1:** and **⑧**. The system will print:

DISMOUNTING ALL DISKS:

```
VOLUME 000, DISMOUNTED FROM SY0:
LABEL: HEATH HDOS 2.0 ISSUE #50.06.00
(COPYRIGHT(C) HEATH CO 1980)890-105
```

REMOVE THE DISK(S). HIT RETURN WHEN READY:

- ( ) 4. Ignore this instruction to remove the disk and type **⑧**. The screen will display:

```
INSERT THE SOURCE DISKETTE IN SY0:. HIT
RETURN WHEN READY:
```

- ( ) 5. Just type **CR**. The distribution diskette is the source diskette.
- ( ) 6. You will be asked to insert the destination disk in SY1: Insert your **SYSTEM VOLUME** in the right-hand drive and type **CR**.

SYSGEN will copy the HDOS System files.

SYSGEN is complete when the computer prints the message  
"nn FILES COPIED".

- ( ) 7. Remove both the distribution disk and the **SYSTEM VOLUME**.

Go on to Step 6, "SET".

## SET

## Step 6

NOTE: Use this step only if you have a video terminal which is capable of lower-case display and backspacing, such as the H19 or H89 computer. Otherwise, go on to Step 7, "Preparing a WORKING DISKETTE."

This section will enable you to communicate effectively with HDOS by using some special features of your computer.

- ( ) 1. Insert your SYSTEM VOLUME into SY<sub>0</sub>:; type **SET**, and continue to boot the system.
- \* ( ) 2. At the HDOS prompt ">", type **SETATT:BKS** and **SET**. This instructs the system to allow you to backspace (using the BACKSPACE, DELETE, or RUBOUT key) in order to delete characters.
- ( ) 3. At the next ">", type **SETATT:NOMLI** and **SET**. This instructs the system to allow you to input lower case letters as well as upper case.
- ( ) 4. At the next prompt, type **SETATT:NOMLO** and **SET**. This tells HDOS to display all lower case input as lower case output.

For more information about the SET command and SET options, refer to the SET section of Chapter Two.

Leave the SYSTEM VOLUME in the drive and go on to Step 7, "Preparing a WORKING DISKETTE."

**PREPARING A WORKING DISKETTE****Step 7**

In this section you will prepare a system volume which will contain only the most essential HDOS system files and BASIC. This disk will not contain INIT, SYSGEN, and other system utility programs, but by excluding such programs, you will be able to use the space they would have occupied for storing BASIC programs. Since this disk will contain the essential HDOS system files, you will be able to use it to perform Bootstrap.

- ( ) 1. At the HDOS prompt ">", type **SYSGEN** and **⑨**.
- ( ) 2. When the message "DESTINATION DEVICE <SY $\emptyset$ :>?" is printed, type **SY1:** and **⑨**.
- ( ) 3. The system will instruct you to remove the disks. Instead, type **⑨**.
- ( ) 4. When you are instructed to insert the source diskette in SY $\emptyset$ :, just type **⑨**. The SYSTEM VOLUME is the source diskette.
- ( ) 5. When asked to insert the destination in SY1:, insert your WORKING DISKETTE in the right-hand drive and press **⑨**.

Sysgen is complete when it displays the message:

nn FILES COPIED

- ( ) 6. After the message "INSTALL A BOOTABLE DISK IN SY0:. HIT RETURN TO REBOOT" type **CR**, and reboot the system. You do not need to press the space bar this time. You will only need to type spaces when you boot from a write-protected disk, or from a newly-created disk that has never performed bootstrap.
- ( ) 7. At the HDOS prompt ">", type **PIP** and **CR**.
- ( ) 8. The prompt ":P:" will appear. Type **SY1:/MOU** and a **CR**.
- ( ) 9. The message

VOLUME 010, MOUNTED ON SY1:  
LABEL: WORKING DISKETTE

will appear on the terminal, followed by the ":P:" prompt.  
Type **SY1:.\*=BASIC.ABS** and a **CR**.

- ( ) 10. At the prompt ":P:", type **CTRL-D**.

This finishes the System Set-Up Procedure.

If you have an H14, H24, or H44 line printer, remove the disks and go on to Step 8, "Configuring Line Printers". Otherwise, leave the diskette in the drive and go on to Step 9, "Power-Down."

**CONFIGURING LINE PRINTERS****Step 8**

If you have an H14, H24, or H44 line printer, this section will instruct you how to incorporate it into your system.

- ( ) 1. Make certain that the jumpers on your serial I/O card are configured for address 340Q (0EOH). If you have a WH89, these jumpers are preset. If you need to set the jumpers, turn off the power, set the jumpers, and then continue this procedure.
- ( ) 2. Insert your WORKING DISKETTE in SY0: and boot-up the system.
- ( ) 3. At the HDOS prompt ">", type **CAT△LPH???.DVD/S** and **⑨**.  
The following will be printed:

NAME	EXT	SIZE	DATE	FLAGS
LPH14	.DVD	7	7-OCT-80	S
LPH24	.DVD	7	7-OCT-80	S
LPH44	.DVD	7	7-OCT-80	S

3 FILES, USING 21 SECTORS (nnn FREE)

This is a directory listing of all the line-printer device driver files. HDOS uses these files to communicate with peripherals. Which of these files you need will depend upon what kind of line printer you have. For instance, if you have an H14, you need file LPH14.DVD. If you have a Diablo printer, you will use file LPH44.DVD.

- ( ) 4. When the HDOS prompt (>) is displayed:

If you have an H14 line printer, type  
**RENAME △ LP.DVD=LPH14.DVD** and **⑨**.

If you have an H24 line printer, type  
**RENAME △ LP.DVD=LPH24.DVD** and **⑨**.

If you have an H44 line printer, type  
**RENAME △ LP.DVD=LPH44.DVD** and **⑨**.

- ( ) 5. At the > prompt, type **BYE** and **@@**.

HDOS will now recognize commands to LP:. For more information about configuring line printers and other peripherals, refer to the "Peripherals" section of this manual.

Leave the diskette in the drive and go on to Step 9, "Power-Down."

#### POWER-DOWN

#### Step 9

Part of the operating system resides in memory at all times, and part of it resides on the diskette. Any alterations you have made to the portion of the system that is being stored in memory may or may not have been written to the diskette. Thus, whenever you are finished using your computer, use one of the following procedures to ensure that any configuration changes you have made to the system are written back to the disk.

If the message "INSTALL A BOOTABLE DISK IN SY0:.. HIT RETURN TO REBOOT" is displayed on the terminal, it is always safe to remove the diskette and turn off the power. Be sure that you remove all diskette(s) before turning off the power, since diskettes left in the drives during power-down may be magnetically damaged.

If the HDOS prompt (>) is displayed on the terminal:

1. Type **BYE** and **@@**.
2. When the message "INSTALL A BOOTABLE DISK IN SY0:.. HIT RETURN TO REBOOT" has been printed, remove all disks.
3. Turn off the power to the computer and drives.

Go on to "Summary" on Page 1-60.

## Summary

You now have two bootable diskettes. Volume 1, SYSTEM VOLUME, is a complete copy of the distribution diskette. Volume 10, WORKING DISKETTE, is a subset of the SYSTEM VOLUME and contains the files necessary to operate the system, as well as BASIC.

You will need to perform parts of the "System Set-Up Procedure" again. All new diskettes must be initialized. We recommend that you run the M (Media check) option in TEST17 or TEST47. This option will tell you whether there are any bad sectors on the diskette. If there are, you can use INIT to instruct HDOS not to write any data to the bad sectors (see INIT Options, on Page 1-75). Remember that even if the media check finds no bad sectors, you must reinitialize the diskette upon which the test was performed.

Since the SYSTEM VOLUME is a duplicate of the distribution diskette, you can substitute your SYSTEM VOLUME into any procedure that formerly required the distribution diskette. Actually, a system volume does not have to be an exact copy of the distribution diskette. A system volume is simply a diskette that contains HDOS system files. Since system files are transferred from the source diskette by means of SYSGEN, all diskettes that have been SYSGENed are system volumes. In this sense, the WORKING DISKETTE is actually a system volume. Only system volumes can be used to perform Bootstrap, so if you have a one-drive system, you will probably want to SYSGEN all of your diskettes.

You may wish to create several system volumes, each with a specific system resource, such as EDIT, DEBUG, ASM, or BASIC. To do this:

1. Perform Bootstrap using your SYSTEM VOLUME.
2. Initialize the blank diskette. Name it anything you like, but it is good practice to name your diskettes according to their function so you can distinguish among them. Note that each volume name and number should be unique -- that is, you should avoid assigning the same name or volume number to two different diskettes.

3. Run SYSGEN. The SYSTEM VOLUME is the source and the blank diskette is the destination.
4. Run ONECOPY, or PIP, if you have a multiple-drive system (see Chapter Two, "General Operation," for more information about PIP). Instead of specifying \*.\* after the :OC: or :P: prompt, specify the name of the individual file or files that you want to be copied to your new volume.
5. Run SET, using the same commands you used in the preceding SET section.
6. Perform the Power-Down procedure.

If you are using 5-1/4-inch drives as your primary boot drives, you will need to use either PIP or ONECOPY to transfer system utilities such as ASM, DEBUG, and EDIT from your SOFTWARE TOOLS disk. The use of both PIP and ONECOPY is documented in Chapter Two.

You will probably want to proceed from here directly to the HDOS Manual (Chapter Two). At some point, however, you should finish reading this entire chapter. When you return to this chapter, begin by reading "Theory of Operation" (which follows immediately), and then proceed through "Utility Optimization", referring back to the "System Set-Up Procedure" sections as you need to.

The following sections will provide theoretical explanations of the steps you performed in the "System Set-Up Procedure", as well as some time-saving options within the programs. "Theory of Operation" explains the conceptual mechanics of the H8/H89/HDOS system, while the "Utility Optimization" section applies these concepts to specific HDOS utility programs. Refer to Appendix A of Chapter Two for definitions of any unfamiliar terms.

## THEORY OF OPERATION

### The Diskette

A diskette is a circular sheet of Mylar\* coated with a magnetic oxide. When you insert the diskette and close the drive door, the diskette settles onto a spindle attached to the drive door. As the diskette rotates at 300 revolutions per minute, a fixed electromagnetic read-write head passes over the oxide material, or "medium," and interacts with it by means of a magnetic field. This combination of head and medium is very similar to that of a magnetic tape recorder.

The medium consists of millions of tiny magnetic particles called "domains." Each of these domains is magnetized, and the polarity of a given domain describes the binary data stored on the diskette.

If the read/write head is "reading" information, it senses the polarity of the domains in a given area and converts this information into electric impulses. These, in turn, are converted into binary digits, or "bits". If the head is "writing," the procedure is reversed: the bits are converted into electric impulses which change the magnetic field around the head. The changed magnetic field polarizes some of the domains according to the value of the bits.

A 5-1/4-inch diskette has the capability to store 102,400 bytes of data, with each byte composed of eight bits. Under HDOS, the diskette is divided into 40 circular rings, or "tracks," much like the grooves in an LP record. Each track is subdivided into 10 sectors, for a total of 400 sectors. Each sector is composed of 256 bytes.

An 8-inch disk can store anywhere from 256,256 bytes of data in the case of a single-sided, single-density disk, to 1,025,024 bytes per disk in the case of a double-sided, double-density disk. Either kind of 8-inch disk is divided into 77 tracks. The tracks on a single-density 8-inch disk are subdivided into 13 sectors; the tracks on a double-density 8-inch disk are subdivided into 26 sectors. As with the 5-1/4-inch diskettes, the sectors on an 8-inch disk are composed of 256 bytes each.

\*DuPont Registered Trademark

## Access Time — Finding the Right Sector

The process by which HDOS finds a given track is called "seeking." It takes a small amount of time for the head to jump from track to track as it seeks the correct one. This is called the "track step-time." The 5-1/4-inch drive used in the H89, H17, and H77 has a guaranteed step-time of 30 milliseconds (.03 seconds). You should have already determined the optimum step-time of your 5-1/4-inch drives during the TEST17 procedure. The guaranteed step-time for the 8-inch drive in the H47 is 3 milliseconds (.003 seconds).

Another factor that determines system speed is called "rotational latency". When you type in a command and file name, the system first locates the track upon which the file is located. Since the read-write head is fixed, the system may have to wait for the correct sector to rotate underneath the head after having selected the correct track. Rotational latency is thus defined as the amount of time that it takes for the spindle in the disk drive unit to rotate the desired sector into a position where the read-write head can read data from the file you have specified. The amount of rotational latency depends on the relative positions of sector and read-write head. If there is a great amount of distance between the head and sector, the rotational latency of the drive may be as great as 200 milliseconds for 5-1/4-inch drives, and as great as 166.6 milliseconds for the 8-inch drives. The rotational latency period of 5-1/4-inch drives averages 100 milliseconds; the average rotational latency for 8-inch drives is 83.3 milliseconds.

The access time, or period of time it takes to locate a sector, depends on the track step-time of the disk drive as well as the relative positions of sector and head. This access time may be as great as 500 milliseconds for the 5-1/4-inch drives, and as great as 216 milliseconds in the case of the 8-inch drives. The average access time for 5-1/4-inch drives is 225 milliseconds; the average access time for 8-inch drives is 91 milliseconds. These averages are based upon calculations that presuppose that, during the average disk access, one-third of the tracks will have to be skipped over. If many sectors close to one another are accessed, the average access times will be much lower.

As soon as HDOS finds the correct sector it reads or writes the data serially one bit at a time. This serial transfer of data takes place at a rate of 16,000 bytes per second with 5-1/4-inch drives, and at a rate of 62,745 bytes/second with 8-inch drives. The binary data is transferred between the disk drive and the disk drive controller. The controller converts the serial data into a parallel format. That is, the controller reformats the single-bit data so that, instead of being transferred one bit at a time, the data is transferred 8 bits (one byte) at a time. The controller then sends the data to the central processing unit by means of an input/output port.

## The Software System

An operating system such as HDOS is a logically organized set of programs which perform various tasks, such as communicating with peripherals and finding data on the diskette. All the programs of HDOS are accessible to you by means of operating system "commands." The exact command syntax is discussed in the "General Operation" section of this Manual.

Two vital programs within the operating system control the other portions of HDOS. One of these programs, HDOS.SYS, is called the "nucleus"; the other, SYSCMD.SYS, is called the "command processor".

The "nucleus" is the heart of HDOS. It is a collection of control routines which the command processor and utility programs, such as PIP and BASIC, call upon to execute your commands. The machine-language routines in the nucleus control such operations as allocating disk space and memory and transferring data from memory to disk and from disk to memory. The nucleus resides in memory whenever the operating system is running.

Working in conjunction with the nucleus is the "command processor", which processes all input from the keyboard. When you enter data at the terminal keyboard, the data goes directly to the nucleus, where it is temporarily stored. The command processor continually checks the data in the nucleus to see if a carriage return has been entered. When the command processor "sees" that the data stored in the nucleus has been terminated by a carriage return, it takes whatever data precedes the carriage return as a command. If you enter a valid command, the command processor then either executes the command itself or passes control to a subprogram which is capable of executing the command. If the command involves some form of disk I/O, the processor or subprogram utilizes the control routines in the nucleus. After the command has been executed, control returns to the command processor, which then awaits the next command.

## Files

All information on a disk is stored as bytes within a 256-byte sector. If the storage of a program or some other type of data requires more than 256 bytes, which is often the case, some means of quickly locating all the sectors which contain that data is needed. Thus, to facilitate location and retrieval of all the component sectors of a program or mass of data, HDOS organizes sectors into data structures known as "files". Files may be composed of only one or many sectors.

With regard to file management, the operating system is like a librarian, who must know where to find all the books in the library. The operating system must: find space on the diskette for new files; give each file a new name so it can be easily located; be able to copy data from one file to another; and be able to rename, update, and delete files. Above all, the operating system must be able to communicate with you and execute your commands quickly and effectively.

HDOS allocates sectors to files in groups called "clusters". Each cluster is composed of two contiguous sectors in the case of the 5-1/4-inch diskettes. Clusters on a single-sided, single-density 8-inch disk are composed of four sectors; clusters on a double-sided, double-density 8-inch disk are composed of 16 sectors.

The number of sectors HDOS assigns to a cluster on a particular type of disk is called the "cluster factor". In the case of a 5-1/4-inch diskette, the cluster factor is 2. If the cluster factor were 2, HDOS would allocate two sectors to a file which required only one sector to store. The system "remembers" whether or not all the sectors in a cluster are used. If HDOS needs to extend a file, it uses one of the unused sectors in the cluster it has assigned to that file. By keeping the component sectors of the file close together in this way, HDOS minimizes seek-time when reading the disk.

Since the 256-byte sector is the basic allocation unit of the diskette, all data transfers to and from the diskette must involve some multiple of 256 bytes. Many of the HDOS system programs such as BASIC, ASM, and EDIT use an area of RAM called the "buffer" to store data until some multiple of 256 bytes is accumulated. When the buffer has become full, whether by "padding" the data to be transferred or by simply waiting for more information to be added to the buffer, the data is written to the disk. A buffer of sufficient size must be set aside by each program which reads files. BASIC automatically sets aside any necessary buffer space.

In order to keep track of all the files in the system, HDOS uses a listing known as a "directory." The directory contains the name, location, size, and creation date of every file in the system. In order to access a given file, HDOS first looks up its name in the directory. It then uses information listed along with the file name to locate the sectors which comprise the file.

Files can be manipulated at the HDOS level, at the level of subprograms, such as ONECOPY, as well as within BASIC and assembly language programs. Refer to the appropriate manual for the proper command syntax.

## Memory Map

An operating system requires a memory management capability in order to function with other programs. When you issue a command to run a program, HDOS locates the file that bears the name of the program and then determines whether or not it will fit into the available memory. If it will fit, HDOS reads the file into a memory area that begins at the program's starting address. After the loading process is completed, HDOS jumps to the starting address of the program, and execution begins.

HDOS conserves memory by using the available area for more than one purpose. For example, some of this area is used only for opening and closing files. This and other similar capabilities are not required very often, so this part of the operating system can be left on the diskette most of the time. When HDOS does require these functions, it temporarily stores the contents of the available memory area, or "overlay area," in a disk file. It then loads the contents of another file into the area. When the operations of this file are complete, HDOS restores the original contents of the overlay area. This process of trading files from diskette to overlay area and vice versa is called "overlaid." When the overlay area is not required for other purposes, HDOS resides there continuously.

## Controlling Peripherals

HDOS will also manage all the peripheral devices in your system. This gives you the capability to type in commands from the console terminal and have the operating system perform some input or output function without your intervention. You can also include I/O commands in your programs without having to write detailed instructions for controlling the peripherals.

HDOS uses programs called "device drivers" to control peripherals. Each device driver is written with the characteristics of a particular device in mind. Its speed, line length, and "handshaking" capability or the capability of a peripheral to instruct the CPU not to send any more data until the peripheral is ready, are all examples of these characteristics. Device drivers are stored on the disk as files, with each device driver corresponding to one peripheral device. For example, to control the disk drives in your system, HDOS uses two device drivers called SY.DVD and DK.DVD. The SY.DVD disk driver controls all disk drives which have been hardware configured as primary boot drives, while the DK.DVD driver controls all disk drives which have been hardware configured as secondary boot drives.

After the device drivers are written as files, one for each peripheral, the drivers become a part of the operating system. Since device drivers are a part of HDOS, it is not necessary to include the drivers in each program which makes use of the peripherals. You can also make a program communicate with many different peripherals, without rewriting it, by redefining the appropriate device drivers. This ability to refer to a peripheral without keying instructions into a program is called "device independence."

The effect of HDOS's device independence is that each peripheral is given a symbolic name, as if it were a file. For instance, the system console terminal is referred to as "TT:", and "SY0:" identifies the system disk drive. The colon (:) at the end of the symbolic name identifies it as a device name rather than a file name.

## UTILITY OPTIMIZATION

### BOOTSTRAP

The Bootstrap procedure is normally performed from the drive that has been hardware configured as primary boot drive 0 (SY<sub>0</sub>:). Only disks that have been SYSGENed (system volumes) are bootable disks. The term "Bootstrap" describes the process by which a series of small programs lifts the operating system off of the disk and into the computer's memory. This process is described in the following paragraphs.

Turning on the power to your computer activates a Read-Only Memory chip on the CPU board which contains a program called the "Monitor ROM Bootstrap program". If you have an H89, this ROM prints "H:" at the upper left-hand corner of the console terminal screen; if you have an H8, the Monitor ROM lights the LEDs on the front panel monitor. The ROM then awaits input.

The valid Bootstrap inputs vary according to which ROM you have installed in your computer and what kind of computer you are using. Regardless of what you enter and how, whether B and  $\odot$  at the H89 terminal, 1 on the H8 front panel LEDs, or RST/0 and GO on the H8, the Monitor ROM interprets your input as an instruction to jump to the starting address of the controller bootstrap ROM.

Having assumed control, the disk controller bootstrap ROM moves the disk read-write head into a position where it can access the first nine sectors of the disk. The read-write head accesses the disk and then reads a program in the first nine sectors off of the disk and into memory. These nine sectors are the "disk Bootstrap sectors", which means that these sectors contain a program which is capable of moving HDOS off of the disk and into the computer's memory. How the loading of these sectors into memory is accomplished depends upon what type of device you are using to perform Bootstrap.

In the case of the H47, the bootstrap ROM loads the first two of these nine bootstrap sectors into memory. The first two bootstrap sectors contain a disk driver which enables the H47 bootstrap ROM to find the other seven sectors. The other seven system sectors contain the disk Bootstrap program itself. The two sectors that are in memory then cause the bootstrap ROM to read the other seven sectors into memory.

In the case of the H17 and H77, all nine bootstrap sectors are read into memory at once, as the disk driver program is contained within the H17 bootstrap ROM. The first two sectors of a 5-1/4-inch disk are "dummied". The other seven bootstrap sectors contain the same loading program as their counterparts on an 8-inch disk.

The program contained in the nine bootstrap sectors which are now in memory assumes control from the bootstrap ROM and determines the address of the console terminal. The system then checks the disk to see if the terminal baud rate is written there. If the baud rate of the terminal has been stored on disk as a result of a previous boot-up, the system proceeds. If the system cannot find a baud rate stored on the disk, it waits for you to press the space bar so it can determine the baud rate. The number of spaces HDOS requires to determine the baud rate will vary. Terminals which transmit at 4800 baud should require three or four spaces; terminals which transmit at less frequently used baud rates, such as 110, may require that you type as many as six spaces.

Having determined the port address and baud rate of your terminal, the system displays on the terminal the message:

ACTION? <BOOT>

If you do not receive this message, repeat the Bootstrap procedure. Make sure you are using a disk that contains the HDOS system files (i.e., the distribution diskette or a copy of it). Also, check to ascertain whether you have correctly installed the disk controller board and interconnecting cable. If your H8 is interfaced to the terminal by means of an H8-4 card, check the cabling between the card and your terminal. If your hardware has been properly installed and you still cannot get the system to "boot-up", refer to the "In Case of Difficulty" section of the appropriate hardware manual.

If you type "B" or **?** after the "ACTION? <BOOT>" message, the 9 bootstrap sectors load the file called HDOS.SYS into memory. HDOS.SYS is composed of two parts: one part is always resident in memory whenever the operating system is running, and the other part is "one-time" code which is used only when the system is being booted-up. If there are no errors in reading HDOS.SYS into memory, the bootstrap sectors begin to execute the one-time code portion of HDOS.SYS. The bootstrap sectors then transfer the terminal baud rate and terminal interface type on to the permanently-resident portion of HDOS.SYS.

The work of the bootstrap sectors is now complete, and the one-time code assumes control. First, this code determines how much memory is installed in your computer. The one-time code then moves the permanently-resident portion of HDOS.SYS into the upper 3K of RAM. Having done this, the one-time code prints:

SYSTEM HAS nnK of RAM

HDOS Version 2.0  
Issue #50.06.00

The one-time code now locates the overlays, which are stored in two files called HDOSOVL0.SYS and HDOSOVL1.SYS. It then scans the disk directory for file entries of the form XX.DVD. These .DVD files are device driver files, which HDOS uses to communicate with the peripheral devices in your system, including the disk drives.

Based on information it finds in the .DVD files, the one-time code builds a device table which lists the characteristics of each device. These characteristics include such information as whether a given device is capable of transmitting data, whether the device is capable of receiving data, or whether the device is capable of both transmitting and receiving data. After building the device table, the one-time code checks both memory and the disk for a date, provided that the SET HDOS NO-DATE option has not been implemented (see the SET section of Chapter 2). If there is a date both in memory and on the disk, the one-time code substitutes the date in memory into the (DD-MMM-YY) format of the date message. If a date has been recorded on the disk only, then the one-time code substitutes that date into the (DD-MMM-YY) format of the date message. If there is no date recorded either in memory or on the disk, the one-time code prints:

DATE (DD-MMM-YY) ?

After you have entered a date or simply typed **?**, the one-time code stores the date in memory.

After storing the date, the one-time code mounts the disk in SY0: and then prints:

```
Volume nnn, Mounted on SY0:  
Label: SYSTEM VOLUME
```

If either the date or terminal baud rate in memory is not the same as the date or terminal baud rate on the disk, the one-time code writes the baud rate and date that are in memory to the disk, unless the disk that is being booted is write-protected. Thus, each disk that has been booted at least once, and which is not write-protected has a terminal baud rate and date written on it. The effect of this is that you do not need to type spaces when you are booting a disk which you have previously used to boot-up the system, unless you have altered the terminal baud rate since you last booted that disk. In the same way, you never really need to enter a date unless you want catalogue listings of the contents of the disk to accurately reflect the date on which each file was created.

Since the one-time code cannot write the date and baud rate onto write-protected disks such as the distribution diskette, you must always type spaces when you boot from a write-protected disk. The date that appears when you boot a write-protected disk is the date such disks were created.

The final function of the one-time code is to turn control of the system over to a file called SYSCMD.SYS. SYSCMD.SYS is the system command processor, which processes all your commands and invokes subprograms, such as INIT, as the functions of such subprograms are needed to execute your commands. It is SYSCMD.SYS that prints the HDOS prompt ">". This > prompt indicates that HDOS is in the command mode and awaits your commands.

### Bootstrap Options

As we mentioned earlier, HDOS records the terminal baud rate on the disk. If you boot using a terminal whose baud rate does not match the terminal baud rate stored on the disk, you will receive binary garbage (or nothing at all) instead of the "ACTION? <BOOT>" message. If this happens, hit the terminal BREAK key and then press the space bar a few times. HDOS will determine the "new" baud rate and print "ACTION? <BOOT>".

Whenever the message "ACTION? <BOOT>" is displayed on the screen, you have four options. First, if you type any character except "C", "B", or ~~C~~, the system will print:

ACTION? <BOOT> HELP

LEGAL COMMANDS:  
BOOT - BOOT HDOS  
CHECK - SECTOR CHECKSUMS  
HELP - PRINT THIS LIST

ACTION? <BOOT>

The second Bootstrap option involves doing absolutely nothing. HDOS will wait 30 seconds for some response to the "ACTION? <BOOT>" message, and will then boot itself up to the "DATE (DD-MMM-YY)?" prompt.

The third option is normal "boot-up". You can boot the system from the "ACTION? <BOOT>" message by typing either a ~~C~~ or the letter "B".

The fourth option involves initiating a "CHECKSUM" test. This test is performed on each of the sectors on the disk except the first ten, which are reserved by the HDOS bootstrap sectors. During CHECKSUM, HDOS adds the value of all the bits stored on each sector. It then compares this sum against a checksum value which is stored in each sector "header", to determine whether any data on the sector has been damaged. The CHECKSUM test enables you to isolate disk access problems to the disk itself.

If HDOS discovers a bad sector, it prints an error message. If this occurs with your distribution diskette, it will have to be replaced. If the problem occurs with any other diskette, you can inform HDOS not to write to the bad sector or sectors by means of INIT (see "INIT Options", Page 1-75).

To initiate CHECKSUM, the message "ACTION? <BOOT>" must be displayed on the screen. After the "ACTION? <BOOT>" message, type a capital "C". The computer will print "CHECK" next to "ACTION? <BOOT>" HDOS will then invoke the CHECKSUM program.

CHECKSUM will print a series of sector numbers along with the sum of the value of the bits stored in each sector. Examine the listing for "?00 \* ERROR \*" messages. Any error messages will precede the number and checksum of the bad sector. To terminate the test early, type CTRL-C. Once the test is terminated, HDOS will redisplay the "ACTION? <BOOT>" message. You can then proceed with the normal boot-up procedure by simply typing  $\textcircled{2}$ .

An abbreviated listing of the CHECKSUM test is printed below:

```
ACTION? <BOOT> CHECK
SECTOR 010 = 0268
SECTOR 011 = 50062
SECTOR 012 = 73497
?00 * ERROR *
SECTOR 013 = 63304
^C (CTRL-C typed)
```

```
ACTION? <BOOT>
```

In this example, a bootstrap error was discovered at sector 013. The operator terminated the listing by typing CTRL-C. If you find that this test produces no error messages and you still cannot get the bootstrap procedure to function properly, refer to the "In Case of Difficulty" section of the appropriate hardware manual.

## INITIALIZATION (INIT)

INIT is a program designed to prepare HDOS diskettes for data storage. INIT is a stand-alone utility. This means that HDOS writes the INIT program into a memory buffer and then runs the program without accessing the diskette which contains the utility.

When you type INIT and **CR**, HDOS loads INIT into a memory buffer, dismounts all diskette(s), and then passes control to INIT. INIT then scans the HDOS device table for the disk drive device driver entries. Having found these, INIT checks the end of the disk driver files for INIT parameters. These parameters are assembly-language routines which initialize the disk surface, among other things. INIT then loads the drivers and parameters into memory, ignoring any device driver entries which lack INIT parameters, and continues by printing the message "Device<SY0:>?"

After you have entered a destination device name and inserted a disk, INIT tries to read the volume name, which is located on the tenth sector of the first track. If it finds a volume name, it prints it. If it does not find a volume name, INIT assumes that the disk has not been previously initialized. INIT then asks whether you really want to initialize the disk. If you type NO, INIT exits to the HDOS Command Mode Level. If you type YES, INIT asks for a volume number and label, which it stores in memory.

After you have entered a volume name and number, the initialization process begins. INIT erases the information on the first track, formats the track into ten 256-byte sectors, and then proceeds to the next track, repeating this procedure until all tracks have been erased and formatted. INIT then writes nine Bootstrap sectors onto the first track of the disk. It retrieves the volume name and serial number you entered from memory, and writes this data to the tenth sector of the first track.

INIT now asks for the numbers of bad sectors. As you enter the sector numbers, INIT builds a map that indicates where the bad sectors are and then writes this map to the disk. INIT then finds 20 consecutive sectors and uses 18 of these to write the file DIRECT.SYS to the disk. DIRECT.SYS is a file that contains the directory which HDOS uses to locate files. INIT uses the other two sectors to store a file called GRT.SYS, which HDOS uses to determine which sectors on the disk are not being used. After transferring DIRECT.SYS and GRT.SYS to the diskette, INIT prints the message "Disk Initialization complete."

Since HDOS uses DIRECT.SYS and GRT.SYS to locate and store your files, and since DIRECT.SYS and GRT.SYS are transferred only by means of the INIT program, you must initialize all new diskettes and diskettes which have been run through the TEST17 and TEST47 procedures.

## INIT Options

To run INIT, perform Bootstrap from SY0: using a distribution diskette or a system volume which contains the INIT program. You can run INIT from the HDOS prompt ">", in either of two ways.

If you simply type INIT, as you did earlier, the INIT program will, describe itself, and ask whether you really want to proceed. If you type YES and  $\textcircled{2}$ , the program will dismount the disk(s) and continue. If you type NO and  $\textcircled{2}$  or simply  $\textcircled{2}$ , you will return to the beginning of Bootstrap. If you have typed YES, the program will ask which drive you want it to use as the destination device. The screen will display:

```
Device:<SY0:>?
```

If you have only one drive in your system, type  $\textcircled{2}$  at this point. This will cause SY0: to be used as the destination drive. If you have a multiple-drive system, you can type the name of one of your other drives. For example:

```
Device:<SY0:>?  SY1:  ( $\textcircled{2}$ )
```

In this example, the operator instructed INIT to use SY1: as the destination drive. The source drive for INIT is always SY0:.

The second method of running INIT is to type INIT and then the name of the disk drive you want to use as the destination drive. For example:

```
>INIT SY1:   $\textcircled{2}$ 
```

The effect of this example is to run INIT as usual, except that, after dismounting the disks, INIT will proceed to instruct you to insert the volume you wish to initialize. Using this method of running INIT eliminates the need to wait for INIT to print the description of itself and the message asking whether you really want to proceed. Moreover, since in using this method you have already told INIT which disk drive you want to be the destination drive, INIT does not need to print the "Device<SY0:>?" message.

Having determined which drive is to be used as the destination drive, INIT will ask you to insert the diskette you wish to initialize. After you have inserted the disk and typed **②**, INIT will identify the volume, unless it is a brand new diskette. It will then ask if you want to proceed, as follows:

Type NO to cancel, type YES to erase and  
initialize the disk. (YES/NO) ?

If you type NO and **②**, INIT will repeat the message which instructs you to insert the disk you want to initialize so you can insert another disk at this point. If you type YES and **②** in response to the message, the procedure will continue.

If you are initializing an 8-inch disk, INIT will ask whether you want the initialized disk to be double density. If you do want the initialized disk to be double density, type YES and **②** or simply **②**. If you want the initialized disk to be single density, type NO and **②**.

INIT will now ask you for a volume serial number. This can be any integer between 1 and 255. It is important that each of your disks have a unique volume number. If you simultaneously use two diskettes that have the same volume number, HDOS may store data on the wrong diskette. Therefore, it is good practice not to initialize two diskettes with the same volume number.

When INIT asks you to enter a volume label, enter anything you like, as long as it is from 1 to 60 characters long. It is good practice to assign meaningful labels to your diskettes, such as SYSTEM VOLUME, DATA FILES, etc. In this way, the label will help you to determine which of your disks contains a given file. After you have entered the label and entered a **②**, INIT will begin to initialize the diskette.

The initialization process will take several seconds. When it is almost complete, you will be asked to enter the numbers of any bad sectors on the diskette you are initializing. You will not be able to identify these sectors until you have run the M option of TEST17 or TEST47. If you have run the appropriate test, enter the number of each bad sector, and terminate each number with a **②**. This will instruct INIT to "flag" the bad sectors so HDOS will not try to write to them. If the M test found no bad sectors, just type **②**.

INIT will again print the message instructing you to insert the diskette you want to initialize. If you do have another diskette to be initialized, insert it, type **②**, and continue. If you do not have more disks to initialize, type CTRL-D. INIT will then print the "Device<SY0:>?" message. Type CTRL-D again. Then INIT will ask if you have more disks to initialize. Type either NO and **②** or simply **②**. You will enter the boot routine when you exit INIT.

## TEST17

TEST17 is used to test new 5-1/4-inch diskettes and any 5 1/4-inch disk drives in your system. The diskette which you use to perform TEST17 must have been initialized. The TEST17 program will destroy the directory that is established on the diskette during INIT, so the diskette you use during TEST17 must be reinitialized.

If you have a configured line printer or alternate terminal, the Hardcopy Report Option of TEST17 will print a hard copy listing of the results of any of the tests performed by TEST17 except "Switch", "Exit", "Clean", and "Align". If you want to use this feature, you will need to use the LOAD command to load your listing device into memory BEFORE you execute TEST17. You can do this while in the HDOS command mode (indicated by the ">", prompt). For example, to load your line printer, type:

```
>LOAD LP:@
```

Or, to load the alternate terminal, type:

```
>LOAD AT:@
```

The Hardcopy Report Option is discussed in detail below.

The Align and Clean functions of TEST17 will not be discussed here. Their use is discouraged for the present, as these tests are designed to be used by Heath service personnel.

The following sections are intended to clarify the various TEST17 options. Refer to the TEST17 output in Appendix D for additional help.

### Initiating TEST17

To run TEST17, perform Bootstrap using either the distribution diskette or a diskette which contains the TEST17 program. Then, at the HDOS prompt (>), type TEST17 and a  $\oplus$ . TEST17 will dismount the disk(s). Like INIT, this program is a stand-alone utility. TEST17 will then instruct you to remove the disk(s). After explaining itself, the program will ask whether you want to proceed. If you type YES and a  $\oplus$  the program will continue; if you type NO and  $\oplus$ , TEST17 will return you to the beginning of the Bootstrap routine.

When TEST17 asks which drive you want to use for the test, type 0 if you have only one drive; 0 or 1 if you have two drives; and 0, 1, or 2 if you have three drives. TEST17 will test the drive whose hardware configuration number corresponds to the number you enter. You will then be instructed to insert a disk. Insert an initialized diskette and type  $\oplus$ . DO NOT use the distribution diskette or any diskette which contains valuable information to perform TEST17.

TEST17 will now print a list of options. To start any test, type the letter which precedes the name of the test in the listing and then type a carriage return. To end a test early, type CTRL-C.

### R — Hardcopy Report

If you have used the LOAD command (as described above) to load your line printer or alternate terminal into memory before initiating TEST17, you can use the Hardcopy Report Option to obtain hard copy listings of the results of any of the following tests except "Switch", "Exit", "Clean", and "Align". To use this feature, enter R and  $\oplus$ . The program will then print:

Hardcopy Report Option (ON/OFF) <OFF>?

Type ON and a  $\oplus$ . The program will now prompt you for a hard copy device name. Enter the two-letter name of the device to which you want the listing sent and type  $\oplus$ . If you have not loaded the device properly, you will receive the message "Unable to Open Hardcopy Device". If you receive this message, exit from TEST17, reboot the system, and load the device while in the HDOS command mode. Then try again.

After you have entered a device name, the program will ask you for a title for the Hardcopy Report. The Hardcopy Report will automatically include the date and page numbers, so you do not have to include these in your title. After you have entered a title, the TEST17 menu will be redisplayed, and you can continue by selecting one of the tests.

Because the Hardcopy Report Option involves buffered I/O, the printer or alternate terminal won't necessarily print out data at the same time it is displayed on the screen. The Hardcopy Report may not be printed entirely until after you either exit TEST17 or turn off the Hardcopy Report Option. You can turn off this option by typing R and a **CR**. Then respond OFF and **CR**, or simply **CR**, to the message "Hardcopy Report Option (ON/OFF)?".

#### T — Drive Speed

The drive speed test checks the rotational speed of your drive. During this test, the screen will display the relative rotational speed of the drive under test. A series of decimal numbers, which should be close to 1.000, will scroll up the screen, updating as they scroll. The rotational speed tolerance is one percent. The final value may safely range anywhere from 0.990 and 1.010. Do not adjust the speed unless it is out of tolerance. Allow this test to run for about 30 seconds; then type CTRL-C.

If the number displayed on the terminal is less than 0.990 or greater than 1.010, restart the test and carefully adjust the SPEED ADJUSTMENT Control (shown in your Operations Manual) with a small screwdriver until the number is within tolerance. The adjustment of this control is extremely sensitive; so if an adjustment is necessary, do not turn it far in either direction. Less than one degree of rotation in either direction should bring the drive speed within tolerance. A counterclockwise adjustment will increase the drive speed, and a clockwise adjustment will decrease the drive speed.

You may have to perform this test later, depending on how heavily your drive is used. As the drive bearings wear, the speed may change slightly. Fluctuations within the tolerance are normal and may be attributed to variations in temperature and humidity.

## D — General Checkout

The purpose of "General Checkout" is to verify that your system is reading from and writing to the diskette properly. Each sector on the diskette is written to and read from a number of times. Various patterns are written on the diskette to allow testing of the head of the seek mechanism and the read-write head itself. The test is repeated three times. Do not be alarmed if this test seems to take an abnormally long time to finish. It is a very thorough test, and requires over 30 minutes to complete. Run this test again only if you encounter problems.

While each pass is being executed, the program will print the letters "ABCDEFG", one after the other, at intervals of a few minutes. These letters indicate the various phases of the test and give you an idea of how far it has progressed. A message will be printed at the end of each pass. Here, there are two possibilities. If everything proceeds normally, the output for the pass will read:

ABCDEFG END OF PASS n

However, if the test discovers any problems on the current pass, the output will include the number of "hard" (h) and "soft" (s) errors, as follows:

ABCDE hhh/ssss FG END OF PASS n

In this example, test E had errors. The tests corresponding to each letter are:

- A = Write all zeroes
- B = Read all zeroes
- C = Write all ones
- D = Read all ones
- E = Write identification pattern
- F = Read identification pattern
- G = Random read/write test

The number of "hard" and "soft" errors (refer to the Glossary in the HDOS Manual) is indicated by the numbers "hhh" and "sss", respectively. Let the test run through all three passes, even if errors are discovered.

If you have any hard errors, the best approach is to exit this program (type "E" at the option menu), initialize another blank diskette, and repeat the entire TEST17 procedure. If this approach is successful, it is probably because the first diskette had one or more bad sectors, possibly caused by dust. If replacing the diskette corrects the hard errors, continue through the other TEST17 options and then use "Switch" to restart TEST17. Then insert the bad diskette and perform "Media Check" in order to identify bad sectors. Once the bad sectors are identified, you can instruct HDOS not to write to those sectors during INIT, and you can then use the diskette normally. If you are getting both hard and soft errors, and "Media Check" finds nothing wrong with the "bad" disk, chances are good that you have hardware failure. Run "Seek Time" to confirm this.

If changing the diskette does not correct the problem, or if you do suspect that you have hardware failure, refer to the troubleshooting guide in your Operations Manual.

#### M — Media Check

This test will examine the diskette under test for defects in the magnetic oxide medium. If you had any hard or soft errors during "General Checkout", defects in the diskette medium could be the cause. If the media check finds any bad sectors, the bad sector numbers will be listed at the end of the test. Run this test on all new diskettes.

The Media Check will take anywhere from five to ten minutes. At the end of the test, the following message will be printed:

nnn BAD SECTORS LOCATED

The number "nnn", which can range from 000 to 400, tells how many of the 400 sectors on the diskette under test are defective. The actual bad sectors, if any, will also be listed. Record the numbers for future reference. If any bad sectors are discovered, the problem will be solved when you reinitialize the diskette after completing TEST17. INIT enables you to type in the identifying number for each bad sector, and then removes the bad sectors from the diskette directory.

### S — Seek Time

This test will vary the track seek time of your drive in order to determine its highest reliable speed. The drive assemblies are guaranteed to perform reliably at a seek time of 30 milliseconds. If you have a multiple-drive system, your fastest possible seek speed for the 5-1/4-inch drives will be the speed of the slowest 5-1/4-inch drive.

The maximum seek speed may change as the drive unit becomes "broken in". If frequent read errors occur with one of your drives, you should re-run TEST17 to check for possible changes in the drive speed.

The first speed to be tested is 36 milliseconds per track. Faster step rates will be attempted until your drive's fastest reliable seek time is determined. As it tests, the program will print what speed it is attempting. As each pass is successfully completed, the message "OK!" will be printed.

It will take anywhere from five to ten minutes to complete this test. When the test is complete, the message "Drive performs reliably at nn milliseconds per track" will be printed, where "nn" is the optimum seek time of your drive. Record this number for future reference.

If you have a multiple-drive system, you will probably want to perform this test on your other drives in order to determine the fastest possible seek speed for all drives in the system. To do this, perform "Switch", as discussed below. The "System Optimization" section of Chapter Two will explain how to set your system for the speed of the slowest drive (see the "SET" section of Chapter Two, Page 2-45).

### U — Switch

This procedure will restart TEST17, thereby enabling you to select another drive unit to be tested, or to insert a new diskette. After you have typed U and  $\odot$ , TEST17 will restart itself. When you are asked which drive you want to test, enter the hardware number of the drive you want to test. You can change the diskette when you are asked to insert the diskette you want to use for this test. Note that using "Switch" will enable you to alternate among your drives for as long as you wish to test them.

### E — Exit

To exit TEST17, type E and  $\odot$ . This will return you to the beginning of Bootstrap.

## TEST47

TEST47 is used to test new 8-inch diskettes and 8-inch disk drives. The diskette which you use to perform TEST47 must have been initialized. The TEST47 program will destroy the directory that is established on the diskette during INIT, so the diskette you use during TEST47 must be reinitialized.

If you have a configured line printer or alternate terminal, the Hardcopy Report Option of TEST47 will print a hard copy listing of the results of any of the tests performed by TEST47 except "Switch", "Exit", "Clean", and "Align". If you want to use this feature, you will need to use the LOAD command to load your listing device into memory BEFORE you execute TEST47. You can do this while in the HDOS command mode (indicated by the ">" prompt). For example, to load your line printer, type:

```
>LOAD LP: @@
```

Or, to load the alternate terminal, type:

```
>LOAD AT: @@
```

The Hardcopy Report Option is discussed in detail below.

The Align and Clean functions of TEST47 will not be discussed here. Their use is discouraged for the present, as these tests are designed to be used by Heath maintenance personnel.

The following sections are intended to clarify the various TEST47 options. Refer to the TEST47 output in Appendix D for additional help.

### Initiating TEST47

To run TEST47, perform Bootstrap using either the distribution diskette or a diskette which contains the TEST47 program. Then at the HDOS prompt (>), type TEST47 and a @@. TEST47 will dismount the disk(s). Like INIT, this program is a stand-alone utility. TEST47 will then instruct you to remove the disk(s). After explaining itself, the program will ask whether you want to proceed. If you type YES and a @@ the program will continue; if you type NO and @@, TEST47 will return you to the beginning of the Bootstrap routine.

When TEST47 asks which drive you want to use for the test, type 0 or 1. TEST47 will test the drive whose hardware configuration number corresponds to the number you enter. You will then be instructed to insert a disk. Insert an initialized diskette and type **@**. DO NOT use the distribution diskette or any diskette which contains valuable information to perform TEST47.

TEST47 will now print a list of options. To start any test, type the letter which precedes the name of the test in the listing and then type a carriage return. To end a test early, type CTRL-C.

#### R — Hardcopy Report

If you have used the LOAD command (as described above) to load your line printer or alternate terminal into memory before initiating TEST47, you can use the Hardcopy Report Option to obtain hard copy listings of the results of any of the following tests except "Switch", "Exit", "Clean", and "Align". To use this feature, enter R and **@**. If you are using a line printer as your listing device, typing R and **@** should produce a form feed. The program will then print:

Hardcopy Report Option (ON/OFF) <OFF>?

Type ON and a **@**. The program will now prompt you for a hard copy device name. Enter the two-letter name of the device to which you want the listing sent and type **@**. If you have not loaded the device properly, you will receive the message "Unable to Open Hardcopy Device". If you receive this message, exit from TEST47, reboot the system, and load the device while in the HDOS command mode. Then try again.

After you have entered a device name, the program will ask you for a title for the hardcopy report. The Hardcopy Report will automatically include the date and page numbers, so you do not have to include these in your title. After you have entered a title, the TEST47 menu will be redisplayed, and you can continue by selecting one of the tests.

Because the Hardcopy Report Option involves buffered I/O, the printer or alternate terminal won't necessarily print out data at the same time it is displayed on the screen. The Hardcopy Report may not be printed entirely until after you either exit TEST47 or turn off the Hardcopy Report Option. You can turn off this option by typing R and **@**, and then responding OFF and **@**, or simply **@** to the message "Hardcopy Report Option (ON/OFF)?".

## M — Media Check

This test will examine the diskette under test for defects in the magnetic oxide medium. If you had any hard or soft errors during "General Checkout", defects in the diskette medium could be the cause. If the media check finds any bad sectors, the bad sector numbers will be listed at the end of the test. Run this test on all new diskettes.

The Media Check will take about twenty minutes. At the end of the test, the following message will be printed:

nnnn BAD SECTORS LOCATED

The number "nnnn", which can range from 0000 to 4000, tells how many of the 4000 sectors on the diskette under test are defective. The actual bad sectors, if any, will also be listed. Record the numbers for future reference. If any bad sectors are discovered, the problem will be solved when you reinitialize the diskette after completing TEST47. INIT enables you to type in the identifying number for each bad sector, and then removes the bad sectors from the diskette directory.

## D — General Checkout

The purpose of "General Checkout" is to verify that your system is reading from and writing to the diskette properly. Each sector on the diskette is written to and read from a number of times. Various patterns are written on the diskette to allow testing of the head of the seek mechanism and the read-write head itself. The test is repeated three times. Do not be alarmed if this test seems to take an abnormally long time to finish. It is a very thorough test, and requires over an hour to complete. Run this test again only if you encounter problems.

While each pass is being executed, the program will print the letters "ABCDEFG", one after the other, at intervals of a few minutes. These letters indicate the various phases of the test and give you an idea of how far it has progressed.

A message will be printed at the end of each pass. Here, there are two possibilities. If everything proceeds normally, the output for the pass will read:

ABCDEFG END OF PASS n

However, if the test discovers any problems on the current pass, the output will include the number of "hard" (h) and "soft" (s) errors, as follows:

ABCDE hhh/sss FG END OF PASS n

In this example, test E had errors. The tests corresponding to each letter are:

- A = Write all zeroes
- B = Read all zeroes
- C = Write all ones
- D = Read all ones
- E = Write identification pattern
- F = Read identification pattern
- G = Random read/write test

The number of "hard" and "soft" errors (refer to the Glossary in the HDOS Manual) is indicated by the numbers "hhh" and "sss", respectively. Let the test run through all three passes, even if errors are discovered.

If you have any hard errors, the best approach is to exit this program (type "E" at the option menu), initialize another blank diskette, and repeat the entire TEST47 procedure. If this approach is successful, it is probably because the first diskette had one or more bad sectors, possibly caused by dust. If replacing the diskette corrects the hard errors, continue through the other TEST47 options and then use "Switch" to restart TEST47. Then insert the bad diskette and perform "Media Check" in order to identify bad sectors. Once the bad sectors are identified, you can instruct HDOS not to write to those sectors during INIT, and you can then use the diskette normally. If you are getting both hard and soft errors, and "Media Check" finds nothing wrong with the "bad" disk, chances are good that you have hardware failure. If changing the diskette does not correct the problem, or if you do suspect that you have hardware failure, refer to the troubleshooting guide in your Operations Manual.

## U — Switch

This procedure will restart TEST47, thereby enabling you to select another drive unit to be tested, or to insert a new diskette. After you have typed U and  $\textcircled{R}$ , TEST47 will restart itself. When you are asked which drive you want to test, enter the hardware number of the drive you want to test. You can change the diskette when you are asked to insert the diskette you want to use for this test. Note that using "Switch" will enable you to alternate among your drives for as long as you wish to test them.

## E — Exit

To exit TEST47, type E and  $\textcircled{R}$ . This will return you to the beginning of Bootstrap.

## SYSGEN

The SYSGEN program is a stand-alone utility designed to generate the HDOS system. The effect of this process is to transfer essential HDOS system files from the source diskette (which must always be installed in SY $\emptyset$ :) to an initialized destination diskette.

When you type SYSGEN and  $\textcircled{R}$ , HDOS loads the SYSGEN program into a memory buffer and passes control to the SYSGEN program. SYSGEN then asks you for a destination device. If the destination device you specify is not SY $\emptyset$ :, SYSGEN loads a disk driver for that drive. Then SYSGEN dismounts all disks, mounts the source disk, and, if the destination drive is not SY $\emptyset$ :, SYSGEN mounts the destination disk. If the destination drive is SY $\emptyset$ :, SYSGEN instructs you to insert the destination.

Having mounted the disk(s), SYSGEN copies the HDOS system files HDOS.SYS (the nucleus), the HDOS overlays, SYSCMD.SYS (the command processor), and a file called PIP.ABS. If the source drive and destination drive are both SY: drives, SYSGEN copies only the SY: disk driver to the destination diskette. If the destination drive is a DK: drive, SYSGEN copies both disk drivers from the source drive to the destination, and renames them appropriately during the transfer. SYSGEN then sets a flag which identifies the disk as having been SYSGENed. It then copies the files which are contained in an internal list within the SYSGEN program. When all these files have been copied, SYSGEN prints the message nn Files Copied, and returns you to the beginning of Bootstrap.

### SYSGEN Options

To initiate SYSGEN, perform Bootstrap, using either the distribution diskette or a system volume that contains the SYSGEN program. When the HDOS prompt ">" has been printed, you can initiate the SYSGEN program in any of three ways. The simplest, with which you are already familiar, is to simply type SYSGEN and  $\odot$ .

Instead of simply typing SYSGEN at the ">" prompt, you can append either of two switches to the SYSGEN command. These are /MIN and \*.\*.

The command

>SYSGEN  $\Delta$ /MIN  $\odot$

will initiate the SYSGEN program as usual, except that the SYSGEN program will copy only the most essential HDOS system files from the source disk to the destination disk. That is, the /MIN switch will cause SYSGEN to transfer only those HDOS system files which are indispensable to the system. These files are:

HDOS.SYS  
HDOSOVL0.SYS  
HDOSOVL1.SYS  
SYSCMD.SYS  
PIP.ABS  
SY.DVD (If you SYSGEN to a drive other than  
an SY: drive, SYSGEN will transfer  
both types of disk drivers and  
rename them appropriately).

The /MIN switch is useful if you want to store a large amount of data on a disk and you also want to be able to use that disk to perform Bootstrap. Note that ERRORMSG.SYS is not transferred, so all volumes created with this switch will show error codes instead of error codes and messages.

The command SYSGEN $\Delta$ \*.\*  $\odot$  will initiate SYSGEN as usual, except that instead of copying only system files, SYSGEN will copy all files, both system and non-system, from the source disk to the destination disk. Thus, SYSGEN $\Delta$ \*.\* will produce an almost exact copy of the volume you are using as the source disk. Using the \*.\* switch eliminates the need to use ONECOPY to transfer non-system files such as BASIC and ASM.

After having been invoked by HDOS, SYSGEN will print the message "Device<SY0:>?" At this point, you can either type **Q**, or you can type a disk drive name and **Q**. If you simply type **Q**, HDOS will use SY0: as both the source and destination drives. This is your only option if you have only one drive. If you have a multiple-drive system, you can avoid having to swap back and forth between source disk and destination disk by typing the name of one of your other drives after the "Device<SY0:>?" message. For example:

```
Device<SY0:>?    SY1:    Q
```

In this example, the operator made SY1: the destination drive. The "Device<SY0:>?" message is your last opportunity to type CTRL-D and exit from the SYSGEN procedure.

When SYSGEN asks you to remove the disk(s), you have two options: you can either use the diskette from which you booted to perform SYSGEN, or you can remove the diskette from which you booted and insert another disk which contains the SYSGEN program. Only the distribution diskette and SYSGENed disks (except disks created using the SYSGEN/MIN switch) contain the SYSGEN program. If you want to SYSGEN from the disk you used to perform Bootstrap, do not remove the disk and simply type **Q**. If you do want to replace the disk you used to boot the system, remove the boot disk, replace it, and then type **Q**. If you do replace the disk, make sure that the names of the alternate disk driver files are the same on both the boot disk and the disk with which you replace the boot disk (i.e., both should be named SY.DVD or both should be named DK.DVD). It is good practice to boot from a disk that contains the SYSGEN program in order to avoid having to switch disks.

When SYSGEN is complete, the system will return you to the beginning of the Bootstrap procedure. After SYSGENing, perform Bootstrap using the destination diskette. This will insure that the diskette has been properly SYSGENed.

### ONECOPY

ONECOPY enables you to copy files from one diskette to another using only one disk drive. ONECOPY is especially useful if you have only one drive in your system. You have the option of copying one file or multiple files in a single operation, as will be explained under ONECOPY in Chapter Two, "General Operation". ONECOPY also requires that you swap back and forth between a source diskette and a destination diskette. Unlike SYSGEN, ONECOPY cannot generate a usable system volume. This utility cannot link a set of programs together to be used as an operating system.

To use ONECOPY, you need a system volume (the distribution diskette or a copy of it) installed in SY0:. The diskette to which you will copy files must have been initialized by means of the INIT program.

ONECOPY is a stand-alone utility. This means that HDOS writes the ONECOPY program into a memory buffer and then runs the program without accessing the diskette which contains the utility.

When you specify source file(s) at the :OC: prompt, the ONECOPY program instructs you to insert a source diskette, and then searches the diskette you insert to make certain that your source diskette contains the specified source file(s). If the source diskette does contain the file or files you have specified, ONECOPY loads the contents of the file(s) into a memory buffer and then asks you to insert the destination diskette. The program will then write the contents of the buffer onto the destination, repeating this process until all files have been copied.

### ONECOPY Options

When you are using ONECOPY with either the distribution diskette or a system volume which is a duplicate of the distribution diskette, the valid file choices under ONECOPY are:

SYSGEN.ABS  
TEST17.ABS or TEST47.ABS  
INIT.ABS  
BASIC.ABS  
SY.DVD  
DK.DVD

Exactly which files you specify will depend upon your requirements. If you type \*.\* , all files in the preceding list will be copied from the distribution diskette or system volume to the destination. For a more comprehensive discussion of ONECOPY options, refer to the ONECOPY section of Chapter Two.

To exit from the :OC: mode, type CTRL-D.

## *Appendix A*

### **MEMORY LAYOUTS**

A simplified memory map of the HDOS system for the H8 Computer is shown in Figure 1-4. The major items shown in the memory map are:

**PAM-8 ROM (1K)** — Contains the PAM-8 (front panel monitor) code.

**HDOS RAM Work area (1K)** — Used by HDOS to hold important system tables. Among other things, these tables are used to hold storage allocation and directory information about the currently mounted disks. Damage to these tables could cause all of the information on a disk to become lost. For this reason, these areas are write-protected (via hardware) from user programs. **Under no circumstances should a program attempt to write into these locations.**

**HDOS ROM (2K)** — Contains the HDOS bootstrap routine, several general-purpose utility subroutines, and some parts of the HDOS operating system.

**SYSTEM RAM AREA** — Occupies the first locations of RAM in your machine. This area contains cells used by PAM-8 as well as cells used by HDOS. These values are kept in RAM because they may need to be changed by HDOS during normal operation. They should not be altered by the user.

**USER STACK AREA** — Used to hold the stack of the user program and HDOS. Since the stack on an 8080A builds downwards, the top of the stack is at 42200A. HDOS will automatically maintain this stack for user programs. Users should not change the stack area by loading the SP register.

**FWA USER RAM** — Location 42200A is the first byte of RAM available to user programs. Most assembly language programs ORG (start) here, but they may ORG at a higher location, if desired. A user program may use the contiguous block of RAM starting at 42200A and continuing up to FWA RESIDENT HDOS. This limit address depends upon the amount of memory in the system, since HDOS locates itself in the highest available RAM. HDOS will issue an error message if you attempt to load a program larger than the available space.

SYSFWA  
to  
LAST RAM  
ADDRESS

000000A (0000H)  
to  
003377A (03FFH)

004000A (0400 H)  
to  
023377A (13FFH)

024000A (1400H)  
to  
027377A (17FFH)

030000A (1800H)  
to  
037377A (1F00H)

040000A (2000H)  
to  
041147A (2167H)

041150A (2168H)  
to  
042177A (227FH)

042200A (2280H)  
to  
SYSFWA-1

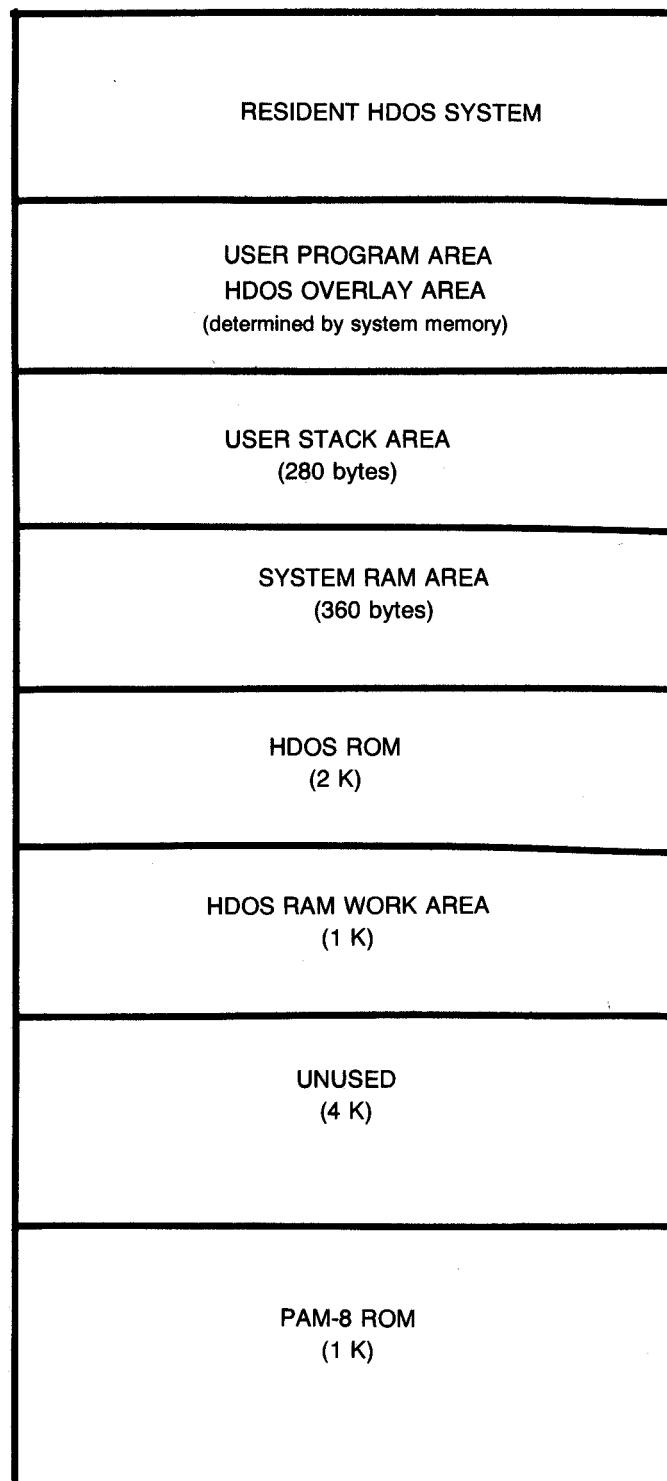


Figure 1-4  
Memory Map for H8.

A simplified memory map of the HDOS system for the H89 is shown in Figure 1-5. The major items shown in the memory map are:

**MTR-88 ROM (2K)** — Contains the MTR-88 (monitor) code.

**HDOS RAM Work area (1K)** — Used by HDOS to hold important system tables.

Among other things, these tables are used to hold storage allocation and directory information about the currently mounted disks. Damage to these tables could cause all of the information on the disk to become lost. For this reason, these areas are write-protected (via hardware) from user programs. Under no circumstances should a program attempt to write into these locations.

**HDOS ROM (2K)** — Contains the HDOS bootstrap routine, several general-purpose utility subroutines, and some parts of the HDOS operating system.

**SYSTEM RAM AREA** — Occupies the first location of RAM in your machine. This area contains cells used by MTR-88 as well as cells used by HDOS. These values are kept in RAM because they may need to be changed by HDOS during normal operation. They should not be altered by the user.

**USER STACK AREA** — Used to hold the stack of the user program and HDOS. Since the stack on the Z80 builds downwards, the top of the stack is at 42200A. HDOS will automatically maintain this stack for user programs. Users should not change the stack area by loading the SP register.

**FWA USER RAM** — Location 42200A is the first byte of RAM available to user programs. Most assembly language programs ORG (start) here, but they may ORG at a higher location, if desired. A user program may use the contiguous block of RAM starting at 42200A and continuing up to FWA RESIDENT HDOS. This limit address depends upon the amount of memory in the system, since HDOS locates itself in the highest available RAM. HDOS will issue an error message if you attempt to load a program larger than the available space.

SYSFWA  
to  
LAST RAM  
ADDRESS  
  
042200A (2280H)  
to  
SYSFWA-1  
  
041150A (2168H)  
to  
042177A (227FH)  
  
040000A (2000H)  
to  
041147A (2167H)  
  
030000A (1800H)  
to  
037377A (1FFFH)  
  
024000A (1400H)  
to  
027377A (17FFH)  
  
010000A (800H)  
to  
023377A (13FFH)  
  
000000A (000H)  
to  
007377A (7FFH)

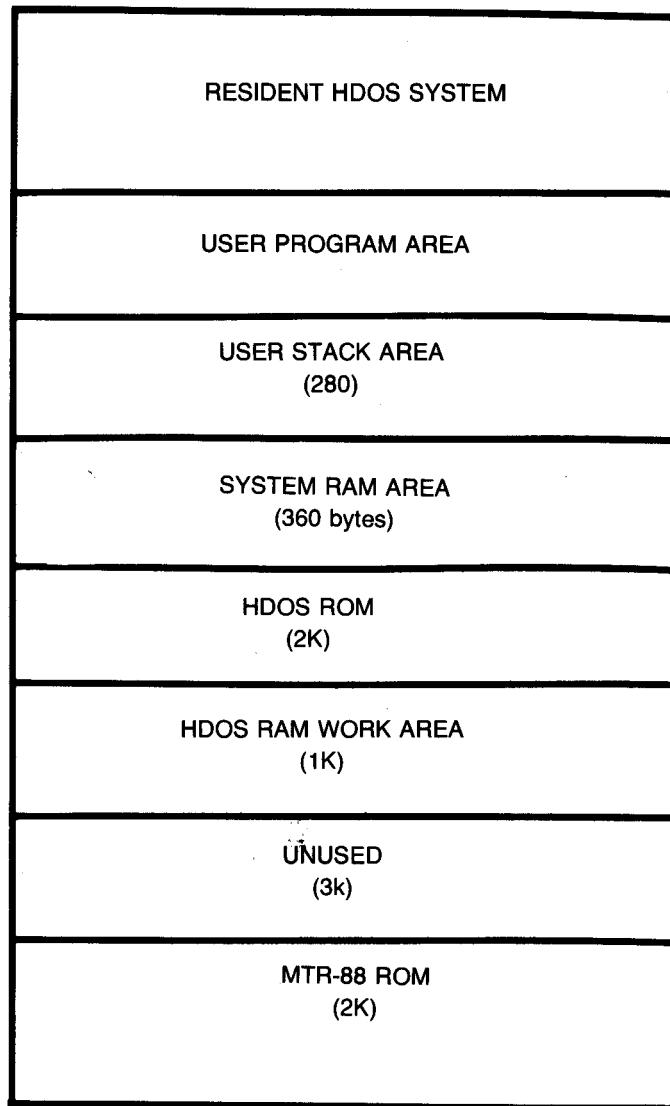


Figure 1-5  
Memory Map for H89.

Port		
H89		H8
H47 Floppy Disk	170-173Q (078-07BH)	H47 Floppy Disk
H17 Floppy Disk	174-177Q (07C-07FH)	H17 Floppy Disk
Reserved	300-307Q (0C0-0C7H)	Reserved
H88-3 Alternate Terminal	320-327Q (0D0-0D7H)	H8-4 Alternate Terminal
Reserved	330-337Q (0D8-0DFH)	Reserved
H14 Line Printer	340-347Q (0E0-0E7H)	H8-4 Line Printer
Console Terminal	350-357Q (0E8-0EFH)	H8-4 Console Terminal
Reserved	360-361Q (0F0-0F1H)	H8 Front Panel
H88-5 Cassette	370-371Q (0F8-0F9H)	H8-5 Cassette
Reserved	372-373Q (0F2-0FBH)	Console Terminal
Reserved	374-375Q (0FC-0FDH)	H8-5 Alternate Terminal
Reserved	376-377Q (0FE-0FFH)	Reserved

Figure 1-6  
Port Assignments

NOTE: Ports 000-077Q (000-03FH) are available for user applications and will not be referenced by Heath software.

<u>Interrupt Level</u>	<u>Use</u>
0	Master Reset/Clear
1	Clock Interrupts
2	Single Step
3	Console Interrupts
4	Reserved for Real-Time Clock (if implemented)
5	Reserved for H47 (if implemented)
6	User/Modem
7	HDOS System Calls

Figure 1-7  
Interrupts

## Appendix B

### CREATING SYSTEM VOLUMES FOR SECONDARY BOOT DRIVES

This Appendix will acquaint you with the procedure for generating system volumes that will enable you to boot your system using any drives which have been hardware configured as secondary boot drives. This Appendix will not touch directly upon the procedure for effecting a secondary boot. For a complete description of secondary boot options, refer to either the MTR-89 or the XCON-8 Manual.

In addition to the steps listed below, at some point you will probably want to test your secondary boot drives and diskettes. Refer to the appropriate TEST Optimization for the various TEST options.

The procedure listed below is by no means the only method for generating system volumes for secondary boot drives. It is intended primarily as a reference for the uninitiated. Variations on the options within the programs suggested below are not only possible but encouraged.

To create a bootable system volume for the secondary boot drives:

1. Perform Bootstrap from primary boot drive SY $\emptyset$ :; using a system volume which is an exact copy of the distribution diskette.
2. Use the INIT DK $\emptyset$ : option to initialize the blank diskette. Primary boot drive SY $\emptyset$ : is the source drive, and secondary boot drive DK $\emptyset$ : is the destination drive. Recall that drive DK $\emptyset$ : is the secondary boot drive whose hardware configuration number is zero.
3. Use the SYSGEN $\Delta$ \*.\* option to copy all files from the source disk to the destination disk. Type DK $\emptyset$ : in response to the prompt "Device<SY $\emptyset$ :>?". When you are asked to insert the source disk, just type  $\textcircled{S}$ . Primary boot drive SY $\emptyset$ : is the source drive, and secondary boot drive DK $\emptyset$ : is the destination.

4. Use the following SET options (if you have a video terminal)

- A. SET $\Delta$ TT: $\Delta$ BKS  $\textcircled{CR}$
- B. SET $\Delta$ TT: $\Delta$ NOMLI  $\textcircled{CR}$
- C. SET $\Delta$ TT: $\Delta$ NOMLO  $\textcircled{CR}$

Suggested Variations:

**INIT**

Instead of typing INIT DK $\emptyset$ :

- A. Type INIT, and then respond DK $\emptyset$ : (or DK1: or DK2:) to the message "Device<SY $\emptyset$ :>?"
- B. Type INIT DK1: or INIT DK2:. INIT DK1: and INIT DK2: are valid options only if you have a disk drive whose hardware configuration number corresponds to the "n" in the DKn: format. DK1: is the secondary boot drive whose hardware number is 1, and DK2: is the secondary boot drive whose hardware number is 2.

**SYSGEN**

Instead of typing SYSGEN $\Delta$ \*.\*:

- A. Simply type SYSGEN, and then respond with DK $\emptyset$ : DK1:, or DK2: to the prompt "Device<SY $\emptyset$ :>?". This will necessitate that you run ONECOPY in order to transfer non-system files such as BASIC. Refer to "ONECOPY Optimization" if you need help.
- B. Type SYSGEN /MIN. This will create a system volume which contains only the most essential HDOS system files. Type DK $\emptyset$ : DK1:, or DK2: in response to the "Device<SY $\emptyset$ :>?" prompt. If you use this SYSGEN option, you will need to use ONECOPY to transfer non-system files. Refer to "ONECOPY Optimization" if you need help.

Once you have generated a system volume by means of this procedure, you can use the disk to generate other system volumes or working diskettes. However, since the source drive for INIT and SYSGEN must be SY $\emptyset$ : if you want to use a secondary-boot system volume to INIT or SYSGEN to any other drive, you must perform a secondary boot using the secondary-boot volume. The procedure for performing a secondary boot is detailed in the MTR-80 and XCON-8 Manuals.

## *Appendix C*

### **STAND-ALONE PROGRAM OUTPUTS**

>INIT

INIT  
VERSION: 2.0  
ISSUE: #50.06.00

THIS ROUTINE IS USED TO INITIALIZE HDOS FLOPPY DISKS. IT IS A STAND-ALONE UTILITY, AND WILL DESTROY ANY FILES ON THE DISKS IT INITIALIZES. DO NOT ATTEMPT TO USE THIS PROGRAM UNTIL YOU HAVE STUDIED THE APPROPRIATE MANUAL.

PROCEED (YES/NO) <NO> ?YES

DISMOUNTING ALL DISKS:

VOLUME 000, DISMOUNTED FROM SY0:  
LABEL: HDOS 2.0 ISSUE #50.06.00 (COPYRIGHT(c) HEATH CO 1980) 890-64

REMOVE THE DISK(S). HIT RETURN WHEN READY:

DEVICE<SY0:>?

INSERT THE VOLUME YOU WISH TO INITIALIZE INTO SY0:;  
REMEMBER, ANY DATA ON THIS VOLUME WILL BE DESTROYED.

HIT RETURN WHEN READY.

READY?

THE VOLUME NOW IN THE DRIVE ...

APPARENTLY HAS NOT BEEN INITIALIZED BEFORE

TYPE NO TO CANCEL, TYPE YES TO ERASE AND INITIALIZE THE DISK. (YES/NO) ?YES

ENTER A UNIQUE VOLUME SERIAL NUMBER FROM 1 TO 255: 1  
ENTER A VOLUME LABEL OF 60 CHARACTERS OR LESS  
SYSTEM VOLUME

ENTER THE NUMBERS OF THE BAD SECTORS ONE AT A TIME. HIT RETURN  
AFTER EACH ENTRY, AND WHEN FINISHED.  
SECTOR?

DISK INITIALIZATION COMPLETE.

INSERT THE VOLUME YOU WISH TO INITIALIZE INTO SY1:;  
REMEMBER, ANY DATA ON THIS VOLUME WILL BE DESTROYED.

HIT RETURN WHEN READY.

READY?

THE VOLUME NOW IN THE DRIVE ...  
APPARENTLY HAS NOT BEEN INITIALIZED BEFORE

TYPE NO TO CANCEL, TYPE YES TO ERASE AND INITIALIZE THE DISK (YES/NO) ?YES

ENTER A UNIQUE VOLUME SERIAL NUMBER FROM 1 TO 255: 10

ENTER A VOLUME LABEL OF 60 CHARACTERS OR LESS

WORKING DISKETTE

ENTER THE NUMBERS OF THE BAD SECTORS ONE AT A TIME. HIT RETURN  
AFTER EACH ENTRY, AND WHEN FINISHED.  
SECTOR?

DISK INITIALIZATION COMPLETE.

INSERT THE VOLUME YOU WISH TO INITIALIZE INTO SY0:;  
REMEMBER, ANY DATA ON THIS VOLUME WILL BE DESTROYED.

HIT RETURN WHEN READY.

READY?

DEVICE<SY0:>?

DO YOU HAVE ANY MORE DISKS TO INITIALIZE (YES/NO) <NO> ?NO

INSTALL A BOOTABLE DISK IN SY0:. HIT RETURN TO REBOOT:

>TEST17

DISMOUNTING ALL DISKS:

VOLUME 001, DISMOUNTED FROM SY $\emptyset$ :  
LABEL: HDOS DISTRIBUTION DISKETTE

REMOVE THE DISK(S). HIT RETURN WHEN READY:

TEST17  
VERSION: 2.0  
ISSUE #50.06.00

THIS PROGRAM TESTS YOUR DISK SYSTEM. CERTAIN TESTS DESTROY THE DATA ON THE VOLUME UNDER TEST. THIS VOLUME MUST HAVE BEEN INITIALIZED AT LEAST ONCE, AND MAY HAVE TO BE REINITIALIZED BEFORE BEING USED FOR ANYTHING ELSE.

PROCEED (YES/NO)? YES

WHICH DRIVE (0/1/2) ? 0

FUNCTIONS AVAILABLE:

T - DISPLAY DRIVE ROTATIONAL SPEED  
D - GENERAL DRIVE CHECKOUT  
M - MEDIA CHECK (SECTOR VALIDITY)  
S - PERFORM SEEK TIME CHECKOUT  
E - EXIT TO BOOT PROGRAM

U - SELECT ANOTHER DRIVE UNIT  
C - CLEAN DRIVE HEAD  
A - ALIGN DRIVE HEAD  
R - HARDCOPY REPORT

CTRL-C CANCELS THE TEST IN PROGRESS.

OPTION: T

INSERT THE DISKETTE YOU WISH TO USE FOR THIS TEST  
INTO DRIVE  $\emptyset$ :, AND HIT RETURN

READY?

0.998  
0.999  
0.998  
0.998

FUNCTIONS AVAILABLE:

T - DISPLAY DRIVE ROTATIONAL SPEED  
D - GENERAL DRIVE CHECKOUT  
M - MEDIA CHECK (SECTOR VALIDITY)  
S - PERFORM SEEK TIME CHECKOUT  
E - EXIT TO BOOT PROGRAM

U - SELECT ANOTHER DRIVE UNIT  
C - CLEAN DRIVE HEAD  
A - ALIGN DRIVE HEAD  
R - HARDCOPY REPORT

CTRL-C CANCELS THE TEST IN PROGRESS.

OPTION: D

INSERT THE DISKETTE YOU WISH TO USE FOR THIS TEST  
INTO DRIVE O:, AND HIT RETURN.

READY?

3 PASS GENERAL DRIVE TEST FOR UNIT O

ABCDEFG END OF PASS 1

ABCDEFG END OF PASS 2

ABCDEFG END OF PASS 3

FUNCTIONS AVAILABLE:

T - DISPLAY DRIVE ROTATIONAL SPEED

D - GENERAL DRIVE CHECKOUT

M - MEDIA CHECK (SECTOR VALIDITY)

S - PERFORM SEEK TIME CHECKOUT

E - EXIT TO BOOT PROGRAM

U - SELECT ANOTHER DRIVE UNIT

C - CLEAN DRIVE HEAD

A - ALIGN DRIVE HEAD

R - HARDCOPY REPORT

CTRL-C CANCELS THE TEST IN PROGRESS.

OPTION: M

0 BAD SECTORS LOCATED

FUNCTIONS AVAILABLE:

T - DISPLAY DRIVE ROTATIONAL SPEED

D - GENERAL DRIVE CHECKOUT

M - MEDIA CHECK (SECTOR VALIDITY)

S - PERFORM SEEK TIME CHECKOUT

E - EXIT TO BOOT PROGRAM

U - SELECT ANOTHER DRIVE UNIT

C - CLEAN DRIVE HEAD

A - ALIGN DRIVE HEAD

R - HARDCOPY REPORT

CTRL-C CANCELS THE TEST IN PROGRESS.

OPTION: S

SEEK TIMING TEST: SEE THE MANUAL BEFORE RUNNING THIS TEST.

\*\*\*\*\*  
\*\*\*\*\*  
\*\*  
\*\* NOTE:  
\*\* THE FLOPPY DISK DRIVES ARE SPEC-  
\*\* IFIED TO STEP AT 30 MILLISECONDS PER  
\*\* TRACK BY THEIR MANUFACTURER.  
\*\*  
\*\* OCCASIONALLY, DRIVES MAY STEP  
\*\* FASTER, AND THIS TEST DETERMINES THE  
\*\* MINIMUM STEP TIME FOR YOUR PARTICULAR  
\*\* DRIVE. HOWEVER, HEATH DOES NOT GUAR-  
\*\* ANTEE THAT ANY DRIVE WILL STEP FASTER  
\*\* THAN 30 MILLISECONDS PER TRACK.  
\*\*  
\*\*\*\*\*  
\*\*\*\*\*

PROCEED (YES/NO) 0 YES

TRYING 36 MILLISECONDS PER TRACK - OK!  
TRYING 34 MILLISECONDS PER TRACK - OK!  
TRYING 32 MILLISECONDS PER TRACK - OK!  
TRYING 30 MILLISECONDS PER TRACK - OK!  
TRYING 28 MILLISECONDS PER TRACK - OK!  
TRYING 26 MILLISECONDS PER TRACK - OK!  
TRYING 24 MILLISECONDS PER TRACK -

DRIVE PERFORMS RELIABLY AT 26 MILLISCEONDS PER TRACK

## FUNCTIONS AVAILABLE:

T - DISPLAY DRIVE ROTATIONAL SPEED	U - SELECT ANOTHER DRIVE UNIT
D - GENERAL DRIVE CHECKOUT	C - CLEAN DRIVE HEAD
M - MEDIA CHECK (SECTOR VALIDITY)	A - ALIGN DRIVE HEAD
S - PERFORM SEEK TIME CHECKOUT	R - HARDCOPY REPORT
E - EXIT TO BOOT PROGRAM	

CTRL-C CANCELS THE TEST IN PROGRESS.

OPTION: U

TEST17  
VERSION: 2.0  
ISSUE #50.06.00

THIS PROGRAM TESTS YOUR DISK SYSTEM. CERTAIN TESTS DESTROY THE DATA ON THE VOLUME UNDER TEST.  
THIS VOLUME MUST HAVE BEEN INITIALIZED AT LEAST ONCE, AND MAY HAVE TO BE REINITIALIZED BEFORE BEING USED  
FOR ANYTHING ELSE.

PROCEED (YES/NO)? YES

WHICH DRIVE (0/1/2) ? 1

## FUNCTIONS AVAILABLE:

T - DISPLAY DRIVE ROTATIONAL SPEED	U - SELECT ANOTHER DRIVE UNIT
D - GENERAL DRIVE CHECKOUT	C - CLEAN DRIVE HEAD
M - MEDIA CHECK (SECTOR VALIDITY)	A - ALIGN DRIVE HEAD
S - PERFORM SEEK TIME CHECKOUT	R - HARDCOPY REPORT
E - EXIT TO BOOT PROGRAM	

CTRL-C CANCELS THE TEST IN PROGRESS.

OPTION: E

INSTALL A BOOTABLE-DISK IN SY0: . HIT RETURN TO REBOOT:

>TEST47

DISMOUNTING ALL DISKS:

VOLUME 001, DISMOUNTED FROM SY0:  
LABEL: HDOS DISTRIBUTION DISKETTE

REMOVE THE DISK(S). HIT RETURN WHEN READY:

TEST47

VERSION: 2.0  
ISSUE #50.06.00

THIS PROGRAM TESTS YOUR DISK SYSTEM. CERTAIN TESTS DESTROY THE DATA ON THE VOLUME UNDER TEST.  
THIS VOLUME MUST HAVE BEEN INITIALIZED AT LEAST ONCE, AND MAY HAVE TO BE REINITIALIZED BEFORE USED FOR  
ANYTHING ELSE.

PROCEED (YES/NO)? YES

WHICH DRIVE (0/1) ? 0

FUNCTIONS AVAILABLE:

D - GENERAL DRIVE CHECKOUT	C - CLEAN DRIVE HEAD
M - MEDIA CHECK (SECTOR VALIDITY)	A - ALIGN DRIVE HEAD
U - SELECT ANOTHER DRIVE UNIT	R - HARDCOPY REPORT
E - EXIT TO BOOT PROGRAM	

CTRL-C CANCELS THE TEST IN PROGRESS.

OPTION: M

INSERT THE DISKETTE YOU WISH TO USE FOR THIS TEST  
INTO DRIVE 0:, AND HIT RETURN  
READY?

0 BAD SECTORS LOCATED

FUNCTIONS AVAILABLE:

D - GENERAL DRIVE CHECKOUT	C - CLEAN DRIVE HEAD
M - MEDIA CHECK (SECTOR VALIDITY)	A - ALIGN DRIVE HEAD
U - SELECT ANOTHER DRIVE UNIT	R - HARDCOPY REPORT
E - EXIT TO BOOT PROGRAM	

CTRL-C CANCELS THE TEST IN PROGRESS.

OPTION: D

3 PASS GENERAL DRIVE TEST FOR UNIT 0  
ABCDEFG END OF PASS 1  
ABCDEFG END OF PASS 2  
ABCDEFG END OF PASS 3

## FUNCTIONS AVAILABLE:

D - GENERAL DRIVE CHECKOUT	C - CLEAN DRIVE HEAD
M - MEDIA CHECK (SECTOR VALIDITY)	A - ALIGN DRIVE HEAD
U - SELECT ANOTHER DRIVE UNIT	R - HARDCOPY REPORT
E - EXIT TO BOOT PROGRAM	

CTRL-C CANCELS THE TEST IN PROGRESS.

OPTION: U

TEST47  
VERSION: 2.0  
ISSUE #50.06.00

THIS PROGRAM TESTS YOUR DISK SYSTEM. CERTAIN TESTS DESTROY THE DATA ON THE VOLUME UNDER TEST.  
THIS VOLUME MUST HAVE BEEN INITIALIZED AT LEAST ONCE, AND MAY HAVE TO BE REINITIALIZED BEFORE BEING USED  
FOR ANYTHING ELSE.

PROCEED (YES/NO)? YES

WHICH DRIVE (0/1) ? 1

## FUNCTIONS AVAILABLE:

D - GENERAL DRIVE CHECKOUT	C - CLEAN DRIVE HEAD
M - MEDIA CHECK (SECTOR VALIDITY)	A - ALIGN DRIVE HEAD
U - SELECT ANOTHER DRIVE UNIT	R - HARDCOPY REPORT
E - EXIT TO BOOT PROGRAM	

CTRL-C CANCELS THE TEST IN PROGRESS.

OPTION: E

INSTALL A BOOTABLE DISK IN SY0: . HIT RETURN TO REBOOT:

>SYSGEN

SYSGEN  
VERSION: 2.0  
ISSUE: #50.06.00

DESTINATION DEVICE<SY0:>?

DISMOUNTING ALL DISKS:

VOLUME 000, DISMOUNTED FROM SY0:

LABEL: HDOS 2.0 ISSUE #50.06.00 (COPYRIGHT(C) HEATH CO 1980) 890-64

REMOVE THE DISK(S). HIT RETURN WHEN READY:

INSERT THE SOURCE DISKETTE IN SY0:. HIT RETURN WHEN READY:

INSERT DESTINATION:

INSERT SOURCE:

INSERT DESTINATION:

INSERT SOURCE:

INSERT DESTINATION:

INSERT SOURCE:

INSERT DESTINATION:

20 FILES COPIED

INSTALL A BOOTABLE DISK IN SY0:. HIT RETURN TO REBOOT:

>ONECOPY 

DISMOUNTING ALL DISKS:

VOLUME 001, DISMOUNTED FROM SY0:

LABEL: SYSTEM VOLUME

REMOVE THE DISK(S). HIT RETURN WHEN READY:

ONECOPY  
VERSION: 2.0  
ISSUE: #50.06.00

ONECOPY IS USED TO COPY FILES FOR SYSTEMS WITH ONLY ONE FLOPPY DRIVE. READ THE APPROPRIATE MANUAL BEFORE USING.

INSERT THE INITIAL SOURCE DISKETTE. HIT READY WHEN READY:

:OC:BASIC.ABS

INSERT DESTINATION:

INSERT SOURCE:

1 FILES COPIED

:OC:

VOLUME 001, DISMOUNTED FROM SY0:

LABEL: SYSTEM VOLUME

INSTALL A BOOTABLE DISK IN SY0: HIT RETURN TO REBOOT:



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