

# **SOFTWARE REFERENCE MANUAL**

## **Heath Disk Operating System**

**Model H89-17**

**595-2334-01**

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**HEATH COMPANY**  
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# **SOFTWARE REFERENCE MANUAL**

## **HDOS SYSTEM**

*Chapter 0*

**Configuration  
for the  
H89-17**

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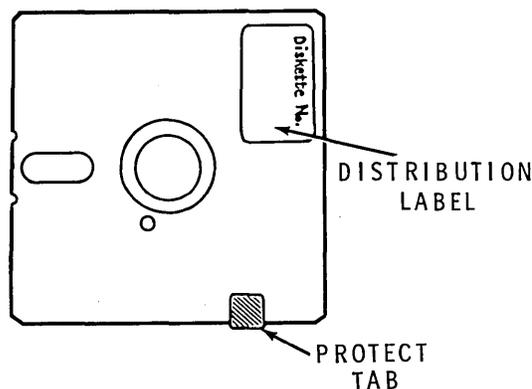
## INTRODUCTION

The heart of your H89-17 Heath Disk Operating System, HDOS, is a sophisticated library of programs which control and facilitate the operations you will soon be performing. Before you use HDOS, be sure to read the parts of this chapter entitled "System Configuration" (on Page 0-5) and "Theory of Operation" (on Page 0-7). You will then have to perform the "System Set-Up Procedure" (on Page 0-15) in order to get your system up and running. From there, you can proceed to Chapter 1, the HDOS Manual, which will instruct you in the everyday use of HDOS.

The H89-17 system and HDOS have 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 enjoyment and rewards you will derive from using the system are limited only by your own imagination.

This Chapter introduces you to the H89 computer system, and instructs you in setting up and running your computer's software. It also contains detailed explanations of the procedures that you must use. If this is your first use of an H89, you can quickly set up your system by using the sections titled **"FIRST TIME THROUGH.?"** Later, you should go back through this chapter and read all the information.

You should have two blank, unlabeled diskettes and the distribution diskette. The distribution diskette has a write-protect tab on it. This tab must NOT be removed. You should only use the distribution diskette to transfer files to other diskettes.



## FIRST TIME THROUGH ?

Follow the instructions in sequence. The responses that you type are given in **bold type**. Messages from the computer are shown in "QUOTES". Each step gives a brief explanation of the program's activity. The complete description is given in the program description following the **FIRST TIME THROUGH** sections. You can check off each step as you finish it.

NOTE: From now on, you will notice that all of the examples assume you can spell and type correctly. This is not always an accurate assumption. If you type a word incorrectly, and notice it **BEFORE** you press the **RETURN** key, you can instruct the computer to ignore that entry. To do this, hold down the **CTRL** key and type the letter **U**. The "U" will be displayed, a carriage return will be automatically generated, and you can re-type your entry.

If you misspell or mistype a word, and don't notice it until after you press the **RETURN**, don't panic. HDOS will attempt to execute the word you entered (UMUT, for example); when it can't, an error message will be displayed for you. A new prompt will then be printed. Just enter the word again.

**GO TO PAGE 0-14.**

## SYSTEM CONFIGURATION

The following paragraphs describe the minimum requirements of your operating system. It is impossible to list all the different combinations that you may want to use. But this information will let you configure the operating system so you can begin using your H89 computer system.

This section only contains the information about the software configuration. Refer to the "System Configuration" section of your "Operation Manual" for instructions on how to configure your hardware.

You must have an H89 computer system with a minimum 16K bytes of memory. Moreover, this memory must operate continuously from decimal location 8192 (i.e.040.000A) to the available upper memory limit of your computer. Note that the lower 8192 bytes of memory are reserved.

Table 0-1 outlines the port allocation scheme used on the H89 computer system. It lists the device and the device name used in the software. For instance, the console terminal is referenced by the software as TT: and the Line Printer as LP:.

The Operating system does not use any port address below 100 octal. These ports are available for your use.

**TABLE 0-1**

DEVICE	DEVICE NAME	INTERFACE CARD	PORT ADDRESS	INTERRUPTS
Console Terminal	TT:		350-357Q	3
Cassette	--*	H88-5 Serial	370-371Q	—
Line Printer	LP:	H88-3 Serial	340-347Q	—
Alt. Terminal	AT:	H88-3 Serial	320-327Q	—
Floppy Disk	SY:	Special	174-177Q	—
Reserved			170-173Q	—
Reserved			360-361Q	—
Reserved			376-377Q	—

\* - None is used.

**NOTES:**

1. If you are using an H36 DECWRITER as a Line Printer, you must connect it as the device AT:. In addition, an H14 Line Printer must be connected as the device LP:.
2. The AT: driver is named ATH84. DVD and must be reconfigured to address Port 320Q. It can only be used to communicate with RS232-style devices.
3. AT: port addresses are given in octal, indicated by "Q". Thus, address 350Q is port 350 octal.

The H89 system includes a single 5.25" disk drive unit. The system also includes a disk controller card, which plugs into the H89 bus.

The drive is mounted in the right side of the H89 cabinet and is connected to the disk controller by means of a 34-conductor flat ribbon cable. This drive will hereafter be referred to as SY $\emptyset$ :

The Heath Disk Operating System, HDOS, supports two disk drives. This second drive is referred to as "SY1:".

SY $\emptyset$ : is the "system" drive unit. You were provided with one 5.25" "distribution" diskette. When you have generated a "system" diskette, as described in the "System Set-Up Procedure", it will always be mounted in SY $\emptyset$ : for normal operation. And since you can easily damage or destroy a diskette by misuse or improper handling, always follow the instructions very carefully until you are thoroughly familiar with HDOS operating procedures.

**WARNING**

You should only use the distribution diskette to transfer files to the volumes in your system. Therefore, do not run any programs other than those specified in these Software Reference Manuals. If you try to run other programs, such as BASIC (with the distribution diskette in SY $\emptyset$ ;) you will cause unpredictable results.

Note that the distribution diskette is supplied with a write-protection tab in place. This is done to guarantee that you will always have an accurate copy of the operating system. Never remove this tab. Heath may refuse to support a system if the write-protection tab is removed from the distribution diskette.

Under normal conditions, you will need extra diskettes for storage of data and programs. We recommend that you have at least two copies of the system diskette on hand, as well as a spare copy of any important information. The "System Set-Up Procedure" will tell you how to make these extra diskettes.

Note: "SY $\emptyset$ :" means system unit zero. Where the notation may be confusing, zeros will be slashed (/), to distinguish them from the letter O.

## THEORY OF OPERATION

Although it is not absolutely essential that you know the Theory of Operation for this system, a basic knowledge of it will help you to use the system more effectively. Read this information before you proceed to the "System Set-Up Procedure". Refer to Appendix A, the "Glossary", in Chapter 1, for a definition of any unfamiliar terms.

A disk system combines many of the advantages of other types of data storage systems. It is not as fast as random-access memory, but for the same amount of storage area it is much less expensive. On the other hand a disk system costs more than a tape system for the same amount of storage, but it can locate a given data record much more rapidly. Each type of data storage system has its advantages. However, the disk system provides the most functional combinations for everyday applications.

### The Diskette

A diskette is a circular sheet of mylar coated with a magnetic oxide. As the diskette rotates at 300 rpm, an electromagnetic head passes over the oxide material, called the "medium", and interacts with it by means of a magnetic field. This combination of head and medium is a lot like the magnetic tape recorder you use to record and play music.

The medium consists of millions of tiny magnetic particles called "domains". Each of these domains is magnetized in one direction or the other. The direction in which a domain is magnetized describes the binary data stored on the diskette.

If the read/write head is "reading" information, it senses the direction in which the domains in a given area are magnetized, and converts this information into electric impulses which become binary bits. If the head is "writing" the opposite happens; the bits are converted into electrical impulses, changing the magnetic field around the head. This, in turn, magnetizes some of the domains in one direction or the other, depending upon whether the bits are ones or zeros.

Each diskette can store 102,400 bytes of data, with each byte composed of eight bits. The diskettes are divided into 40 tracks, circular rings, much like the grooves in an LP record. Each track is subdivided into 10 sectors, giving a total of 400 sectors of 256 bytes each.

## Access Time — Finding The Right Sector

The process of finding the correct 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 and this is called the “track step-time”. The drive used in the H89 has a guaranteed track step-time of 30 milliseconds. “Test” will explain how to determine your drive’s optimum time.

Another factor that determines system speed is called “rotational latency”. Since the diskette rotates at 300 rpm, the system may have to wait as long as 200 milliseconds for the desired sector to rotate under the head after it finds the correct track. This latency period averages 100 milliseconds for a random disk access.

A little arithmetic, then, shows that up to 500 milliseconds will be required to access a random sector. This depends on the track step-time of the particular drive; and it is based on calculations which show that one-third of the tracks will have to be skipped over, on the average, for a random disk access. The average drive will require about 225 milliseconds for every access of a random sector. If many sectors are accessed and if they are close to each other, the average access time will be much lower.

As soon as the system finds the correct sector, it reads or writes the data, one bit at a time (serially) at a rate of 16,000 bytes per second. The data is transferred between the drive and the controller. The controller converts the serial data into a parallel format, and communicates it by means of an I/O port to the CPU.

As an example of its quick access and high performance, the H89 system can load Extended Benton Harbor BASIC into memory in about two seconds. The Heath cassette system, operating at 1200 baud, requires about two minutes to load from the beginning of the tape.

## The Software System

The sector, because it is the smallest amount of data that the system can transfer between the disk drive and memory in a single access, is the basic unit of the diskette. The disk system is “hard-sectored”. This means that the size and location of each sector is determined by the disk controller board rather than by the operating system. This is actually where HDOS comes into play. It must communicate with hardware devices, such as a disk drive controller. On the other side of the interface, it must also communicate with you, the “user” or “operator”, by means of programmed instructions or console commands.

An operating system is more than just a collection of programs that perform various functions, such as communicating with peripherals or finding data on a diskette. The central idea is that the software system is logically organized. All its programs are available to you at any time, for specific purposes, by means of operating system “commands”.

A portion of the operating system called the “**Monitor**” is in command of the other portions. It controls the decoding of commands and temporarily passes control to subprograms, which carry out the commands. After each operation is completed, control returns to the monitor, which awaits the next command. Thus, the monitor is like a switchboard operator who handles communications for a busy city.

## Files

The operating system establishes this communication between hardware and software by means of a data structure known as a “**file**”. If you consider a disk drive as if it were a filing cabinet, then the sectors on the diskette correspond to sheets of paper within the filing cabinet. The disk file is then analogous to a folder within the cabinet, with a label on it, which contains a number of the sheets of paper. In other words, a file is an organized group of disk sectors.

Whether you keep the files in an office filing cabinet or on a diskette, you must organize them in a way that allows you to find them easily. A new file must be inserted into its proper place, and old files that are changed must be replaced for future reference.

In this sense, an operating system is like a clerk who keeps track of a great deal of information, or a librarian who must know where all the books are found. The operating system must: find space on the disk for new files; give each file a name that allows it to be cross-referenced; be able to copy data from one file to another; and be able to re-name, update, and delete files. Above all, the operating system must be able to communicate with you and carry out your commands quickly and efficiently.

Under HDOS, each file consists of one or more “**clusters**”, where each cluster is composed of two contiguous sectors. HDOS automatically increases the size of files, as required, in increments of one cluster. Therefore, the size of an HDOS file can run from 512 bytes, which is two 256-byte sectors, up to the total available space on a diskette.

In order to communicate with the operating system, you or your program must issue commands. The exact command syntax is discussed in the HDOS Manual. In some cases, the commands will be issued from the system console.

Other commands may be included in a program written in BASIC or assembly language. These will allow a process to “open” and “close” files, and to perform read/write operations on the files. Refer to the appropriate language manual for the proper command syntax.

## Controlling the Peripherals

An operating system must also manage all the peripherals in the system. This allows you to type-in commands from the system console, and have the operating system perform some I/O function without your intervention. You may also include such commands in your programs without having to write detailed instructions for controlling the peripherals. The operating system will take care of the “messy details”.

HDOS uses programs called “**device drivers**” to control peripherals. Each device driver is written with the characteristics of a particular peripheral in mind. Its speed, line length, and “handshaking” capability are examples of the characteristics. For standard ASCII serial peripherals, the device drivers may differ only in minor details. They may be unique for other devices such as paper tape punches or X-Y plotters.

However, all device drivers have one thing in common. After they are written, one for each peripheral, they become a part of the operating system. It is not necessary to include the drivers in each program which uses the peripherals because these programs can simply issue I/O requests to the operating system. This can save a great deal of space in each program because the instructions for controlling the peripherals need not be repeated. You can also make a program communicate with many different peripherals, without rewriting it, by simply redefining the appropriate device drivers.

Programs running under HDOS are called “device independent”. Each peripheral is given a symbolic name, much like a file. For instance, the system console is referred to as “TT:”, and “SYØ:” identifies the system disk drive. The colon (:) at the end of each name identifies it as that of a device name rather than a file name.

## Transferring Data

Data can be copied from file to file. It can also be copied from a file to a device, or from a device to a file. To create a new file with data typed-in from the console, you simply command HDOS to copy from your terminal to a unique file name. Refer to the HDOS Manual for the syntax of such commands.

In order to keep track of all the files and devices in the system, an operating system uses a cross-index 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 with the name to locate the sectors which make up the file.

As the sectors are accessed, HDOS transfers the data between the disk and RAM. The area of RAM that is used to hold the data is called the “**buffer**”. A buffer of sufficient size must be set aside by each program which reads files. BASIC automatically sets aside any necessary buffer space.

## Memory Map

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

The HDOS monitor is automatically located in the high end of your H89’s memory when you “boot-up” the system. It occupies about 2.4K of RAM. Other portions of HDOS, such as the program which communicates with the disk drive and other peripherals, may require another 9K. Therefore, 12K is required to run HDOS. Other products, such as BASIC, require as much as 16K total RAM, with HDOS included.

HDOS attempts to conserve 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 capability is not required very frequently, so this part of the operating system can be left on the diskette most of the time. When HDOS requires these functions, it temporarily stores the contents of the overlay area on a file while it loads the contents of another file into the area. This new portion of the operating system performs its task and then restores the original overlay area memory contents when finished. When the overlay area is not required for other purposes, HDOS resides there continuously.

## Errors

The last important function of HDOS, its ability to recognize and report errors, is one with which you will soon become very familiar. Typical errors involve attempts to issue commands which are not correctly formatted, or references to nonexistent files. In order to prevent damage to the contents of your diskette, HDOS recognizes such attempts and replies with appropriate error messages.

*NOTE: The remaining parts of this "Introduction" will lead you through the important parts of HDOS one step at a time, so your errors should be few. If you follow the instructions carefully, you will be able to take full advantage of all the capabilities of HDOS.*

## Notation Conventions

△ = Required space, produced by depressing the space bar.

Ⓒ = Carriage return, produced by the RETURN key.

<exp> = If you type a Ⓒ, HDOS assumes the reply enclosed in the arrows.

CTRL = Symbol for Control key on a console keyboard.

Underlined text is used to indicate user/operator input from the console.

## Console Conventions

In addition to the standard operating system commands, there are a number of conventional ASCII control codes you can use for special purposes. For example, in typing a command, you may accidentally strike the wrong key on your console. You may use the ASCII DELETE (or RUBOUT) control code to erase the last character, which you may then retype. You may also use the key several times in succession to back-up more than one space. You may reject an entire line of keyboard input by striking CTRL-U, as long as you do it before typing a carriage return. The following list summarizes the HDOS control conventions.

**CTRL-C** — Halts any ongoing activity by HDOS or a utility program. Control is retained by whatever program is currently running, but it will stop and await command from the console.

**CTRL-D** — Causes an exit from the command mode of a utility program, such as PIP, back to the end of the HDOS command mode. When copying files, this signifies an “end-of-transmission” condition, returning you to the current command mode, whether it is the “main” HDOS command mode, or one of the utilities.

**CTRL-O** — Discards output from HDOS and the utilities until the next prompt is reached.

**CTRL-P** — Immediately resume output (following a CTRL-O).

**CTRL-S** — Temporarily halts the output to the console until CTRL-Q is struck.

**CTRL-Q** — Restarts output to the console (following a CTRL-S).

**CTRL-U** — Discards the current console input line, allowing you to start over.

**CTRL-Z** — Cancels any ongoing HDOS activities when struck twice in succession. Also causes the data in an input file or buffer to be discarded. This code is generally used in emergency situations to return directly to the HDOS command mode.

**DELETE** — Allows you to retype the last character. The system will backspace over the last character, removing it from the screen.

**RUBOUT** — Has the same effect as DELETE.

## FIRST TIME THROUGH BOOT-UP?

- ( ) 1. Make sure the off-line key is up. This puts the console terminal on-line to the computer.
- ( ) 2. Turn on the power to the H89. You should hear two beeps and see an "H:" in the upper left hand corner of the screen.
- ( ) 3. Insert the distribution diskette in the drive. The label should be facing towards the console screen, on the upper corner of the diskette. Close the door on the drive unit after you insert the diskette.
- ( ) 4. Type the letter **B**. The screen will print "oot".
- ( ) 5. Press the **RETURN** key. (This is will referred to from now on as Ⓢ). You will hear some noise and clicks from the disk drive as it accesses the diskette. This is normal. Get used to it!
- ( ) 6. A message "TYPE SPACES TO DETERMINE BAUD RATE" will display on the screen. **Press the space bar** until the message "ACTION? <BOOT>" appears. (Don't worry if you press the space bar extra times and get a lot of "ACTION? <BOOT>" messages. You haven't damaged anything.
- ( ) 7. Type a Ⓢ (carriage return, produced by the RETURN key). There will be some more noise.
- ( ) 8. The message "DATE (DD-MMM-YY)?" will display. Type the correct date after the message in the format shown: **16-OCT-79** and then type a Ⓢ. Expect more sounds from the drive!!
- ( ) 9. A ">" will display on the screen. This is a prompt from HDOS, and means that the operating system is now in memory and in charge. You can now request the operating system to do things for you. So long as your request is valid, it will be done!

**THIS FINISHES THE BOOT-UP PROCEDURE.  
IF THIS IS YOUR FIRST TIME THROUGH, GO  
TO INITIALIZATION, PAGE 0-19.**

## SYSTEM SET-UP PROCEDURE

At this point, your H89 computer system should be assembled and the "Rotational Speed Test" in your Operations Manual should have been successfully completed. Read through the following sections before actually performing any of the operations.

You will use this section frequently. The first time, however, you will have to sysgen a diskette. The distribution diskette should only be used to transfer files. Running a program other than those specified in this procedure will cause unpredictable results.

Sysgening a diskette will produce your own system volume capable of running HDOS and other programs. You will probably wish to configure different diskettes for other programs. For now however, follow this procedure to generate a system volume.

**WARNING:** If the "Rotational Speed Test" failed, DO NOT attempt to perform the "System Set-Up Procedure" at this time. Instead, refer to the troubleshooting guide in your H89 Operations Manual.

### Power-Up

Use the following method to get your H89 system started from a power-off condition.

**WARNING:** DO NOT install a diskette in the drive unit before applying power.

1. Make sure your unit is "on-line", and apply power to your H89. You should hear two "beeps", and see an "H:" on the upper left corner of the console screen.
2. Install the system (distribution) diskette in your system drive unit. The label should be facing towards the console screen, on the upper corner of the diskette. Close the door on the drive unit after you insert the diskette.
3. Type a "B" after the "H:" prompt. The monitor will complete the word "BOOT" for you. Type a  $\oplus$  and the H89 will access the ROM.
4. Perform the "Bootstrap" procedure which follows.

## Bootstrap

This procedure establishes communication between your H89 computer and your disk drive. It is called “booting” the operating system (HDOS) to get it started. When you “boot up”, the ROM bootstrap program (located on the CPU board) will examine your H89’s memory to find out how much is installed. It will then load the HDOS monitor into the upper 2.4K of the memory area. When this is accomplished, control will be passed from the ROM bootstrap program to the monitor. The monitor will then take control.

The following instructions tell you how to accomplish this process of “booting up” the system. Before starting it, you should have performed the “Power-Up” procedure above.

The “Type Spaces to Determine Baud Rate” prompt appears from the HDOS monitor. It is now ready to access the diskette, and must know the console baud rate. Usually, this takes 3-4 striking of the space bar, but can vary. The variation is dependent both on baud rate and how fast you strike the space bar.

Once HDOS has determined the baud rate at which your terminal is set, it will resume with the normal “BOOT” routine. (Note: the number of spaces HDOS requires to determine your baud rate will vary.) When the baud-rate is determined, HDOS will prompt on the system console with:

```
ACTION? <boot>
```

If this does not take place, repeat this procedure, making sure you are using the system (distribution) diskette and that you have correctly installed the disk controller board and interconnecting cable. If you have the system properly configured and it still does not “boot up” correctly, refer to the troubleshooting guide in your H89 Operations Manual.

At this point, you can take any one of three options. First, if you strike any key except “C”, “B”, or Carriage Return, a “help” listing will be printed, as follows:

```
ACTION? <boot> HELP
```

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

```
ACTION? <boot>
```

The most common option is to “boot up” your system normally. Use the following procedure:

1. Press the carriage return or the letter “B”. HDOS will identify itself by printing the version and issue number. The current date is then requested by printing:

```
DATE (DD-MMM-YY)?
```

2. Respond with the date in the following format:

```
25-MAY-79 Ⓢ
```

If you are rebooting the system without having turned off the power, the current date is retained in the computer’s memory. In this case, the date will be printed out. If the date is correct, you may proceed by hitting a carriage return. If not, you may type in a new date.

The system is now booted up. From now on, HDOS will reply with “>” as a prompt to indicate that it is in the command mode, waiting for you to issue operating system commands. In general, you should type the command as directed and follow it with a carriage return.

The third option selects a “checksum” test to be performed on each of the diskette’s sectors, except the first ten, which are reserved by HDOS. HDOS compares the numbers printed during this test with a checksum value stored in each sector “header” to determine if any data on a given sector has been damaged.

If a bad sector is discovered, an error message will be printed. This allows you to isolate the problem to the diskette itself, rather than the drive or controller. If this occurs with your distribution diskette, it will have to be replaced. If the problem occurs with any other diskette you can reuse it as explained in the “Initialization” section. Take the following steps to execute the CHECKSUM routine.

1. Type a capital C.
2. Examine the listing for an error message.

You may type a CTRL-C to terminate the test early. An abbreviated listing of the CHECKSUM test is printed below:

```
ACTION?<BOOT> C
SECTOR 010 = 0268
SECTOR 011 = 50062
SECTOR 012 = 73497
?00 * ERROR *
SECTOR 013 = 63304
^C
```

```
ACTION? <BOOT>
```

In this example a Bootstrap error was discovered at sector 013. The listing was terminated when CTRL-C was pressed. If this test should function without any error message and the "Bootstrap" procedure still does not function properly, refer to the troubleshooting guide in your "Operation Manual" for assistance.

## FIRST TIME THROUGH INITIALIZATION?

- ( ) 1. After the HDOS prompt ">", type **INIT** and a **␣**.
- ( ) 2. The INIT program will execute and tell you to remove the diskette. Take the diskette out of the drive, and type a **␣**.
- ( ) 3. When asked if you want to proceed, Type **YES** and a **␣**.
- ( ) 4. Install one of the new, unlabeled diskettes in the drive and type **␣**. Be sure that it is a new diskette, because this program erases information.
- ( ) 5. You will be asked if you really want to initialize this particular diskette. Type **YES** and a **␣**.
- ( ) 6. When asked to enter a volume number (which must be unique for each diskette you use) type a **1** and a **␣**.
- ( ) 7. When asked to enter a volume name, type **MY SYSTEM VOLUME** and a **␣**.
- ( ) 8. The disk drive will click for a few seconds. This is normal. When the question "SECTOR?" is printed, just type a **␣**.
- ( ) 9. When you are asked if you have more diskettes to initialize, type **YES** and a **␣**.
- ( ) 10. Remove the diskette you have just initialized. With a felt-tip pen (do NOT use a pencil or hard-tipped pen), write the number (1) and the name (MY SYSTEM VOLUME) of the volume on a label and then put the label on the diskette.
- ( ) 11. Insert the other new diskette in the drive and type **␣**.
- ( ) 12. When asked if you wish to proceed, type **YES** and a **␣**.
- ( ) 13. When asked for a volume number, type a **10** and a **␣**. (Remember, this is a different diskette, and so it must have a different volume number and name.)

- ( ) 14. When asked for a volume name, type **BASIC DISKETTE** and a **Ⓢ**.
- ( ) 15. The disk drive will click for a few seconds. This is normal. When the question "SECTOR?" is printed, just type a **Ⓢ**.
- ( ) 16. When asked if you have more diskettes to initialize, type **NO** and a **Ⓢ**.
- ( ) 17. Remove the diskette you have just initialized.
- ( ) 18. With a felt-tip pen (do NOT use a pencil or a hard-tipped pen), write the number (10), and the name (BASIC DISKETTE) of the volume on a label and then put the label on the diskette.

**THIS FINISHES THE INTIALIZATION PRO-  
CEDURE. IF THIS IS YOUR FIRST TIME  
THROUGH, GO TO TEST, PAGE 0-24.**

## INITIALIZATION (INIT)

Initialization is a program that instructs the operating system to prepare a floppy diskette for new data storage. A new diskette must be initialized before you can use it. If it already contains data, the data will be destroyed when that volume is initialized.

NOTE: HDOS should now be in the command mode with a prompt (>) printed at the left margin of the console.

The "Initialization" program sets up a directory on the diskette which allows HDOS to locate files. Therefore, it is necessary to initialize new diskettes and those diskettes which have been run through the "Diagnostic" procedure.

Even after you have finished this procedure for the first time, you must use INIT to prepare diskettes for storage of data. You will be able to copy the INIT file onto your system volume(s). Then 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 SYØ:

INIT is a "tutorial" or "conversational" program in that it instructs you when to perform each step and asks you to make decisions. The following instructions should clarify this conversational process, but you may refer to the appropriate listing in "Appendix B" for an example of how the output from this program should look.

The program will print a message each time a step is to be performed. Wait until it has completed printing out the message; then take the actions indicated by the numbered steps. The discussion following each step explains the options available.

1. Type INIT Ⓢ.

HDOS will "dismount" the distribution diskette, meaning the operating system is no longer in control. INIT is now "standing alone" in memory, and has taken over the following steps. To get back into HDOS, it will be necessary to "reboot" the system. You can do this at any time by performing "Power-Up" and "Bootstrap," although a normal completion of this procedure will allow you to return to the operating system by performing only "Bootstrap." You may initialize as many diskettes as you have available, but remember that any data or programs contained on them will be destroyed.

2. Remove the distribution diskette from the disk drive and press the carriage return.

INIT will print a warning message and ask if you wish to proceed. If you type YES the program will continue. If you type NO or a carriage return, INIT will instruct you to reinstall the "bootable" diskette (the distribution diskette) and type a carriage return. You will then have to perform "Bootstrap" from the beginning.

3. Type YES and a carriage return.
4. Install the diskette to be initialized and press the carriage return.

INIT will identify the volume, unless it is a brand new diskette, and ask again if you wish to proceed. If you type NO, you can replace the diskette with another one which you may initialize instead, beginning at this step. If you type YES, however, the procedure will continue.

5. Type YES and a carriage return.
6. Enter a volume number for the diskette to be initialized, followed by a carriage return. This can be any integer between 1 and 255; leading zeroes may be omitted.

It is important that each diskette you own have a unique volume number. If you use two diskettes at one time that have the same volume number HDOS will become confused and may store data on the wrong diskette. Do NOT initialize two diskettes with the same volume number.

7. Enter a volume label, followed by a carriage return. This can be anything you like, from 1 to 60 characters. However, it is best to use a meaningful label, such as "System Volume". As soon as you press the carriage return following the label, initialization will occur.

This process will require several seconds. When it is almost completed, you will be asked to identify the bad sectors on the diskette under initialization. Ignore this option if this is your first time through the procedure. You will not be able to identify the bad sectors, if any, until you have run "Diagnostic." After you have run "Diagnostic," you may identify each bad sector by typing in its number and a carriage return. This will remove any bad sectors from the diskette's "available sectors" table; thus, ignoring the defective sectors.

8. Press the carriage return.

You will be asked if you have any more diskettes to initialize. If you do, answer YES and go back to step 4 in this procedure. Remember that you must initialize all new diskettes before you can use them, and that the distribution diskette MUST NOT be initialized. If you have no more diskettes, proceed to the next step.

9. Press the carriage return.
10. Reinstall the distribution diskette and press the carriage return.

You will now have to perform the "Bootstrap" procedure, after which you will proceed to the Diagnostic section.

## FIRST TIME THROUGH TEST?

You must re-boot the system to run this program. The boot procedure is summarized again here:

- i. Insert the distribution diskette and type a **Ⓢ**.
- ii. Type **spaces** in response to the "TYPE SPACES TO DETERMINE BAUD RATE" query.
- iii. Type a **Ⓢ** at the "ACTION<BOOT>?" query.
- iv. Type a **Ⓢ** (after date). Note that the date is remembered, unless you shut the power off.
- v. At the prompt ">", type **TEST** and a **Ⓢ**. This requests HDOS to execute the TEST program, instead of the INIT program that you previously requested.

**GO TO NEXT PAGE FOR START OF TEST  
PROCEDURE.**

## START OF TEST PROCEDURE

- ( ) 1. The TEST program will execute and instruct you to remove the distribution diskette. Remove the diskette and type a **Ⓢ**.
- ( ) 2. When asked if you wish to proceed, type **YES** and a **Ⓢ**.
- ( ) 3. When asked which drive you want tested, type **0** (zero) and a **Ⓢ**.
- ( ) 4. As TEST instructs, insert the diskette labeled MY SYSTEM VOLUME and type a **Ⓢ**.
- ( ) 5. A list of test options will be displayed. You will test the drive rotational speed first. To do this, type a **T** and a **Ⓢ**.
- ( ) 6. You should see numbers between 0.990 and 1.010 displaying on the screen. If they are NOT in this range, you will have to adjust the drive speed. Your OPERATIONS MANUAL describes this procedure in the section "ROTATIONAL SPEED TEST".

If the numbers are in this range, you will have to type a **CTRL-C** (Control C) to stop the test. To do this, hold down the CTRL key and also type a C.

- ( ) 7. The list of options will be displayed again at the end of the test. Request seek time checkout by typing a **S** and a **Ⓢ**.
- ( ) 8. When asked if you wish to proceed, type **YES** and a **Ⓢ**.

Write the last number that is displayed on the following line:

\_\_\_\_\_ FASTEST RELIABLE STEP TIME

- ( ) 9. When the list of options is displayed, select the media check option by typing **M** and a **Ⓢ**.

If there were any bad sectors, a list of them will be displayed. Write them, along with the diskette's name, down for later use.

\_\_\_\_\_ BAD SECTORS ON VOLUME \_\_\_\_\_

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

This test should be allowed to run completely. It takes over 30 minutes, at the end of each pass (there are 3), it will print a message. If this message is NOT:

```
ABCDEF G END OF PASS 1
ABCDEF G END OF PASS 2
ABCDEF G END OF PASS 3
```

then you had some errors. Refer to the text on "Test", Page 0-30 for further information.

- ( ) 11. When the list of test options is displayed, type **U** and a **Ⓢ**. This will re-start the program, so you can switch diskettes at a later step.
- ( ) 12. When asked if you wish to proceed, type **YES** and a **Ⓢ**.
- ( ) 13. You will be asked which drive you want tested. Type **0** and a **Ⓢ**. Remove the diskette in the drive and replace it with the diskette labelled BASIC DISKETTE.
- ( ) 14. When the list of test options is given, you will want the media checkout option. Type **M** and a **Ⓢ**. This option should be run on every diskette that you use. It tells you what sectors are bad on the diskette, if any. Later, you can instruct HDOS not to write in those locations.

If there are any bad sectors, the list of them will be displayed. Write them down, along with the name of the diskette, for later use.

\_\_\_\_\_ BAD SECTORS ON VOLUME \_\_\_\_\_

- ( ) 15. When the list of test options is given, type **E** and a **Ⓢ**. This will exit you from the TEST program.
- ( ) 16. Remove the diskette and install the distribution diskette.

**THIS FINISHES THE TEST PROCEDURE. IF THIS IS YOUR FIRST TIME THROUGH, GO TO RE-INITIALIZATION, PAGE 0-34.**

## DIAGNOSTIC (TEST)

A Diagnostic program is used to troubleshoot computer systems, or the various components of a computer system. The most common diagnostics are programs that are used to find possible read/write errors in memory devices.

HDOS should be in the command mode, with a prompt (>) printed at the left margin of the console. The diskette you initialized during "INIT" will now be used with a program called TEST to test your system. The directory which was established on this diskette during "Initialization" will be destroyed, so it will have to be reinitialized before you can use it for program or data storage.

When you have completed the "System Set-Up Procedure," and are performing everyday operations such as programming or text-editing, you may wish to use "Diagnostic" to test new diskettes or to test your system. You may copy TEST onto your system volume(s) using a program called ONECOPY; or by the use of methods discussed in the HDOS Manual. If you do this, you may substitute a system volume for the distribution diskette throughout this procedure.

Like INIT, this program stands alone in memory and operates in a conversational fashion. It will instruct you when to perform certain operations and will ask you to make decisions. The following instructions are intended to clarify the various options. Each time TEST prints a message, you should perform the action indicated in the appropriate numbered instruction. Many of the numbered instructions have explanations printed beneath them. You may refer to the TEST output in "Appendix B" for additional help.

1. Type TEST and a carriage return.

HDOS will dismount the diskette(s). This means that you will have to reboot the system when this procedure is terminated. TEST is now resident in memory and has taken control of the following operations. It will first tell you to remove the diskette(s).

2. Remove the distribution diskette from SYØ: and press the carriage return.

TEST will now identify itself and print a message. If you wish to proceed at this time, make sure you have an initialized diskette available to use in this test. If you would rather not proceed, type a NO Ⓢ and reinstall the distribution diskette. You will then have to execute the "Bootstrap."

3. Type YES and a carriage return.

TEST will ask you which drive you wish to test. If this is your first time through the procedure, you should reply with a “ $\phi$ ” in order to test SY $\phi$ :, the system drive. If you purchased two drives, you may repeat this test with the second drive by typing “1” after you perform “System Generation.” As an alternative, you may switch to the other drive by using the “Switch” procedure (Page 0-33).

4. Type  $\phi$  and a carriage return. TEST will ask you to insert the diskette to be used in the test. DO NOT use the distribution diskette.
5. Insert a diskette that has been initialized into the left-hand drive (SY $\phi$ :) and press the carriage return.

TEST will print a list of test options. If this is your first time through “Diagnostic,” perform these tests in the order listed. To start a test, type the letter which precedes the name of the test in the listing, and then type a carriage return. To end a test, type a CTRL-C on your console.

The instructions for each test are printed below. You may now proceed to the first test, labeled “Drive Speed.”

## Drive Speed

*First time through “Diagnostic”?*

*Run this test to set your drive speed. Rerun the test only if you suspect speed problems.*

1. Type a T and a carriage return.

The console screen will display the relative rotational speed of the drive under test. A decimal number, which should be close to 1.000, will scroll, updating as it scrolls. The rotational speed tolerance is one percent. The final value should be between 0.990 and 1.010. Do not adjust the speed unless it is out of tolerance.

You may have to perform this test again at some future time, depending upon 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.

2. If the decimal number displayed on the console terminal is less than 0.990 or greater than 1.010, carefully adjust the Speed Adjustment Control, (shown in the 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 into tolerance. A counterclockwise adjustment will increase the drive speed, and a clockwise adjustment will decrease the drive speed.

3. Type CTRL-C to terminate the drive speed test.

Proceed to "General Checkout."

## General Checkout

### *First time through "Diagnostic"?*

*The TEST program should now be running, with a list of test functions printed on your console. You should have performed the "Drive Speed" procedure successfully. If the rotational speed is incorrect, this and other tests may give erroneous indications.*

The purpose of "General Checkout" is to verify that your system is working normally. Each sector on the diskette under test will be written and read a number of times. Various patterns will be written on the sectors to allow the testing of the head of the seek mechanism and the read/write head itself. The test will automatically be repeated three times. Do not be alarmed if this test seems to be taking an abnormally long time to finish. It is a very thorough test and requires over 30 minutes. Rerun this test 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” and “soft” errors, as follows:

```
ABCDEFGG xxx/yyy END OF PASS n
```

In this example, test G had errors. The tests are:

A = Write all zeros  
B = Read all zeros  
C = Write all ones  
D = Read all ones  
E = Write ID patten  
F = Read ID patten  
G = Random read/write test

The numbers of hard and soft errors (refer to the “Glossary” in the HDOS manual) are indicated by the numbers “xxx” and “yyy”, 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 perform the “Exit” section of this program; then run another blank diskette through “Initialization” and repeat the entire “Diagnostic.” If this approach is successful, the first diskette probably had one or more bad sectors, possibly caused by dust. Set the “bad” diskette aside for now and after performing “Media Check” and “Seek Time” as explained below, you may use the “Switch procedure to restart TEST. You may then use “Media Check” again with the bad diskette to identify the bad sectors. Once they are identified, you will be able to type in their numbers during “Initialization” and use the diskette normally. If you have soft errors, and failures on the “Media Check”, you probably have hardware failure. Run “Seek Time” to confirm this.

If changing the diskette does not correct the problem, refer back to the troubleshooting guide in the “Operations Manual”.

1. Type D and a carriage return.

Remember, you will have to wait at least 30 minutes for this test to be completed. The disk drive will make “ticking” or “grinding” sounds while the test progresses. This is perfectly normal; it is the sound made by the head-seek mechanism.

2. Record the numbers of hard and soft errors, if any, for future reference.
3. If required, perform the troubleshooting procedure as explained above. When the test is completed, the list of test functions will automatically be printed. When this happens, proceed to “Media Check.”

## Media Check

*First time through "Diagnostic"?*

*The list of test functions should now be printed on your console and you should have already performed the "Drive Speed" and "General Checkout" tests.*

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," such defects could be the case. If any bad sectors are found, they will be listed at the end of the test. Run this test on all diskettes.

1. Type M and a carriage return.

This test will take less than five minutes. At the end, a message will be printed, which reads:

```
nnn BAD SECTORS LOCATED
```

The number nnn, which can range from 000 to 400, tells you how many of the 400 sectors 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 "Diagnostic." "Initialization" allows you to type in the identifying number for each bad sector, and it removes the bad sectors from the diskette's directory.

The list of test functions will automatically be printed at the end of this test. When this occurs, you may proceed to the next test.

## Seek Time

*First time through "Diagnostic"?*

*The list of test functions should now be printed and you should have already performed the "Drive Speed," "General Checkout" and "Media Check" tests.*

This test will vary the track seek time of your unit in order to determine its highest reliable speed.

The drive assemblies are guaranteed to perform reliably at a seek time of 30 milliseconds. You can check the optimum seek time using "tests" supplied with your disk software. If you are using dual drives, your fastest possible seek speed will be determined by your slower drive assembly.

Remember, the seek speed can change as a unit "wears in". If frequency errors occur, you should re-run the seek test to check for possible changes in your drive assembly speed. Again, the drives supplied with the operating system are specified at 30 mS only.

1. Type S and a carriage return. You will be asked if you wish to proceed. If you reply "NO", the list of test functions will be printed again.
2. Type YES and a carriage return.

The first interval to be attempted is 36 milliseconds. This information will be printed on your console. Shorter intervals will be attempted until your disk drive's best capability is determined. As each pass is completed, the message "OK!" will be printed.

The test will require a few minutes for completion. When it is finished, the message "Drive performs reliably at nnn milliseconds per track." will be printed out, where "nnn" is the optimum interval for your unit. Record this number for future reference.

\_\_\_\_\_ FAST RELIABLE SEEK TIME

\_\_\_\_\_ Date

If you purchased two drives, you can perform this test again after "System Generation," or you can switch to the second drive and repeat the test, as explained in the "Switch" procedure. The "General Operation" section of Chapter 1 will explain how to set your system for the speed of the slower of the two drives.

The list of test functions will automatically be printed when this test is completed. If you have a single-drive system, you are now ready to Exit, as explained below. If you have a dual-drive system, you may perform "Switch" to test the second drive, or you may Exit and test the second drive later. If you have two drives, we recommend that you test it now.

## Switch

### *First time through "Diagnostic"?*

*You should now have completely tested SY0: by performing the "Drive Speed," "General Check-out," "Media Check" and "Seek Time" tests, before switching to SY1:. If you have only a single-drive system, you now perform "Exit."*

This procedure will allow you to select SY1: in order to run it through the complete "Diagnostic."

1. Type U and a carriage return.

TEST will restart itself from step three of the main section, where it identifies itself, prints a message, and asks if you wish to proceed. You may use each test procedure as before, except that you should type 1, when asked which drive you wish to test. Note that executing the "Switch" procedure will allow you to swap back and forth between the two drive indefinitely as long as you wish to test them.

## Exit

1. Type E and a carriage return.

You will be instructed to install a bootable disk in SY0:. This refers to your distribution diskette; or, if you have performed "System Generation," this means your system volume.

2. Install the diskette and press the carriage return.

You are now ready to perform the "Bootstrap" again to get back into the HDOS command mode. If this is your first time through the "System Set-Up Procedure," you may then perform "System Generation."

## FIRST TIME THROUGH RE-INITIALIZATION?

Since TEST destroyed the formatting on the diskette, it is necessary to re-initialize the diskettes before you progress. However, this extra step is a worthwhile precaution, since you confirm the quality of the diskette.

You must re-boot from the distribution diskette before you start on this procedure. If you are unsure of the boot procedure, refer to Page 0-14.

- ( ) 1. At the HDOS prompt ">", type **INIT** and a **↵**.

Take the distribution diskette out of the drive and type a **↵**.

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

Install the diskette labelled **MY SYSTEM VOLUME** in the drive and type a **↵**.

- ( ) 3. The volume will be identified and you will be asked if you still wish to proceed. Type **YES** and a **↵**.

- ( ) 4. When asked for the volume number, enter a **1** and a **↵**.

- ( ) 5. When asked for a volume name, type **MY SYSTEM VOLUME** and a **↵**.

The diskette will click for a few seconds. This is normal. When the question "SECTOR?" is printed, enter the numbers printed out during the sector test (M) in the TEST program. If there were none, type a **↵**.

- ( ) 6. When asked if there are more diskettes to initialize, type **YES** and a **↵**.

Remove the diskette you have just initialized.

Insert the diskette labelled **BASIC DISKETTE** in the drive and type **↵**.

- ( ) 7. INIT will identify the diskette you have just inserted, and ask if you wish to proceed. Type **YES** and a **↵**.

- ( ) 8. When asked for a volume number, type a **10** and a **↵**.

- ( ) 9. When asked for a volume label, type **BASIC DISKETTE** and a Ⓢ.

The disk drive will click for a few seconds. This is normal. When the question "SECTOR?" is printed, enter the numbers printed during the sector (M) test in the TEST program. If there were none, type a Ⓢ.

- ( ) 10. When asked if you have more diskettes to initialize, type **NO** and a Ⓢ.

Remove the diskette you have just initialized.

Insert the distribution diskette and type a Ⓢ.

**THIS FINISHES THE RE-INITIALIZATION PROCEDURE. IF THIS IS YOUR FIRST TIME THROUGH, GO TO SYSGEN, WHICH FOLLOWS IMMEDIATELY.**

## **FIRST TIME THROUGH SYSGEN?**

Again, you will have to re-boot the system. This means that you must perform the bootstrap procedure, using the distribution diskette. Again, this procedure is summarized on Page 0-14.

- ( ) 1. At the HDOS prompt, type **SYSGEN** and a **Ⓢ**.
- ( ) 2. Ignore the instruction to remove the diskette and type a **Ⓢ**.
- ( ) 3. When asked to insert the source diskette, type another **Ⓢ**.

When the program tells you to insert the destination, insert the diskette labelled **MY SYSTEM VOLUME** and type a **Ⓢ**.

When the program tells you to insert the source, insert the distribution diskette and type a **Ⓢ**.

**THIS FINISHES THE SYSGEN PROCEDURE. IF  
THIS IS YOUR FIRST TIME THROUGH, GO TO  
ONECOPY, PAGE 0-39.**

## SYSTEM GENERATION

This procedure will allow you to make usable copies (“system volumes”) from your distribution diskette. You cannot use the distribution diskette for normal purposes; it is physically write-protected with a sticker which was placed over the slot on the edge of the diskette.

The reason for protection is that users of operating systems frequently make errors. The wrong error could result in the destruction of the distribution diskette if it had no protection. Diskettes are very fragile. They should be kept away from dust, static electricity, liquids, electrical machinery, children, and pets. After you complete the “System Set-Up Procedure,” you should use the distribution diskette only to generate system volumes by means of a utility program called SYSGEN. Then store it in a safe place for use as a back-up copy.

In this procedure you will begin with the distribution diskette mounted in SYØ. It will then be necessary to perform “Initialization” again on the diskette which was used in “Test.” As soon as the spare diskette is reinitialized, you must reinstall the distribution diskette and execute SYSGEN as explained below. This program will require you to swap back and forth between the distribution diskette and the spare diskette. The result will be a minimum system copied onto the spare diskette.

The next step will be to use the new system volume to copy a few more programs from the distribution diskette, depending upon your intended use of the system. These programs are BASIC, DEBUG, EDIT, ASM, INIT, TEST, and SYSGEN.

However, we suggest that you make at least two system volumes, by means of SYSGEN, and keep one as a spare. You should also make an extra copy of any programs or records you create with HDOS in case the primary diskette is inadvertently erased or damaged.

### SYSGEN

The system should be booted up and in the command mode, with a prompt (>) printed at the left margin of your console. Remember, you should have performed “Initialization” and “Diagnostic” before attempting this procedure.

1. Perform “Initialization” to initialize the diskette that will become your primary system volume.
2. Reinstall the distribution diskette and perform “Bootstrap” to boot up the system.

3. Type "SYSGEN" and a carriage return.

HDOS will dismount the disk(s) and turn control over to SYSGEN; you will have to reboot when this procedure is finished. You will be instructed to remove the disk(s). This will not be necessary, since the distribution diskette should already be installed in SYØ:. It would be necessary to remove the diskette only if you wished to perform SYSGEN using a different source diskette.

4. Leave the distribution diskette installed, and type a carriage return.
5. Type another carriage return.

SYSGEN will now instruct you to alternate between the source and the destination. When you are told to insert the destination, you must install the spare diskette in SYØ: and type a carriage return. When you are told to insert the source, you must install the distribution diskette in SYØ: and type a carriage return. This procedure will be repeated a number of times, depending upon the amount of memory in your H89.

6. Swap the diskettes, as instructed, and type a carriage return, repeating this step until all the files are copied.

When the procedure is finished, SYSGEN will tell you how many files were copied, and return you to the beginning of the "Bootstrap" procedure.

7. Leave the destination diskette installed and perform "Bootstrap."

You now have a minimum system volume. The files on it permit you to explore the capabilities of your H89, using HDOS. There are also other files that have not yet been transferred to your diskette; they permit you to run BASIC or other programs. You will use a stand-alone utility called ONECOPY, similar to SYSGEN, to copy those files.

## FIRST TIME THROUGH ONECOPY?

It is necessary to boot the system in order to execute this program. Remember, all the programs you have executed so far are "stand-alone". This means that they take over memory for their job. When that is done, you have to re-boot to gain control and switch to another process. (The boot procedure is summarized on Page 0-14). Note that you booted from the diskette, MY SYSTEM VOLUME, this time. This is because the SYSGEN procedure copied the minimum files to make your diskette bootable. You will soon be finished with the distribution diskette!

- ( ) 1. At the HDOS prompt ">", type **ONECOPY** and a **↵**.
- ( ) 2. When instructed to, remove the diskette and type a **↵**.
- ( ) 3. Insert the distribution diskette and type a **↵**.
- ( ) 4. A new prompt "OC:" will appear. Type \*.\* and a **↵**.

You will be repeatedly asked to insert the destination diskette, and to insert the source diskette.

When the program tells you to insert the destination, insert the diskette labelled MY SYSTEM VOLUME (after removing the diskette already in the drive) and type a **↵**.

When the program tells you to insert the source, insert the distribution diskette and type a **↵**.

When the program has finished copying all the files, the prompt "OC:" will be displayed.

- ( ) 5. At the prompt, type a **CTRL-D** (Hold the CTRL key down) and type **D**.

Remove the distribution disk and put it in a very safe place. Your diskette, MY SYSTEM VOLUME, is now a complete copy of the distribution diskette.

**THIS FINISHES THE ONECOPY PROCEDURE.  
IF THIS IS YOUR FIRST TIME THROUGH, GO  
TO PREPARING THE BASIC DISKETTE, PAGE  
0-42.**

## ONECOPY

This program allows you to copy files from one diskette to another using only a single-drive system. You have the option of copying one file or multiple files in the same operation, as explained below. It also requires you to swap back and forth between a source diskette and a destination diskette, in exactly the same way as SYSGEN. The difference is that 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 this program you need a system volume installed in SYØ. HDOS should be in the command mode, with a prompt (>) printed at the left margin of your console.

1. Type "ONECOPY" and a carriage return.

HDOS will dismount the diskette(s) and turn control over to ONECOPY. You will have to reboot the system when you are finished copying files.

2. Remove the system volume and type a carriage return.

You will now have to install the source diskette. If this is your first time through this procedure, the source is the distribution diskette. If you have already created a full system volume and wish to copy files from it, you can use the system volume as the source diskette.

3. Install the source diskette and type a carriage return.

ONECOPY will prompt you with :OC:. It will be necessary to specify a file to be copied, so BASIC.ABS will be used in this example. The valid choices are:

```
SYSGEN .ABS
TEST .ABS
INIT .ABS
TXTCON .ABS
BASCON .ABS
PATCH .ABS
DEBUG .ABS
EDIT .ABS
ASM .ABS
BASIC .ABS
HDOS .ACM
```

Refer to the appropriate sections of this Manual for information about BASIC, EDIT, DEBUG, PIP, and the Assembler (ASM).

The following example will show you how to copy BASIC to your system volume. You may use the same procedure to copy the other files simply by substituting the proper file name in the following step.

4. Type "BASIC.ABS" and a carriage return.

ONECOPY will load several sectors of this file into a memory buffer and ask you to insert the destination diskette. It will then write the contents of the buffer onto the destination.

5. Swap the diskettes as instructed by ONECOPY, and repeat this step until the entire file is copied. You must type a ⊕ after removing or inserting a diskette.

When the file is copied, ONECOPY will notify you and then issue another prompt. You will then be able to specify another file to be copied by repeating steps 4 and 5. You may specify any of the files, depending upon your requirements. If you are not sure which you will be needing, you may wait until you are more familiar with the various products. You can use ONECOPY at any time.

You are now ready to return to the HDOS command mode to continue with "System Set-Up procedure."

6. Type CTRL-D on your console. This will get you back to the beginning of the "Bootstrap."
7. Install the new system volume in SYØ: and boot up the system.

Be sure to store your distribution diskette in a safe place while you explore the capabilities of HDOS.

## FIRST TIME THROUGH PREPARING THE BASIC DISKETTE?

This section will enable you to communicate efficiently with HDOS by using some special features of your hardware. It also sets up the second diskette, BASIC DISKETTE, as a diskette to use for executing BASIC and storing BASIC files.

- ( ) 1. At the HDOS prompt ">", type **SET TT: BKS** and a **↵**. This instructs the system to allow backspacing (character deletion).
- ( ) 2. At the next prompt, type **SET TT: NOMLI** and a **↵**. (This instructs the system to accept lower case input.)
- ( ) 3. When the HDOS prompt is re-displayed, type "**SET TT: NOMLO**" and a **↵**. This tells the system to display all lower case input as lower case.
- ( ) 4. At the next prompt, type **sysgen** and a **↵**.
- ( ) 5. Ignore the instruction to remove the diskette and type a **↵**.
- ( ) 6. When asked to insert the source, just type another **↵**.

When the program tells you to insert the destination, insert the disk labelled BASIC DISKETTE and type a **↵**.

When the program tells you to insert the source, insert the diskette labeled MY SYSTEM VOLUME and type a **↵**.

You should end with the destination (BASIC DISKETTE) installed.

- ( ) 7. Remove this diskette and insert your system volume.
- ( ) 8. Re-boot the system.
- ( ) 9. At the HDOS prompt ">", type **onecopy** and a **↵**.
- ( ) 10. Do not remove the diskette and do type a **↵**.
- ( ) 11. When asked to insert the source, just type a **↵**.

- ( ) 12. The prompt “:OC:” will appear. Type **basic.abs** and a Ⓢ.

When the program tells you to insert the destination, insert the diskette labelled BASIC DISKETTE (after removing the disk already in the drive) and type a Ⓢ.

When the program tells you to insert the source, insert the diskette labelled MY SYSTEM VOLUME and type a Ⓢ.

You should end with the source (distribution) disk installed and the ONECOPY prompt “:OC:” displayed.

- ( ) 13. At the prompt, type **CTRL-d**.
- ( ) 14. Reset the system by holding down the right shift key and depressing the reset key. This will return you to the “H:” prompt. Don’t be alarmed at any strange characters that appear on the screen. When you move your fingers off of the keys, only the “H:” will show.
- ( ) 15. Remove the diskette and insert the diskette labelled BASIC DISKETTE. Do the boot procedure with the BASIC DISKETTE installed.
- ( ) 16. At the HDOS prompt, type **basic** and a Ⓢ.

You are now executing Extended Benton Harbor Basic.

Go to the EXTENDED BENTON HARBOR BASIC Manual (Chapter 5 of this book) if you wish to write programs, or otherwise use BASIC. If not, go to the next page of this section.

**THIS FINISHES THE SET-UP PROCEDURE.**

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

At some point, you will want to read all of this Manual, especially the chapter on HDOS. However, you may feel more comfortable only using BASIC until you have more of a “feel” for the system. The choice is yours.

## Power-Down

When you have finished using your computer, after performing some or all of the procedures in this Manual, it will be necessary to power-down the system in an orderly fashion. Part of the operating system resides in memory at all times, and part of it is located on the system diskette. The exact proportions are determined by the operations which are currently being performed. When you power-down the system in the correct fashion, you insure that the contents of the system diskette are updated to reflect the most recent changes in the system.

When you are in the command mode, with a ">" printed at the left margin of the system console, execute the following steps to shut down the system:

1. Dismount the diskette(s) by typing:

```
>BYE ☺
```

2. Remove the diskette(s).

**WARNING:** Always remove the diskette(s) before shutting off the power. Failure to do so could result in data loss as the hardware powers down.

3. Shut off the power to your computer.

## APPENDIX A

### Memory Layout

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

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

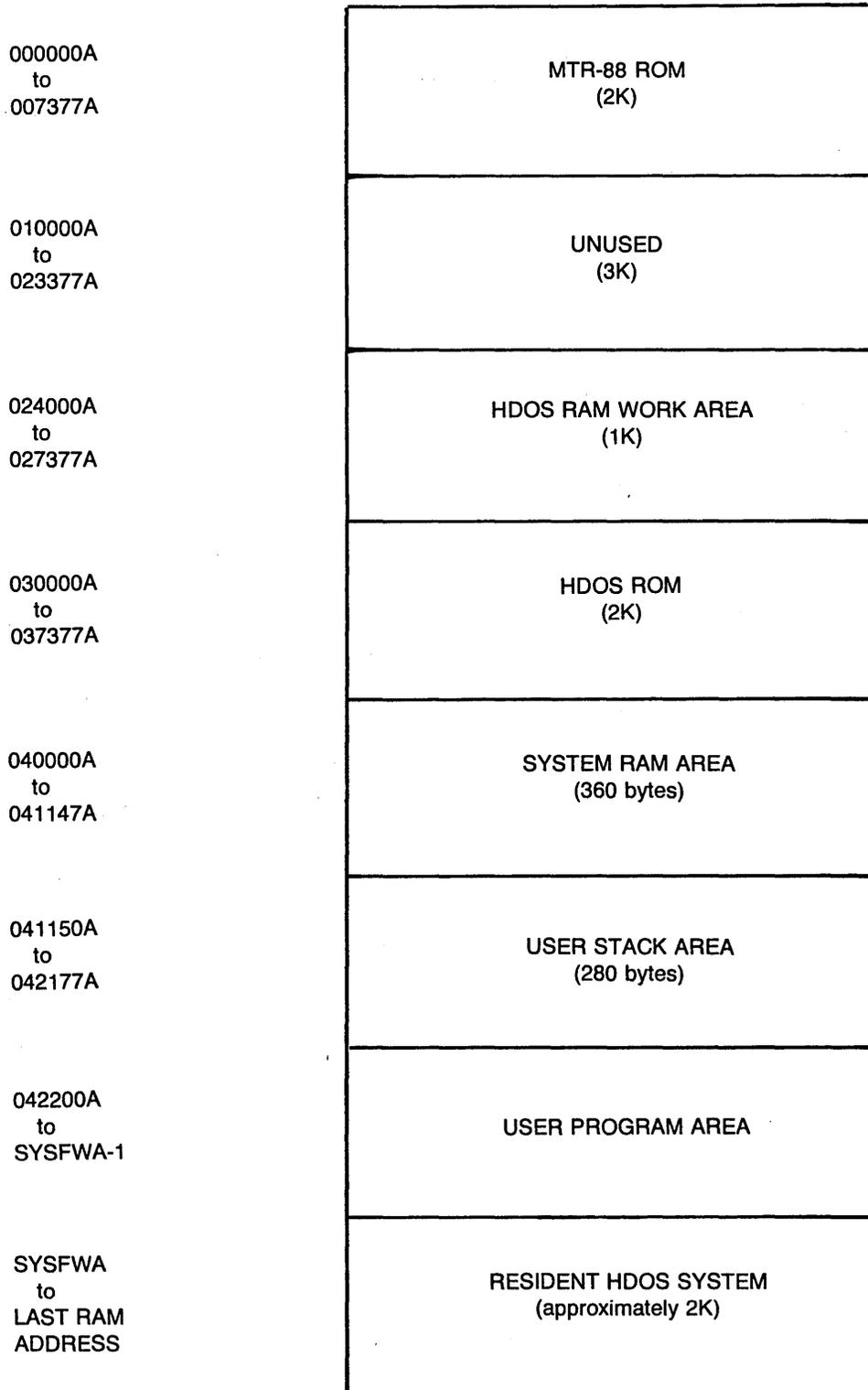
**HDOS RAM Work area (1K)** — Used by HDOS to hold important system tables. Among other things, these tables are used to hold storage allocation and directory information about the currently mounted disks. Damage to these tables could cause all of the information on a disk to become lost. For this reason, 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. See Appendix D of the HDOS Manual for a listing of the utility subroutines. Except for those routines listed in the appendix, user programs should not call routines in this ROM.

**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 a 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.



**Figure 1**  
Memory Map

### Table of Port Assignments

Port	Description
170-173Q	Reserved
174-177Q	Floppy Disk
300-307Q	Reserved
320-327Q	H88-3 Alternate Terminal
330-337Q	Reserved
340-347Q	H14 Line Printer
350-357Q	Console Terminal
360-363Q	Reserved
370-371Q	H88-5 Cassette
376-377Q	Reserved

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

### Interrupts

Interrupt Level	Use
0	Master reset/clear
1	Clock
2	Single step
3	Input/Output
4	Reserved
5	Unused
6	Unused
7	HDOS system calls

## APPENDIX B

## Stand Alone Program Outputs

## INITIALIZATION

>INIT 

Dismounting All Disks:

Volume 001, Dismounted from SYØ:  
Label: HDOS SYSTEM VOLUMERemove the Disk(s). Hit RETURN when ready: INIT  
Version: 1.5  
Issue: #50.04.00

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 

Insert the volume you wish to initialize into SYØ;  
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: 2 

Enter a volume label of 60 characters or less

SYSTEMΔVOLUME 

Enter the numbers of the bad sectors one at a time. Hit RETURN  
after each entry, and when finished.

Sector? 

Disk Initialization complete.

Do you have any more disks to initialize (YES/NO) <NO> ?

Install a bootable disk in SYØ:.. Hit RETURN to reboot:

Type spaces to determine BAUD RATE

ACTION? <BOOT>

## DIAGNOSTIC

>TEST Ⓢ

DISMOUNTING ALL DISKS:

VOLUME 000 DISMOUNTED FROM SYØ  
LABEL: HDOS SYSTEM VOLUME

Remove the Disk(s). Hit RETURN when ready:

TEST  
Version: 1.5  
Issue #50.04.00

This program tests your disk system. It destroys the data on the volume under test. This volume must have been initialized at least once, and will have to be reinitialized before being used for anything else.

TO PROCEED. TYPE YES; TO CANCEL TYPE CTRL-C  
PROCEED? YES Ⓢ

WHICH DRIVE (0/1) ? 0 Ⓢ

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

FUNCTIONS AVAILABLE:

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

CTRL-C CANCELS THE TEST IN PROGRESS

OPTION: T Ⓢ

1.007  
1.008

<CTRL-C>

## FUNCTIONS AVAILABLE:

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

CTRL-C CANCELS THE TEST IN PROGRESS.

OPTION: D ☉

## GENERAL DRIVE TEST FOR 3 PASSES:

ABCDEFG END OF PASS 1  
ABCDEFG END OF PASS 2  
ABCDEFG END OF PASS 3

## FUNCTIONS AVAILABLE:

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

CTRL-C CANCELS THE TEST IN PROGRESS.

OPTION: M ☉

000 BAD SECTORS LOCATED

## FUNCTIONS AVAILABLE:

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

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)? 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!
Drive performs reliably at 26 milliseconds per track.

```

FUNCTIONS AVAILABLE:

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

CTRL-C CANCELS THE TEST IN PROGRESS

OPTION: U

TEST  
VERSION: 1.5  
ISSUE #50.04.00

This program tests your disk system. It destroys the data on the volume under test. This volume must have been initialized at least once, and will have to be reinitialized before being used for anything else.

TO PROCEED TYPE YES; TO CANCEL TYPE CTRL-C  
PROCEED? YES.

WHICH DRIVE (0/1) ? 1

INSERT THE DISKETTE YOU WISH TO USE FOR THIS TEST INTO DRIVE SY1:, AND HIT RETURN.

READY?

FUNCTIONS AVAILABLE:

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

CTRL-C CANCELS THE TEST IN PROGRESS.

OPTION: E

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

TYPE SPACES TO DETERMINE BAUD RATE

ACTION? <BOOT>  BOOT

SYSTEM HAS 24K OF RAM

VOLUME 000, MOUNTED ON SY0:  
LABEL: HDOS SYSTEM VOLUME

HDOS VERSION 1.5  
ISSUE # 50.04.00  
DATE (10-MAY-79)?   
>

**SYSTEM GENERATION**

>SYSGEN Ⓢ

Dismounting all Disks:

Volume 001, Dismounted from SYD:  
Label: HDOS SYSTEM VOLUME

Remove the Disk(s). Hit RETURN when ready: Ⓢ

SYSGEN  
Version: 1.5  
Issue: #50.04.00

Insert the System Distribution Source Disk. Hit RETURN when ready: Ⓢ

INSERT DESTINATION: Ⓢ

INSERT SOURCE: Ⓢ

INSERT DESTINATION: Ⓢ

INSERT SOURCE: Ⓢ

INSERT DESTINATION: Ⓢ  
15 FILES COPIED

TYPE SPACES TO DETERMINE BAUD RATE

ACTION? <BOOT> Ⓢ BOOT

SYSTEM HAS 16K OF RAM

VOLUME 001, MOUNTED ON SYD:  
LABEL: SYSTEM VOLUME

HDOS VERSION 1.5  
ISSUE # 50.04.00  
DATE (10-MAY-79)? Ⓢ  
>

**ONECOPY**

>ONECOPY Ⓢ

Dismounting All Disks:

Volume 001, Dismounted from SY0:

Label: HDOS Disk:

Remove the Disk(s). Hit RETURN when ready: Ⓢ

ONECOPY

Version: 1.5

Issue: #50.04.00

ONECOPY is used to copy files for systems with only one floppy drive. Read the appropriate manual before using.

INSERT THE INITIAL SOURCE DISK. HIT RETURN WHEN READY: Ⓢ

:OC:BASIC.ABS Ⓢ

INSERT DESTINATION: Ⓢ

INSERT SOURCE: Ⓢ

1 FILES COPIED

:OC: <CTRL-D>

TYPE SPACES TO DETERMINE BAUD RATE

ACTION? <BOOT>

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