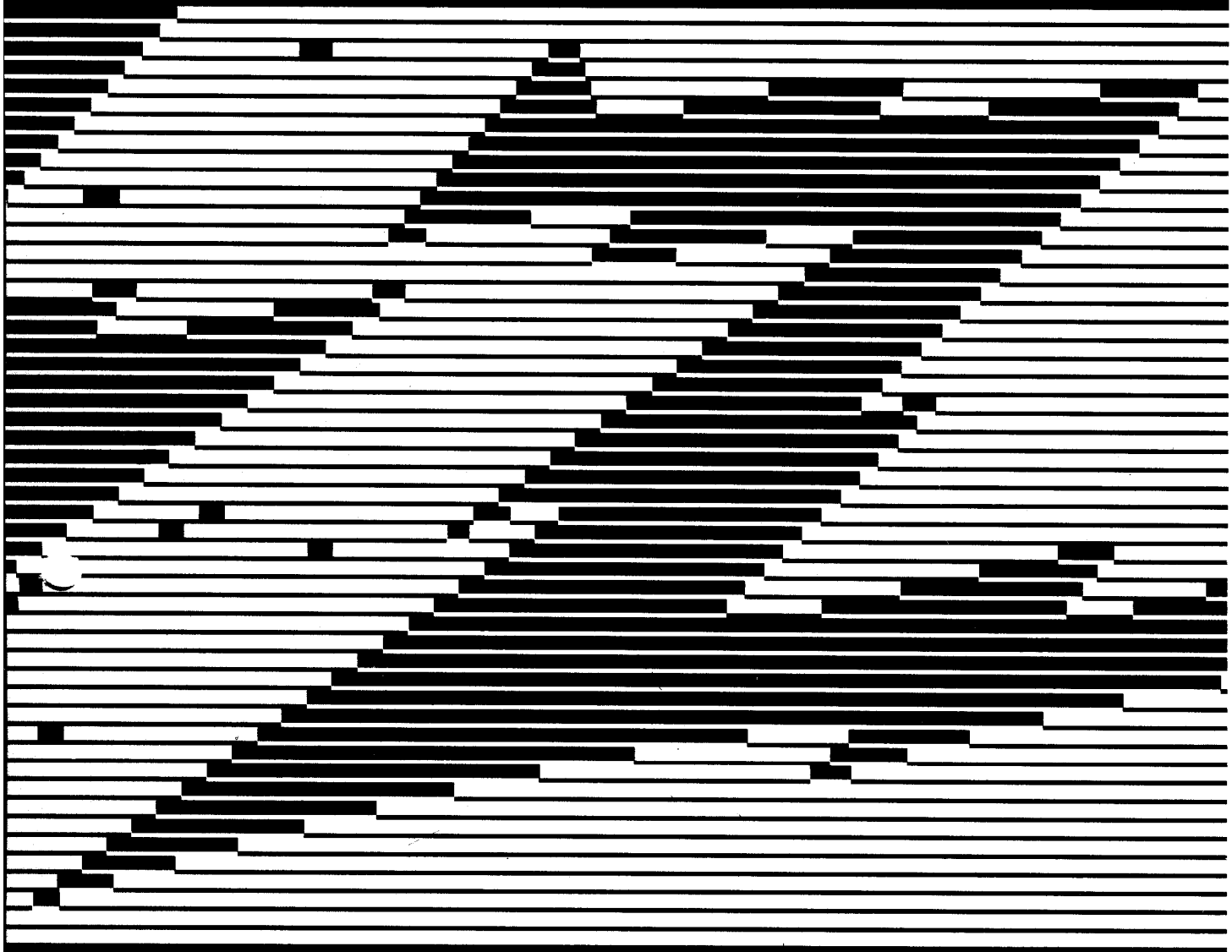
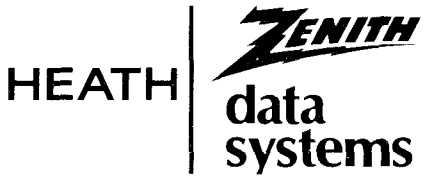
H/Z-67 SOFTWARE UTILITIES



HEATH | ZENITH data systems

Z-67 SOFTWARE UTILITIES DOCUMENTATION

Model Z-67



ZENITH DATA SYSTEMS
SAINT JOSEPH, MICHIGAN 49085

595-2785

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

(616)-982-3884 Application software
(616)-982-3860 Operating System/Language software

Consultation is available from 8:00 AM to 12:00 PM and from 1:00 PM to 4:30 PM (EST) on normal business days.

Zenith Data Systems
Software Consultation
Hilltop Road
St. Joseph, Michigan 49085

TABLE OF CONTENTS

About This Manual

Although it isn't necessary to memorize this entire manual, you should review the entire sequence, taking note of special cautions before using PART. Use extreme caution before you run PREP67, since it will erase any data that is stored on the Winchester Disk.

The following chapters are in Section One. They provide background and instructions for getting started. These are written for the first-time user of computers:

- Chapter 1, "Introduction"
- Chapter 2, "Background Information"
- Chapter 3, "Introduction to Utility Operation"

The next chapters are in "Section Two: The PART Utility". These contain the basic instruction for the first-time user:

- Chapter 4, "Standard Partitions"
- Chapter 5, "Booting from the Winchester Disk"
- Chapter 8, "Error Recovery"

The following chapters (also in "Section Two: The PART Utility") explain more sophisticated applications of PART for the advanced user:

- Chapter 6, "User-Defined Partitions"
- Chapter 7, "PART Data Structures"

Finally, the following chapter is in "Section Three: The PREP67 Utility". `This chapter is for the user who runs into PART errors that require that PRl:P67 be run:

- Chapter 9, "Winchester Disk Diagnostic/Preparation Utility"

If you need more information about using the terminal keyboard, or about a specific operating system, refer to the user guide for that operating system.

Section One

INTRODUCTION

Chapter 1

Introduction

PART

The Heath/Zenith Partitioning Utility, PART, is an innovative software package that enables the use of more than one operating system on the same H/Z-67 Winchester Disk. Currently, it supports the three principal operating systems:

- CP/M
- HDOS
- UCSD Pascal

However, PART can assist in the use of other arbitrarily-defined operating systems as well.

Special features of PART include:

-- Easy-to-use menu-driven procedures.

-- Special "standard partition" options for the beginner and for the users of simpler computer systems.

-- A special "user-defined" partitions option for the sophisticated user.

PREP67

The PREP67 Utility (PREP67) initializes the drive, checks the media and builds tables on the drive that will be used by PART. PREP67 is run on the Winchester drive before it is shipped from the Heath/Zenith Data Systems factory.

NOTE: Because PREP67 has been already run at the factory, you do not need to run this utility unless the PART utility (covered in "Section One") detects an error that requires PREP67 to be run again.

FUNCTIONAL OVERVIEW

The purpose of PART is simply to divide the physical Winchester Disk into as many as 62 user "partitions" or "logical areas" for the operating system(s) selected.

During the partitioning procedure, PART presents a menu of choices to determine how to allocate space on the disk into partitions for each operating system. With the user-defined partition option, PART enables the user to specify an operating system name, a one-letter ID, and the regions on the disk that the operating system will occupy and/or manage. PART then organizes this information into a region allocation map for display and writes coded information on the Winchester Disk describing how the regions are allocated.

After the partition procedure is complete, a bootstring that uses the operating system name determines which partition will be booted up. A special feature of PART enables you to specify a default bootstring, as well, so that you do not need to type a frequently-used bootstring at each use. (For more technical information about command strings for booting, refer to the MTR-90 Manual.)

PART enables the modification of initial partitioning. It is important, however, to make back-up copies of the data residing in each partition before you make modifications.

The purpose of PREP67 is to initialize the entire Winchester Disk, and it erases all previously recorded data on the disk. It also builds a set of information tables that PART requires during the partitioning operation.

You will probably use PREP67 very rarely, if at all.

Chapter 2

Background Information

The purpose of this chapter is to assist the computer novice in learning to use PART. Helpful information includes care and handling of diskettes, and fundamental computer terms.

CARE AND HANDLING OF DISKETTES

The following points are important when handling diskettes:

- Always put your diskette back into its protective envelope or container after use. Never touch the disk where the magnetic surface is exposed.
- Preserve your diskettes by storing them at 10-52 degrees Centigrade or from 40-125 degrees Fahrenheit.
- Avoid high humidity.
- Use a felt tip pen to make any notes on the labels of a diskette. Using a ballpoint pen or pencil could damage the diskette inside the envelope.
- Never insert a diskette into the disk drive before you turn on the computer and the disk drive; and always remove a diskette before you turn off the disk drive or the computer.
- Store your diskettes in a safe place, away from dust, contamination, or the presence of a magnetic field from a video unit or an electric motor. In this way, you will prevent the loss of data.

FUNDAMENTAL COMPUTER TERMS

Although you don't have to know everything about computers in order to use PART, you may find the following list of commonly used computer terms helpful. The discussions have been simplified for easier understanding.

BOOTING UP

Booting up is the process of loading an operating system into the computer. Different systems may have different booting up procedures. Refer to the operating system manual to find the boot up procedure for a particular system.

BOOT STRING

A boot string is a string of characters (e.g. **B** or **BS**) entered by the user to indicate the device used for booting up an operating system.

In booting from the H/Z-67 Winchester Disk, the user types additional characters as the last part of the boot string to indicate which partition is to be booted.

These additional characters may be stored on disk so that they need not be typed at each booting of a frequently-used partition. These additional characters are then referred to as the "default boot string".

DEFAULT VALUE

The default value is the value which the system uses if the user specifies no other value. For example, if the default boot string specifies an HDOS partition, then the HDOS partition will be booted if no other partition is specified at boot up.

PART indicates default values by enclosing them in "less than" and "greater than" signs (< >).

DISK STORAGE MEDIA

The two common types of disk storage media are floppy disks and hard disks. Floppy disks are often referred to as either "disks" or as "diskettes" and are available in two sizes, 8-inch and 5.25-inch.

Floppy disks can store a large amount of data at a low cost. However, accessing floppy disks is also slow. Despite their relatively large storage capacity, floppy disks tend to be too small for many business files. Hard disks such as the H/Z-67 "Winchester Disk" were invented to solve this problem.

Hard disks offer larger storage capacity and higher access speed; however their cost is higher.

HARDWARE

Hardware is the mechanical and electronic resources of the computer.

OPERATING SYSTEM

An operating system is a complex software package. Its purpose is to execute commands so that the user can use all of the hardware resources connected to the computer. It can be thought of as an interface between the computer hardware and the computer user.

The operating system is a set of master instructions which the computer must have in order to do work and run programs. Several different operating systems can be used on the H/Z-89/90 computer. They include:

- CP/M
- HDOS
- UCSD PASCAL

PART

PART (H/Z-67 Partition Utility Program) enables the owner of a H/Z-67 Winchester Disk to use more than one operating system on a single disk storage device. The Partition Utility's main purpose is to divide the H/Z-67 Winchester Disk into separate and unique areas, "partitions," for use by a given operating system. The program is menu driven and has a special feature which will permit sophisticated users to set up partitions for operating systems not currently supported by Heath/Zenith Data Systems.

Remember, PART doesn't write an operating system onto the Winchester Disk. It simply tells the computer where to find the operating system and its associated files.

PARTITION

A partition is an area on the hard disk allocated to one operating system by PART.

SOFTWARE

Software is all the programs, the procedures and the instructions associated with the computer.

This concludes the background information necessary for using PART. For more information about a specific operating system procedure, refer to the operating system manual. Then proceed to Chapter 4, "Standard Partitions."

Chapter 3

Introduction to Utility Operation

The purpose of this chapter is to explain those steps that are necessary before the utilities actually run. Information about the Main Menu, from which both PART and PREP67 are run, is covered here.

The H/Z-67 Winchester Disk System is supplied with an eight-inch diskette containing software utilities that have been designed and developed by Heath/Zenith Data Systems. The utilities provide for a unique and innovative approach to rigid (Winchester) disk allocation and management. The operating systems that are developed and supported by Heath/Zenith Data Systems, take advantage of this new allocation and management technique. By using these utilities, users will be able to define the partition allocation of the disk and specify which operating systems will manage each allocated portion.

The eight-inch diskette is labeled, "Winchester Disk Utilities". The diskette is distributed in "bootable" form. That is, the computer monitor reads in and executes a short program from the diskette. This short program then goes back to the diskette and reads in (pulls up by the bootstraps) the operating system. The operating system is what provides an easy and clean interface between the user and the physical equipment (hardware). In the case of the utilities mentioned above, it is the operating system that provides the mechanism for their use.

GETTING STARTED

To run the utilities, place the utilities diskette into the floppy disk drive on the H/Z-67 system. Simultaneously press the SHIFT and RESET keys on your computer keyboard. This action produces the monitor prompt, "H:". Follow the simple "bootstrap" procedures outlined in the MTR90 manual, to access and "boot" the utilities diskette.

MAIN MENU SELECTIONS

When the bootstrapping operation is completed, the operating system displays the following menu on your terminal:

```
H/Z-67 PARTITIONING/PREPARATION MENU

A - WINCHESTER DISK PARTITIONING UTILITY
B - WINCHESTER DISK DIAGNOSTIC/PREPARATION UTILTIY
C - EXIT

SELECTION ?
```

To use either of the disk utilities, respond to the "Selection ? :" prompt, by typing an A or B, then immediately press RETURN. Both utilities will return back to this menu upon completion of their assigned functions. Selecting the C option returns control back to the monitor, i.e., the "H:" prompt.

OPTION A: "WINCHESTER DISK PARTITIONING UTILITY"

The partitioning utility (PART) is described fully in Section Two of this manual. Turn to Section Two and follow those instructions. When you have completed PART, you will return to the menu shown above.

OPTION B: "WINCHESTER DISK DIAGNOSTIC/PREPARATION UTILITY"

The preparation utility (PREP67) is described fully in Section Three of this manual. Turn to Section Three and follow those instructions. When you have completed PREP67, you will return to the menu shown above.

Section Two

THE PART UTILITY

Chapter 4

Standard Partitions

*After reviewing the background information in Chapter 2, you are ready to use **PART**. This chapter explains the standard partition options of **PART**.*

PART displays a main menu of choices for dividing or "allocating regions" of the Winchester Disk into partitions. Types of allocations include standard and user-defined partitions (for user-defined partitions refer to Chapter 5 Page 27.) After you have chosen the type of allocation, PART displays your allocation in a "region allocation map" (Figure 2). PART then gives you the opportunity to approve that map or reject it.

If you approve the region allocation map, PART permits you to specify a default bootstring and to then print the map.

After initial use of PART, you can make changes to the partitions or the bootstring by following the same basic procedure. Be sure that affected areas are backed up before you change the partitions.

NOTE: To end or "abort" PART at any time without saving information on the Winchester Disk, press the C key while holding down the CTRL key. You will be returned to the menu described in Section 3.

GENERAL PROCEDURE

1. PART displays the main menu (Figure 1).

```
                    HEATH/ZENITH H/Z-67
          Hard Disk Partitioning Utility (PART) vers 1.0

      The main menu
A.    All CP/M.
B.    All HDOS.
C.    All UCSD PASCAL.
D.    Half CP/M, half HDOS.
E.    Half CP/M, half UCSD PASCAL.
F.    Half HDOS, half UCSD PASCAL.
G.    Third CP/M, third HDOS, third UCSD PASCAL.
H.    User-Defined Partitions.

Enter Selection ..... <G>?
```

Figure 1.
The main menu.

2. Press any of the letters A through G to choose one of the standard partitions. If you would like a "user-defined" partition, option H, refer to Chapter 5. Pressing RETURN instead of a letter selects option G, the default partition.

   PART displays the region allocation map (Figure 2).

```
Operating Systems:        Region Allocation Map:

S. System                    0  1  2  3  4  5  6  7  8  9  A  B  C  D  E  F
U. Unallocated            +-------------------------------------------------
A. CPM          0         : >S >A' A' A' A' A' A' A' A' A' A' A' A' A' A' A'
B. HDOS         1         : A' A' A' A' A' A' A' A' A' A' A' A' A' A' A' A'
C.              2         : A' A' A' A' A' A' A' A' A' A' A' A' A' A' A' A'
D.              3         : A' A' A' A' A' A' A' A' A' A' A' A' A' A' A' A'
E.              4         : A' A' A' A' A' A' A' A' A' A' A' A' A' A' A' A'
F.              5         : A' A' A' A' A' A' A' A' A' A' A' A' A' A' A' A'
G.              6         : A' A' A' A' A' A' A' A' A' A' A' A' A' A' A' A'
H.              7         : A' A' A' A' A' A' A' A' A' A' >B' B' B' B' B' B'
I.              8         : B' B' B' B' B' B' B' B' B' B' B' B' B' B' B' B'
J.              9         : B' B' B' B' B' B' B' B' B' B' B' B' B' B' B' B'
K.              A         : B' B' B' B' B' B' B' B' B' B' B' B' B' B' B' B'
L.              B         : B' B' B' B' B' B' B' B' B' B' B' B' B' B' B' B'
M.              C         : B' B' B' B' B' B' B' B' B' B' B' B' B' B' B' B'
N.              D         : B' B' B' B' B' B' B' B' B' B' B' B' B' B' B' B'
O.              E         : B' B' B' B' B' B' B' B' B' B' B' B' B' B' B' B'
P.              F         : B' B' B' B'

Allocation Correct. . . . . .<N>?
```

Figure 2.
Sample region allocation map.

The sample region allocation map above reflects option D, half HDOS and half CP/M. The letter A indicates regions allocated to CP/M and the letter B indicates regions allocated to HDOS.

The symbols which may appear in a region allocation map are explained in Figure 3.

>	Indicates the ending of one partition and the beginning of the next.
S	Indicates a "system" partition which cannot be reallocated by the user.
A through P	Indicate the operating system ID for a partition.
A' through P', U'	Indicate regions affected by PART.
U	Indicates an unallocated region.

Figure 3.
Symbols used in region allocation maps.

3. Press N if the region allocation map is not correct. PART redisplays the main menu.

   Press Y if the region allocation map is correct. PART displays:

   Enter Default Boot String < >?

4. Press RETURN if you do not want to specify a default boot string.

   If you want to specify a default boot string, type the operating system name as it appears in the region allocation map. Then press RETURN. PART displays:

   Would you like a printout of the Region Allocation Map ? <N>

5. If you would not like a printout, press N. PART saves the map and terminates.

   If you would like a printout, make sure your printer is ready. Then press Y. PART displays:

Printer	Baud
H-14	4800 – (A)
H-24/TI-810	4800 – (B)
H-34/LA-34	300 – (C)
H-44, H-54/1640, 630 R0	1200 – (D)
MX-80	4800 – (E)
H/Z-25	4800 – (F)

Which Printer is to be used?

6. Make sure that your printer is set for the indicated baud rate and that it is connected to port 340 A of your H/Z-89/90. Press the letter key corresponding to the type of printer you use. PART begins printing the map immediately. Then it displays:

PART terminated - Changes in effect.

CHANGING OR ERASING THE DEFAULT BOOT STRING

PART permits changes to the default bootstring when the "Default Bootstring?" prompt is displayed. Repeat the procedure just described to display this prompt on a previously partitioned disk. Be sure to save the map without changes by choosing either the same option or the user-defined option of the main menu.

To change the default boot string, type the new operating system name and press RETURN. To erase the default boot string without specifying a new one, press the space bar and then RETURN. A single RETURN will leave the boot string unchanged.

CHANGING THE STANDARD PARTITIONS

After initially dividing the Winchester Disk into partitions, change any of these partitions by repeating the same procedure. Simply choose a different option from the main menu.

Be sure that affected areas are backed up before you change the partitions.

This completes the procedure for making standard partitions with PART. If you receive any error messages during PART, refer to Chapter 8, "Error Recovery." If you still have problems after reviewing the documentation, call Heath/Zenith Customer Services.

Chapter 5

Booting From the Winchester Disk

After partitioning the Winchester Disk (Chapter 4 or Chapter 6), prepare the disk for your operating systems by referring to the operating system manual. Then return to this chapter for an explanation of how to boot from the Winchester Disk.

PART provides a routine for booting selectively from any partition. Boot as you normally would on your system. However, before you press RETURN, type the information indicated in the format below:

:operating system name;n

The operating system name should be typed exactly as it appears in the region allocation map (no embedded punctuation.)

The semicolon and the occurrence number, n, are options for the user-defined partitions only. Refer to Chapter 6 for more information about the occurrence number.

Sample boot strings: :CPM :CPM;1 :HDOS;4

Specifying no occurrence number boots the first partition (0) for an operating system. Specifying no operating system boots the default partition (if specified) or displays a screen like the sample below:

```
                    HEATH/ZENITH H/Z-67
                Software Boot Code (SBC) vers 1.0
                    Boot Option(s) Menu
Operating systems:      Maximum Occurrence number:

   CPM                        00
   HDOS                       00


Boot String?
```

Simply type the operating system name as displayed and (for the user-defined partitions) a semicolon and the occurrence number. Then press RETURN.

GENERAL PROCEDURE

1. Type what you normally type to boot your system, but do NOT press RETURN.

2. Press the colon key (:) and type the name of the operating system as it appears in the region allocation map.

3. If you have chosen the user-defined partition option and would like to boot a specific partition, press the semicolon key (;) and type the occurrence number.

4. Press RETURN.

This completes the procedure for booting from the Winchester Disk. If you receive any error messages during PART, refer to Chapter 8, "Error Messages." If you still have problems after reviewing the documentation, call Heath/Zenith Data Systems Software Consultation. You will not be able to boot a partition until it has been "initialized" and "SYSGENed" by the operating system that you are using.

Chapter 6

User-Defined Partitions

Chapter 6 discusses the user-defined partition option of the main menu. This is a sophisticated option recommended only for advanced users and computer specialists.

To define partitions other than those offered by the main menu, (or to display the current partitions), press H while viewing the main menu. PART displays the region allocation map (Figure 4). For each partition:

1. Set the operating system name and ID.
2. Set the beginning and ending regions.
3. Save the information on disk.

These procedures and others for displaying and abandoning the map, as well as for setting the default boot string are explained in the following sections. Refer to your operating system manual to calculate the minimum and maximum number of regions per partition.

The sample map in Figure 4 shows a map of an unpartitioned Winchester Disk. Symbols used in any map are explained in Figure 5.

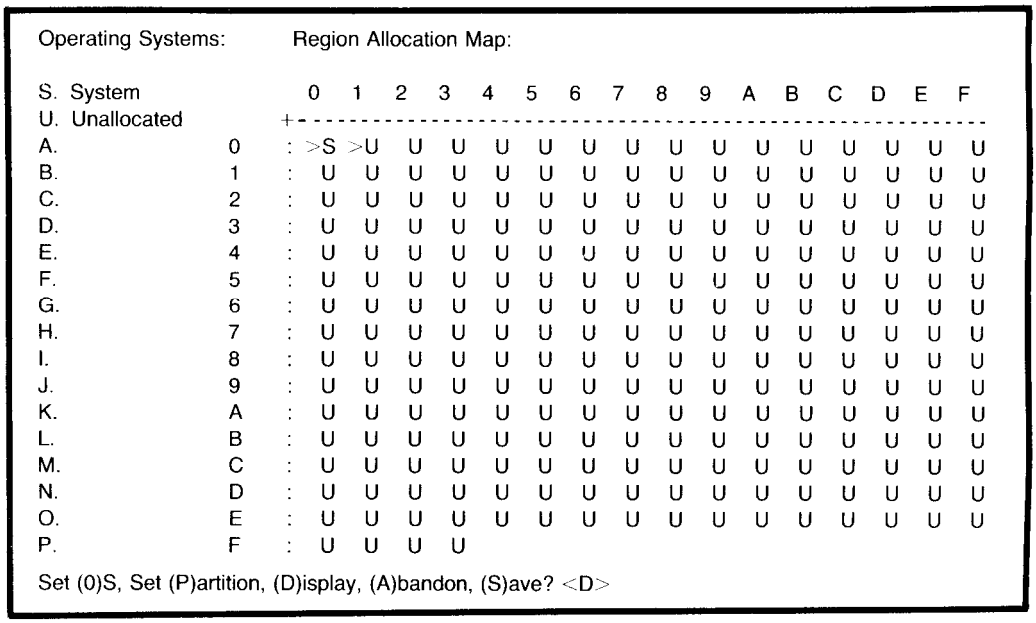


Figure 4.
Sample region allocation map for user-defined partitions.

>	Indicates the ending of one partition and the beginning of the next.
S	Indicates a "system" partition which cannot be reallocated by the user.
A through P	Indicate the operating system ID for a partition.
A' through P', U'	Indicate regions affected by PART.
U	Indicates an unallocated region.

Figure 5.
Symbols used in region allocation maps.

Default values are enclosed by "greater than" and "less than" (<>) signs.

Note: To cancel PART at any time without saving information on the disk, press CTRL C.

SELECTING THE OPERATING SYSTEM ID

Pressing 0 while viewing the region allocation map permits you to select and specify the operating system ID (the letters A-P) and the operating system name (up to 16 characters, no embedded punctuation or spaces.) The letter S is the ID for the PART system partition and should not be selected. A selection of U for the system ID causes PART to specify the region as unallocated to any system.

PART permits only one ID for each operating system name.

To change an operating system name, type a new operating system name, or press the space bar at the prompt. Pressing a space bar and then **RETURN** for the operating system name causes **PART** to erase the original name and unallocate any partitions allocated to it. To leave an operating system name unaltered, press **RETURN**.

A sample procedure to set the operating system ID to J and the operating system name to CP/M is described below:

1. Press 0. PART will display:

   Operating System ID (S,U,A-P)<U>?

2. Press J. PART will display:

   Operating System Name < >

3. Type CPM and press **RETURN**. **PART** will redisplay the command line shown at the bottom of Figure 4.

SETTING THE BEGINNING AND ENDING REGIONS

Pressing P while viewing the region allocation map permits you to specify the beginning and ending regions of a partition assigned to the operating system displayed in brackets. (The operating system displayed in brackets is the last operating system name entered. To change it, use the 0 option from the main menu.)

The numbering scheme used for the two digits specifying the regions is horizontal row first, vertical column second.

If you try to allocate a system partition, such as 00, the computer will beep and ask for a different entry. An ending region number which is less than a beginning region number will also cause an error and the computer will beep.

The following is a sample procedure to set the CP/M partition beginning and ending regions at 37 and B7, respectively:

1. Press P. PART will display the last operating system name entered:

   [CPM] from Region <done>?

2. Type 37 and press RETURN. PART will display:

   [CPM] to Region <37>"?

3. Type B7 and press RETURN. PART will display another prompt for you to specify another beginning region for an additional partition for the same operating system. If you are finished, simply press RETURN to return to the region allocation map prompt.

DISPLAYING THE REGION ALLOCATION MAP

Pressing D (or RETURN, since D is the default value) while viewing the region allocation map causes PART to redisplay the map incorporating all the partition changes previously entered.

ABANDONING PART

Pressing A while viewing the region allocation map causes PART to return the computer to the system level without saving any of the changes. PART will display:

PART aborted-no changes applied.

SAVING THE PARTITIONS

Pressing S while viewing the region allocation map permits you to enter a default boot string (following section.) PART also offers the option of printing as described in Chapter 4. PART will then save the information on the hard disk.

THE DEFAULT BOOT STRING

The default boot string identifies the partition of an operating system to be used for booting if you do not specify one during boot up.

The format for the default boot string appears below:

operating system;n

where "operating system" is written exactly as it appears in the region allocation map and ";n" indicates an optional "occurrence number" (0-62).

The "occurrence number" describes the relative position of an operating system partition in the region allocation map. For example, assume the CP/M operating system has three partitions:

- From beginning region 02 to ending region 55.
- From the beginning region 56 to ending region 7A.
- From beginning region B3 to ending region F2.

The partition from regions 02 to 55, appears first in the region allocation map. Its occurrence number is "0."

The partitions from regions 56 to 7A, and from B3 to F2 appear second and third in the region allocation map. Their occurrence numbers are "1" and "2," respectively.

Change the default boot string just as you would for the standard partition option (Chapter 4).

This concludes the procedures for the user-defined partition option from the main menu. If you receive any error messages during PART, refer to Chapter 8, "Error Recovery." if you still have problems after reviewing the documentation, call Heath/Zenith Customer Services.

Chapter 7

PART Data Structures

The purpose of this chapter is to give the advanced user a deeper technical understanding of how PART functions. Topics include the PART data structures on the Winchester Disk: the software boot code, the operating system table, the sector allocation table, the region control table and the bad sector table. Also included is an example of how the PART data structures interact.

Data structures which PART maintains on the Winchester Disk include:

- The software boot code, (SBC), which enables booting a given operating system from a partition.

- The two copies of the superblock. The superblock consists of the operating system table, the sector allocation treble, and the region control table.

In addition to writing the above data structures (and checking them at each usage), PART checks the bad sector table on the Winchester Disk and displays a warning if the bad sector table is incorrect.

THE SOFTWARE BOOT CODE (SBC)

PART writes the software boot code (SBC) to sectors 0 through 9 of the Winchester Disk. When the user attempts to boot a partition of the Winchester Disk, the Monitor 90 boot ROM (see the MTR90 manual) loads the SBC. The SBC will then perform secondary boot of the hard disk.

The SBC first looks for an MTR90 boot string in the format:

operating system[;n]

where n is the optional occurrence number. If no boot string is typed, the SBC looks for a default boot string from sector 0 on the Winchester Disk. (See Figure 8)

If none of the above boot commands are entered, SBC will display the operating systems and maximum occurrence numbers of the partitions currently allocated. SBC will also verify the data structures.

After the user enters the boot command, SBC searches the operating system identification table (Figure 10) for a match with the operating system name specified. If SBC finds a match, it uses this relative location [where 1 is the first operating system, 2 is the second, etc.] as the value for the allocation ID (Figure 11). SBC then searches the allocation ID byte of the sector allocation table (Figure 12) to locate all partitions allocated to the specified operating system. If no occurrence number was specified in the boot string, SBC boots the first partition for the operating system. If an occurrence number was specified in the boot string, SBC the $(n + 1)^{th}$ partition subdivision allocated to the specified operating system. (For example, if the occurrence number is 1, SBC boots the second partition for that operating system.)

'I'be format of the first 128 bytes of sector 0 on the H/Z-67 appears in the following table:

Bytes	Description
3	System bytes
1	PART/SBC version number — Used to maintain consistency across different releases of the operating system.
1	PART/SBC revision number
19	Default boot string (16 bytes define the boot string, the remaining 3 bytes define the ; and the occurrence number.)
3	Beginning sector number of bad sector table A
3	Beginning sector number of bad sector table B
3	Beginning sector number of superblock A
3	Beginning sector number of superblock B
2	*Sector size
2	*Sectors per track
2	*Tracks per cylinder
2	*Cylinders per volume
2	**Sectors per region
3	*Number of sectors
1	**Number of regions—0-based, i.e., 0 = 1, 1 = 2,...255 = 256
2	Checksum for superblock copy A
2	Checksum for superblock copy B
2	Checksum for bad sector table copy A
2	Checksum for bad sector table copy B
70	Reserved for future expansion
	*Physical device characteristics
	**Determined by physical characteristics

Figure 8.
Description of the first 128 bytes of sector 0 on the Winchester Disk.

The format of the three-byte sector numbers is low, middle, high byte.

THE SUPERBLOCK

PART writes two copies of the superblock-copy A and copy B-on the first two error-free tracks of the H/Z-67 Winchester Disk (see Figure 8). The second copy, which should not be used routinely, provides extra protection against data loss and is used during error recovery. The superblock consists of the operating system identification table, the sector allocation table, and the region control table. The following is a schematic representation of the superblock:

The Operating System Identification Table	}	256 bytes
The Sector Allocation Table	}	256 bytes
The Region Control Table	}	256 bytes

Figure 9

Schematic representation of the superblock.

A checksum is provided for each superblock and is found in sector 0. The SBC calculates and verifies this checksum at boot up to make sure that the data in the superblock has not been corrupted.

THE OPERATING SYSTEM IDENTIFICATION TABLE

The operating system identification table contains the names of all the operating systems which have partitions allocated on the hard disk. Since PART can support up to 16 operating systems, the table may have up to 16 entries. Unused entries in the table contain spaces.

The relative position of the operating system in the table is the value for the allocation ID. This value is used to search all the allocation ID bytes of the sector allocation table for the location of the operating system partition. In this manner, the byte of the first operating system in the table is 1.

The following is a sample operating system identification table for the region allocation map shown.

Operating Systems Identification Table

16 Bytes

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
01	B	e	t	a	D	o	s									
02	A	l	p	h	a	D	o	s								
03	C	P	M													
04																
05																
06																
07																
08	H	D	O	S												
09																
0Ah	2	5	6	D	o	s										
0Bh																
0Ch																
0Dh																
0Eh																
0Fh																
10h	U	C	S	D	P	a	s	c	a	l						

Operating Systems:

S. System
U. Unallocated
A. BetaDos
B. AlphaDos
C. CPM
D.
E.
F.
G.
H. HDOS
I.
J. 256Dos
K.
L.
M.
N.
O.
P. UCSDPascal

Region Allocation Map:

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0	>S	>P′	P′	P′	P′	P′	P′	P′	P′	P′	P′	P′	P′	P′	P′	P′
1	P′	P′	P′	P′	P′	P′	P′	P′	P′	P′	P′	P′	P′	P′	P′	P′
2	P′	P′	P′	>J′	J′	J′	J′	J′	J′	J′	J′	J′	J′	J′	J′	J′
3	J′	J′	J′	J′	J′	J′	J′	>C′	C′	C′	C′	C′	C′	C′	C′	C′
4	C′	C′	C′	C′	C′	>C′	C′	C′	C′	C′	C′	C′	C′	C′	C′	C′
5	C′	C′	C′	C′	C′	>C′	C′	C′	C′	C′	C′	C′	C′	C′	>J′	J′
6	J′	J′	J′	J′	J′	J′	J′	J′	J′	J′	J′	J′	J′	J′	J′	J′
7	J′	J′	J′	>A′	A′	A′	A′	A′	>J′	J′	J′	J′	J′	J′	J′	J′
8	J′	J′	J′	J′	J′	J′	J′	J′	J′	J′	J′	J′	J′	J′	J′	J′
9	J′	>U′	U′	U′	U′	U′	U′	U′	U′	U′	U′	U′	U′	U′	U′	>J′
A	J′	J′	J′	J′	J′	J′	J′	J′	J′	J′	J′	J′	J′	J′	J′	J′
B	J′	J′	J′	J′	J′	J′	J′	J′	J′	J′	J′	>B′	>J′	J′	J′	J′
C	J′	J′	J′	J′	J′	J′	J′	J′	J′	J′	J′	J′	J′	J′	J′	J′
D	>H′	H′	H′	H′	H′	H′	H′	H′	H′	H′	H′	H′	H′	H′	H′	H′
E	H′	H′	H′	H′	H′	H′	H′	H′	H′	H′	H′	H′	H′	H′	H′	H′
F	H′	H′	H′	H′												

Figure 10.

Sample operating system identification table for the region allocation map shown.

THE SECTOR ALLOCATION TABLE

The sector allocation table maps the operating system partitions to physical sectors on the H/Z-67 Winchester Disk.

Since PART enables up to 63 partitions (62 user, 1 system), the table contains up to 63 entries. The final entry is the end of table delimiter. Each entry is four bytes in size and describes the start of a new partition. The format for each value for the first byte of each entry, the allocation ID byte, is as follows:

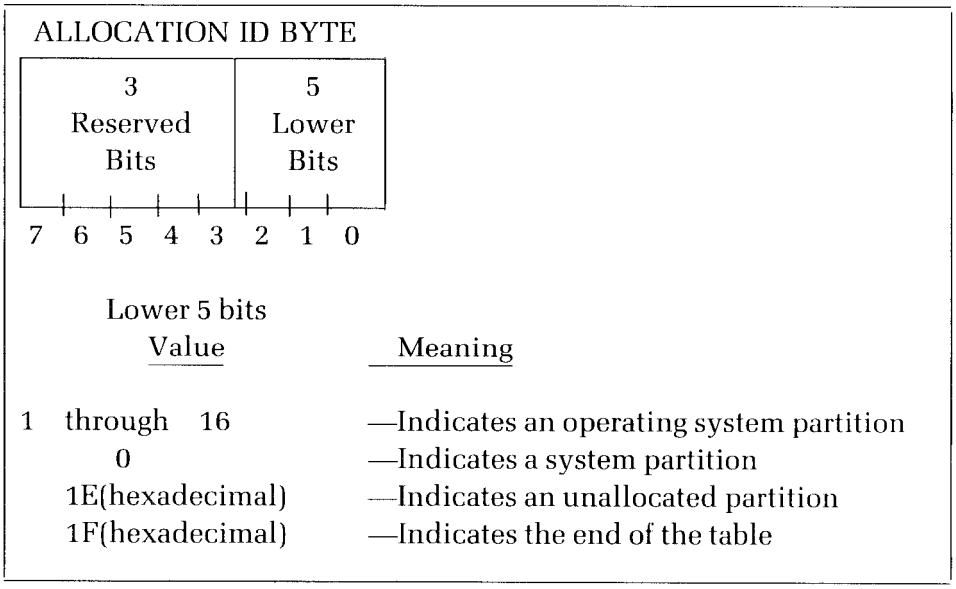
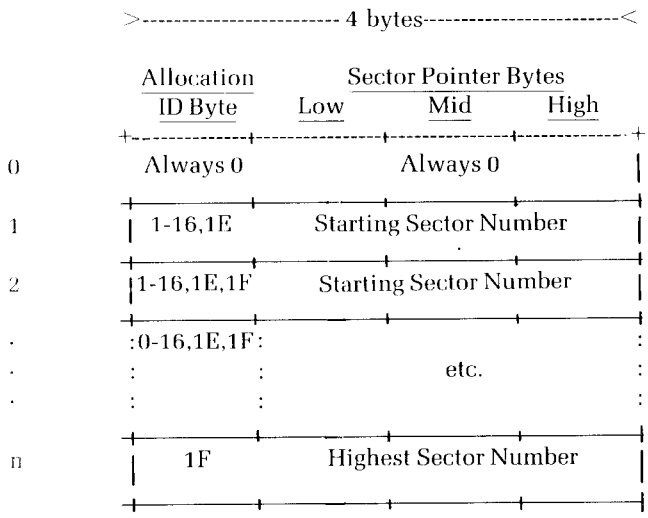


Figure 11.
The allocation ID byte.

PART reserves the first three bits of the allocation ID byte for future use.

The remaining three bytes of each entry in the sector allocation table indicate the first sector allocated to the partition. The table is in ascending -sector order and the format for the sector number is low byte, middle byte, high byte. The end-of-table sentinel (lFh) contains a sector number that is one greater than the maximum number of sectors on the disk. You may calculate the last sector allocated to a partition by inspecting the next sector allocation table entry and subtracting one. A schematic of the table follows, along with a sample sector allocation table for the region allocation map in Figure 10.



	Allocation ID Byte	Sector Pointer Bytes Low	Med	High
01	00h	00h	00h	00h
02	10h	A0h	00h	00h
03	0Ah	E0h	15h	00h
04	03h	60h	22h	00h
05	03h	20h	35h	00h
06	0Ah	C0h	3Ah	00h
07	01h	E0h	47h	00h
08	0Ah	00h	4Bh	00h
09	1Eh	A0h	5Ah	00h
0A	0Ah	60h	63h	00h
0B	02h	E0h	74h	00h
0C	0Ah	80h	75h	00h
0D	08h	00h	82h	00h
0E	1Fh	80h	98h	00h
0F	00h	00h	00h	00h
	...	...	...	...
3E	00h	00h	00h	00h
3F	00h	00h	00h	00h

Figure 12.
Sector allocation tables.

THE REGION CONTROL TABLE

PART provides the region control table primarily for future use. Since this table provides one byte of information for each region on the Winchester Disk, its length in bytes is equal to the number of regions.

One bit of each byte is currently defined. It indicates that the associated region has been affected by PART in the partitioning/repartitioning operation as shown by the apostrophed system ID letters in the region allocation map. Operating systems might inspect and/or clear this bit to determine if formatting is necessary before referencing any region falling within a partition controlled by the particular operating system. A schematic representation of the region control table follows.

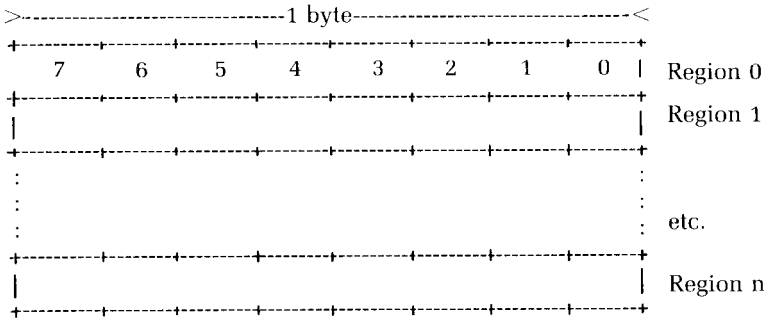


Figure 13.
The region control table.
Bit definitions: 7=Region altered, 6 through 0=Undefined

THE BAD SECTOR TABLE

The bad sector table is an ordered list of sector numbers of unusable sectors. There are two copies of the bad sector tables, copy A and copy B. This table is created at the Heath/Zenith factory by Prep67 prior to shipment and should not be changed by the user. PART checks the bad sector table at each boot up and may display a warning message if the table is in error.

The length of the bad sector table, i.e., the maximum number of bad sectors of a usable hard disk, is 170 entries. A schematic representation of the bad sector table follows. Unused table entries contain zeroes.

To locate the beginning sector of the bad sector table, see Figure 8.

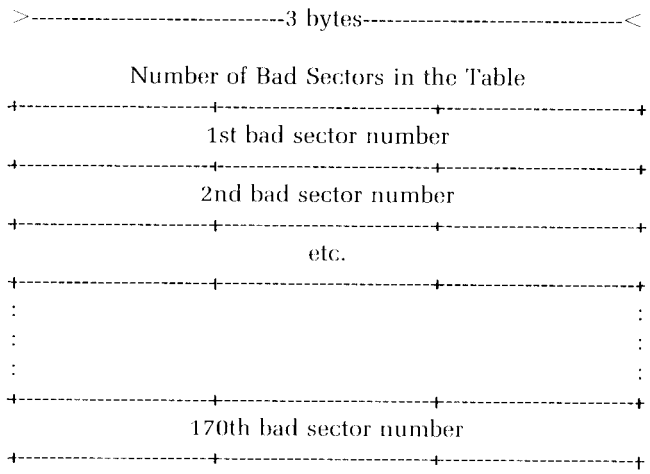


Figure 14.
The bad sector table.

Error Recovery

This chapter describes the error messages and recovery procedures during bootup from the Winchester Disk and during PART.

DURING BOOTUP FROM THE WINCHESTER DISK

If the user does not specify a default boot string, and/or enters an invalid boot string, the system displays an error message and a boot options menu similar to the sample screen in Figure 6. This boot options menu summarizes the partitions currently defined so that the user can generate a valid boot string.

The maximum occurrence numbers indicate the maximum value to enter for the occurrence number in the boot string. For example, if the CP/M operating system has 4 partitions, the maximum occurrence number is 3.

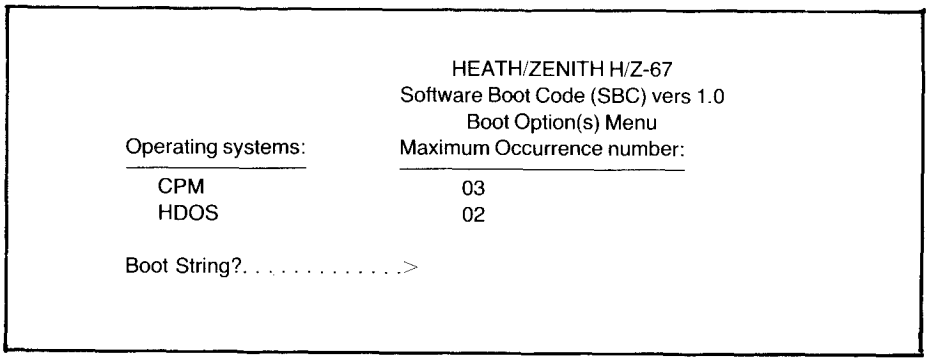


Figure 6.
Boot options menu.

To recover, simply type the operating system name (as displayed) and, optionally, the occurrence number. Then press RETURN.

Other error messages that may occur during booting are shown in Figure 7.

ERROR MESSAGE	RECOVERY
Error — Partition not found.	Indicates that the partition number specified in the boot string is invalid. Press RETURN to display the Boot Options Menu.
Error — Syntax error in Boot String.	Indicates that the form of the boot string entered is incorrect. Press RETURN to continue.
Error — Operating System not found.	Indicates that an invalid operating system name has been entered. Press RETURN to continue.

ERROR MESSAGE	RECOVERY
Error — Unable to read Boot Code from Partition.	Indicates that the partition's boot-code has a bad sector. Press RETURN and verify the operating system name. If there are still problems, call Heath/Zenith Data System Software Consultation.
ERROR — Syntax error in Default Boot String.	Indicates that the form of the default boot string is incorrect. Press RETURN to continue.
FATAL ERROR — EXTENDED SBC LOAD ABORTED.	Indicates that the second part of the SBC failed loading. Booting is aborted. Call Heath/Zenith Data System Software Consultation.
ERROR — CANNOT READ SUPERBLOCK A.	Indicates that superblock A cannot be read at booting time. Boot is continued using information from B.
FATAL ERROR — CANNOT READ SUPERBLOCK B.	Indicates both superblocks A and B cannot be read. Call Heath/Zenith Data System Software Consultation.

Figure 7.
Error messages during booting.

DURING PART

PART maintains two copies (copy A and copy B) of the region allocation map. If for some reason one copy becomes physically damaged or corrupted, PART displays the error messages below. These enable the user to verify which copy reflects the correct partitioning of the Winchester Disk.

WARNING **Verification Error between Checksum A and Checksum B**

WARNING **Superblocks Readable, but Checksums A and B Do Not Match.**
To avoid loss of your data, choose the correct Region allocation Map.
Press RETURN to display the first choice.

or:

WARNING **Checksum Error in Superblock A.**

WARNING **Checksum Error in Superblock B.**

WARNING **Superblocks Readable, but Both Superblock Checksum are In Error.**
To avoid loss of your data, choose the correct Region allocation Map.
Press RETURN to display the first choice.

Pressing RETURN displays a region allocation map and the message:

Allocation Correct.... Nom? (Press RETURN to display the other choice.)

By pressing RETURN you can redisplay either of the two maps until you are certain which is correct.

Pressing CTRL C ends PART.

Pressing Y selects for processing the region allocation map displayed. PART displays:

NOTE: The Region Allocation that you have chosen is now in effect.

Press RETURN.

SUPERBLOCK ERROR RECOVERY

If errors occur in reading the two copies of the superblock on the Winchester Disk, PART attempts to recover. A checking code called the "checksum" is calculated for each of the copies of the superblock in preparation for the hard disk write. These two checksums, along with the superblock copies are written on the hard disk. Later, when the copies and checksums are retrieved from the hard disk, a checksum is again calculated for each superblock copy. A comparison of the post-retrieval checksums with the pre-write checksums, insures that any corruption of the superblock copies is noted.

For simplicity, a correct checksum match is called a "good checksum," and an incorrect checksum match is called a "bad checksum."

Note that the two superblock checksums should be identical because the two copies of the superblock should be identical. The error messages shorten "copy X of the superblock" to "superblock X" where "X" is A or B.

Error messages may occur for the following reasons:

- A copy of the superblock has a bad checksum.
- A copy of the superblock is unreadable.
- Both copies of the superblock have bad checksums.

Both copies of the superblock have good checksums, but the checksums are not the same.

A Copy of the Superblock has a Bad Checksum

If a copy of the Superblock has a bad checksum, PART uses the uncorrupted copy of the superblock to recreate (repair) the corrupted superblock. It also displays:

WARNING - Checksum Error in Superblock A.
WARNING - Bad Checksum on Superblock A. Recreating from Superblock B.

or:

WARNING - Checksum Error in Superblock B.
WARNING - Bad Checksum on Superblock B. Recreating from Superbiock A.

Only One Copy of the Superblock is Readable and It has a Good Checksum

If one of the superblock copies is unreadable and the other is readable and has a good checksum, PART attempts to reformat the area where the superblock is written on the hard disk. PART also displays:

WARNING - Read Error in superblock A.

or

WARNING - Read Error in Superblock B.

If the reformating is successful, PART displays the following statement, along with a note indicating from which copy of the superblock information will be taken to recover from the error:

Reformat was Successful,

NOTE: Region allocation information will be taken from Superblock B.

or:

NOTE: Region allocation information will be taken from Superblock A.

Complete the partition procedure to save both copies of the superblock on the Winchester Disk.

If the reformat is not successful, PART will abort after displaying the following statement:

FATAL ERROR ENCOUNTERED DURING REFORMAT.

Only One of the Copies of the Superblock is Readable and It has a Bad Checksum

If one of the copies of the superblock is unreadable, and the other is readable but with a bad checksum, PART displays a warning message:

```
WARNING - Read Error in Superblock A.
WARNING - Checksum Error in Superblock B.
WARNING - Superblock A is Unreadable and Checksum for Superblock B is In Error. Information in
Superblock B may be corrupt.
```

or

```
WARNING - Read Error in Superblock B.
WARNING - Checksum Error in Superblock A.
WARNING - Superblock B is Unreadable and Checksum for Superblock A is In Error. Information in
Superblock A may be corrupt.
```

PART attempts reformatting as described in the previous section.

This concludes the most important error messages that you can receive from PART. If you receive other error messages from which you CANNOT recover:

1. Note the steps that led to the error message.
2. Call Heath/Zenith Customer Service.

Section Three

THE PREP67 UTILITY

Chapter 9

Winchester Disk Diagnostic/ Preparation Utility

NOTE: Prior to shipment from the Heath/Zenith Data System's factory, the PREP67 utility is run on the Winchester Disk drive. The Winchester drive, as received from the factory or store has been initialized, checked and readied for operation with the PART utility. You do not need to run this utility unless the PART utility (Section One) detects an error requiring PREP67 to be run.

After you select the B option from the main menu, the preparation utility, PREP67, displays the following menu:

```
PREP67 FOR THE WINCHESTER DISK
COPYRIGHT (C) 1981 HEATH/ZENITH DATA SYSTEMS

THIS ROUTINE IS USED TO:

    1.  INITIALIZE THE WINCHESTER DISK
    2.  PERFORM MEDIA CHECK ON THE WINCHESTER DISK SURFACE
    3.  INITIALIZE TABLES FOR USE WITH THE PARTITIONING UTILITY, PART

PREP67 IS A STAND-ALONE UTILITY.  IT WILL DESTROY ALL FILES ON THE WINCHESTER DISK.
DO NOT USE PREP67 UNTIL YOU HAVE MADE A BACKUP OF THE FILES CURRENTLY ON THE
WINCHESTER DISK.

PROCEED (YES/NO)? .
```

WHAT PREP67 DOES

INITIALIZATION

PREP67 first initializes the Winchester Disk by formatting the entire disk. Do not confuse this formatting process with any format operation used by a specific operating system such as FORMAT under CP/M or INIT under HDOS.

NOTE: Since each track and sector of the disk surface is initialized, any data previously recorded on the disk will be erased.

MEDIA CHECK

After the initialization process, PREP67 will perform a media check on the Winchester Disk. The media check will detect any sectors on the disk surface that may have only a marginal ability to be read or written to without error. It is not unreasonable to expect, over the lifetime of the disk, that some sectors may become unusable. A list of bad sectors, which are detected by PREP67, is maintained on the disk for use by individual operating systems.

PREP67 INITIALIZES THE PART TABLES

The partitioning utility, PART, requires that certain sectors be initialized prior to PART being run. PREP67 initializes these data areas (sectors) during the last step in its operation.

RUNNING PREP67

Be ause PREP67 destroys all information currently on the Winchester :disk, the prompt,

PROCEED (YES/NO)?

appears to allow you to either proceed with the PREP67 utility or return to the main menu. To emphasize again, PREP67 destroys all information currently residing on the Winchester Disk. Make sure you back up any files that you do not want destroyed.

If you elect to proceed, type YES to the prompt above. Typing NO, causes a return to the main menu. After a YES response, PREP67 displays,

PLEASE TYPE P TO PROCEED

This message provides you with a last opportunity to not proceed with PREP67. If you type any character other than P, control transfers to the main menu found in section 1. Otherwise, PREP67 begins its operation.

'I'he first message displayed by PREP67 is,

INITIALIZING THE DISK.. .

It is during this step in the process that the drive is physically being initialized.

After the drive is initialized, PREP67 performs the media check. The message,

MEDIA TEST IN PROGRESS...

appears prior to the start of this operation. During the media test, PREP67 will display,

TESTING CYLINDER NNN

where `NNN' is the current disk cylinder number under test. The number, 'NNN' will be updated as each cylinder is checked. The media test takes approximately 40 to 50 minutes to complete. After the media test, the PART data initialization occurs. PREP67 displays:

PREP67 Complete.

If no errors are encountered during the PREP67 process, control is transferred to the main menu.

PREP67 ERROR MESSAGES

If an error is encountered while running PREP67, one of the following error messages will be displayed at your terminal:

1. Wrong drive type.
2. Drive is not ready.
3. Error during formatting of the drive.
4. Track 0 contains bad sector(s).
5. Bad sector count exceeded for this drive.
6. Request sense status error.
7. Status parity error.
8. Host adapter parity error.
9. Completion byte is non zero.
10. Internal Error followed immediately by,

    Test aborted.

If you encounter an error, verify that the drive type and hardware settings on the disk controller board are set correctly (See the H/Z-67 Operations Manual). If the problem cannot be easily resolved, call your Heath/Zenith Data Systems Software Consultation.