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Miniscribe 2012 10Mb
Full Height MFM Drive

PREP v3 Utility
The Z-DOS v3 Utility that Initializes a Hard Drive in a Z-100!

Edited by Steven W. Vagts
"Z-100 LifeLine"

PREP v3 Utility

REFERENCES:
> MS-DOS Version 3 Software Manual
> Copyright (C)1982 Microsoft Corp.
> Copyright (C)1984 Zenith Data Systems Corporation
> Digital Research CP/M-85 Winchester Supplement
> Copyright (C) 1982 by Zenith Data Systems Corporation

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The PREP utility prepares the magnetic surface of many different types of Winchester disks (hard drives) for use as mass storage devices in a Z-100 environment.

The PREP utility is seldom needed, except:

   - if the disk begins to consistently have an unreasonable number of disk access errors that the use of the VERIFY utility cannot correct, or
   - if a new or used hard drive is being installed. A drive used previously for an IBM-PC environment will require PREPping before use.

Although this disk runs under the Zenith version of the MS-DOS Operating System (hereafter, we will call it Z-DOS to alleviate any confusion that may be caused with Microsoft's MS-DOS for the PC-clones); you can boot up with it, just as you would with any other bootable disk.

Note: While PC-DOS used the FDISK utility to prepare their hard drives for PC-clones, Zenith chose to use the PREP utility for reasons unknown to me. The utilities are completely different.

CAUTION: Using PREP will destroy all software and/or data stored on your Winchester disk. DO NOT USE PREP until you have transferred your Winchester disk files to floppy disks.

Note: Before you use the PREP utility, a hardware "jumper" must be installed at the "Format Enable" location in the upper left corner, just under the power cable connection, on the Z-217 Winchester disk drive controller card. This jumper is stored, when not in use, between pins 3 and 4 in the top row of a double row of pins at the bottom left of the board. See Figure 1.
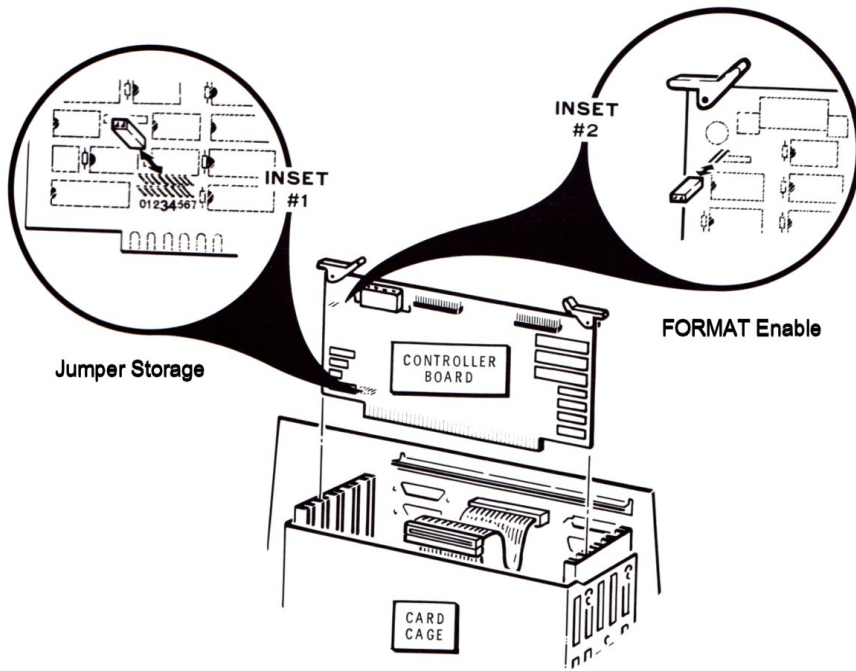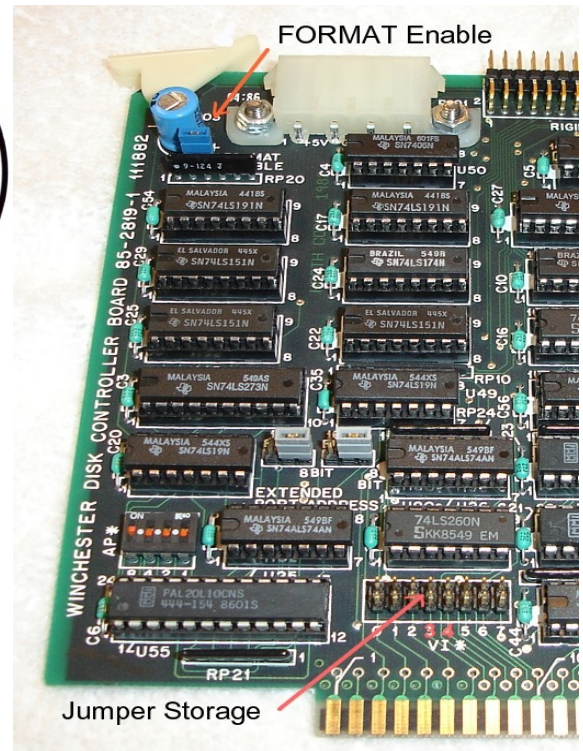
Figure 1. The Winchester Disk Controller Board

After you use the PREP utility, turn off the computer, return the jumper to its storage location, and reboot the system with a bootable floppy disk.

WARNING: Unplug your computer from its power source before touching any hardware component within the computer's cabinet.
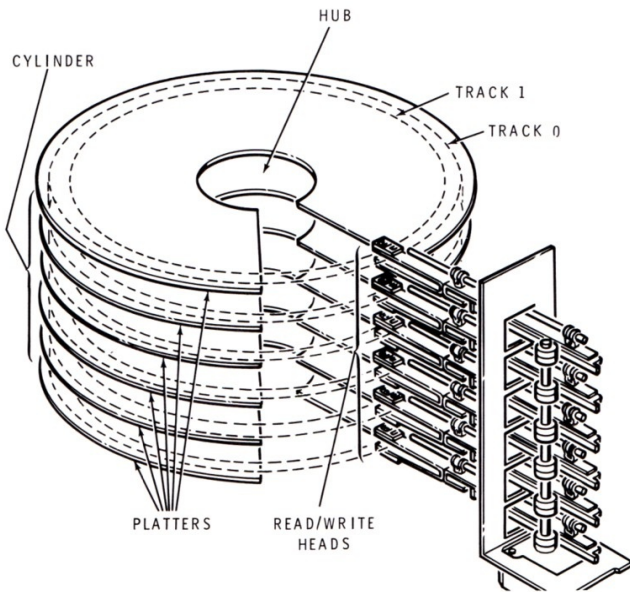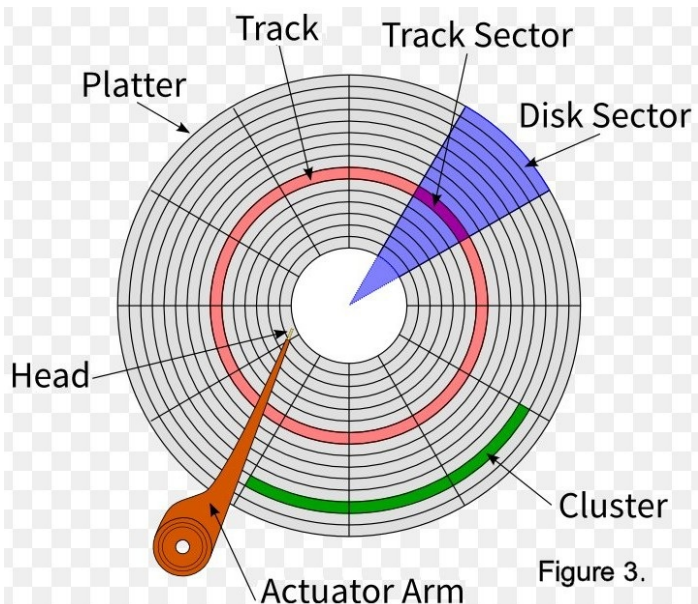
1   WINCHESTER DISK FEATURES

Figure 2. The Elements of a Hard Disk

"Winchester Disks" come in a variety of sizes and configurations, Figure 2. The central feature and core of a "hard" disk device is one or more rigid platter(s), each consisting of a non-magnetic metal (generally aluminum) disk, coated with a thin plating of ferric oxide or cobalt. This differs from the floppy disk, which has a single plastic (usually mylar) core with a thin coating of a similar magnetic substrate.

Winchester disk platters are generally sealed in a case to prevent particulate matter (such as dust, smoke, dirt, or hair) from contaminating a platter's surface or interfering with the read/write head (a head crash). Winchester disks can be either "fixed" or "removable". The fixed is permanently mounted inside the device, but removable Winchester disks come in disk packs or cartridges and may be removed or interchanged.

The read/write heads are electromagnets that slide back and forth a fraction of an inch above the surface of Winchester disk platters. The movement of a Winchester disk drive's read/write heads between the hub of the platters and the edge of the platters is called "stepping". Therefore, this movement is measured by an amount known as the "step rate".

Winchester disks used for Zenith Data Systems and Heath products can be divided into several logical subunits called "partitions". This is partly because large quantities of storage locations are easier to deal with if they are subdivided. The various subdivisions help speed storage and retrieval of data.

Figure 3.

Referring to Figure 3, a "sector" is the basic unit of data organization for disk drives. Like floppy disks, Winchester disks are divided into sectors. Winchester disk sectors are normally 512 bytes long on smaller drives, such as 10 or 20 Mb (Megabytes), and 1024 on larger drives, 32 Mb and above.

Each recording surface of a Winchester disk platter is also divided into concentric rings called "tracks", which are similar to the tracks of a floppy disk. The Winchester disks initialized by PREP are formatted with 18 sectors per track. A further division of a Winchester disk's storage area is the cylinder. A "cylinder" is a collection of all the tracks, across all the platters, that are located the same distance from the outer edge of each recording surface. Winchester disk read/write heads can access all of the data stored on a particular cylinder without any stepping movement.

For example, if a Winchester disk drive has four read/write heads, the drive can access a cylinder of 72 sectors (4 tracks times 18 sectors) without stepping (moving the heads). This amounts to a total of 36864 bytes (36 kilobytes) being read or written.

2   INVOKING PREP

Invoke PREP by entering the following command at the MS-DOS system prompt:

    A:PREP[/x] {RETURN}

    Where **/x** is one of the following optional switches:
    /K   Kilobyte -- causes PREP to format the Winchester disk with 1024-byte sectors rather than 512-byte sectors.
    /Q   Query -- causes PREP to prompt for disk parameters regardless of whether they have been previously specified. (Normally, PREP prompts for Winchester disk parameters only if PREP has never been used on the drive before or

if an error is found in the reserved Winchester area of a previously prepared disk.) Also, this switch initializes the bad sector table.

CAUTION: Do not specify the /K (Kilobyte) switch if you are still using the original Z-DOS v1 operating system, which only supported the 512-byte sector.

When you invoke PREP, the following display appears:

> *PREP version 2.01*
> *Copyright (C) 1984, Zenith Data Systems*
>   *Corporation*
>
> *The PREP utility helps you to:*
> ** Initialize surface of Winchester disk*
> ** Test data retention capabilities of*
>   *Winchester disk media*
> ** Isolate questionable disk sectors*
> ** Divide the surface of Winchester disk*
>   *into two partitions of equal size (one*
>   *Z-DOS partition and one CP/M partition)*

PREP may prompt you to specify six Winchester disk characteristics in order to identify the type of Winchester disk you have installed.

Then PREP displays messages as it operates on the disk.

CAUTION: Using PREP can destroy all files on your Winchester disk.

Winchester disks that had been supplied by Zenith or Heath were normally prepared by PREP before they were shipped. Users of these disks will need to use PREP only if they are consistently encountering an unreasonable number of disk access errors.

Do not use PREP until you have transferred your Winchester disk files to floppy disks.

> *Do you wish to proceed with PREP (Y/N)? _*

Pressing an {**N**} at this prompt ends the PREP utility and returns you to the system prompt.

Pressing a {**Y**} causes PREP to display the following prompt:

> *Please type P to proceed _*

Pressing any response other than {P} ends the PREP utility and returns you to the system prompt.

Note: Z-DOS was Zenith's version of MS-DOS 1.0, with several significant differences. Later version of Zenith's MS-DOS changed to the MS-DOS name but maintained several of the Z-DOS characteristics, one of the reasons that the native Z-100 could not run IBM-PC software. For our purposes, I shall continue to call Zenith's versions of MS-DOS 'Z-DOS' to avoid confusion with MS-DOS meant to run on PC-clones, including the Z-100 when running a PC-emulator.

3 RESPONDING TO DISK CHARACTERISTIC PROMPTS

Pressing {P} at the "Please type P to proceed" prompt causes PREP to query:

   Winchester drive unit number (0-3): _

Responding with a number from 0-3, with 0 representing the first drive, causes PREP to begin its operation.

If the disk has been previously prepared by PREP and no errors are found in the first sector of the boot code (see section "The Reserved Winchester Area"), PREP skips these disk characteristic prompts, assumes the disk surface has been previously initialized, and proceeds immediately to disk initialization (see section "4.1 Initializing the Disk").

If the disk has not been prepared with PREP, or if there is an error found in the first sector of the boot code (see the section, "The Reserved Winchester Area"), then the following six disk characteristic prompts will appear in sequence:

   Enter number of heads in hex:
   Enter number of cylinders in hex:
   Enter reduced write current cylinder in hex:
   Enter pre-comp cylinder in hex:
   Enter step-rate code in hex:
   Enter parking cylinder number in hex:

Note that the numbers needed to respond to these questions are in hexadecimal. Other PREP-like programs may require they be given in decimal.

The significance of each of these disk characteristic prompts is:

   Enter number of heads in hex:

At this prompt, type a hexadecimal value for the number of read/write heads contained in the drive you are preparing. Then press {RETURN}.

   Enter number of cylinders in hex:

At this prompt, type the hexadecimal value of the number of cylinders contained in the device you are preparing, and press {RETURN}.

For disks with floating read/write heads, this number would be equal to the total number of tracks divided by the total number of read/write heads. For disks with fixed read/write heads, this number would be equal to the total number of tracks divided by the total number of usable platter surfaces.

   Enter reduced write current cylinder in hex:

At this prompt, type the hexadecimal value for the location of the first cylinder at which read/write head current must be reduced, and press {RETURN}.

Toward the hub of the platters, where the circumference of each cylinder is smaller, data storage sectors are recorded closer together than the sectors on cylinders near the edge of the platters. Therefore, some Winchester disk

drives reduce the electrical current sent to the read/write heads when they write data on cylinders close to the hub of the disk platters. This reduction of current reduces the probability of magnetic interference between the data sectors that are recorded extremely close together.

   Enter pre-comp cylinder in hex:

At this prompt, enter the hexadecimal value for the number of the first cylinder at which pre-compensation must take place and press {RETURN}.

On the cylinders located close to the hub of a Winchester disk, where data is recorded at extremely high density, bit shift can occur. "Bit shift" is a phenomenon where the data bits written at a particular location spread apart slightly on the media after they have been written. Bit shift is most likely to occur when similar bits are written close together. The "pre-comp" (write precompensation) characteristic compensates for bit shift by writing some bits earlier or later than the normal rate of data writing. Precompensation for Winchester Disks causes a slight deviation (about 12 nanoseconds for every 100 nanoseconds) from the normal rate of data writing during the writing of bits that are apt to shift.

   Enter step rate code in hex:

At this prompt, you should enter the hexadecimal value code that indicates the rate at which the read/write heads step between tracks and press {RETURN}.

   Enter parking cylinder number in hex:

At this prompt, enter the hexadecimal value code that indicates the cylinder at which you want the read/write heads parked when the SHIP utility is run. If the manufacturer of your Winchester disk does not specify a parking cylinder, enter the maximum allowable cylinder number for your unit at this prompt.

After you respond to the "parking cylinder number" prompt, PREP will automatically begin to perform its three operations (see section "4 PREP Operations").

The PREP utility is capable of preparing a wide variety of Winchester disks for data storage. Table 1 lists several different Winchester disks and indicates the hexadecimal values you should enter, in sequence, to prepare each disk when prompted by PART for a specific disk characteristic.

The labels for the columns of numbers in Table 1 correspond to PREP characteristic prompts. If the model number of your Winchester disk is listed in the left-hand column of the table, then enter the numbers listed in the right-hand columns in sequence as the characteristic prompts are displayed. The first row for each Hard Drive lists the values in Hex. The second row provides the corresponding Decimal amount, if needed for other purposes.

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         Table 1:  COMMON HARD DRIVES & PARAMETERS FOR THE Z-100
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Drive:	Cap: (Megs)	Heads:	Total Cyl:	Reduced WC Cyl:	PreComp Cyl:	Step Rate:	Park Cyl:	Pwr:	Notes:
Computer Memories, Inc:									
CMI 5412	11	4	132hex	133	80	1	136	25w	3
			306dec	307	128		310		
Miniscribe:									
Mod II, 2012	11	4	132h	200	80	1	14F		
			306d	512	128		335		
Mod III, 3012	11	2	264h	300	80	1	28D		
			612d	768	128		653		
Mod IV, 4020	16	4	1E0h	200	80	1	209		
			480d	512	128		521		
Seagate:									
ST-125	21	4	267h	268	268	1	26C	10w	1,4
			615d	616	616		620		
ST-138	32	6	267h	268	268	1	0	10w	1,5,6
			615d	616	616				
ST-225	21	4	267h	268	12C	1	26C	15w	1
			615d	616	300		620		
ST-251	42	6	334h	335	335	1	38E	11w	1,5,6
			820d	821	821		910		
ST-251-1	42	6	334h	335	335	1	38E	12w	1,5
			820d	821	821		910		
ST-406	5	2	132h	200	80	1	131		
			306d	512	128		305		
ST-412	11	4	132h	200	80	1	131		
			306d	512	128		305		
ST-419	16	6	132h	200	80	1	131		
			306d	512	128		305		
ST-506	5	4	99h	80	40	96	9A		
			153d	128	64		154		
ST-706	5	2	132h	200	80	1	131		
			306d	512	128		305		
ST-4026	21	4	267h	268	268	1	0	25w	2
			615d	616	616				
ST-4038	32	5	2DDh	2DF	2DF	1	0	25w	2
			733d	735	735				
ST-4051	42	5	3D1h	3D2	3D2	1	0	25w	2,6
			977d	978	978				
ST-4096	80	9	400h	401	401	1	0	25w	5,6
			1024d	1025	1025				
IMI:									
5006H	5	2	132h	200	D6	1	148		
			306d	512	214		328		
5012H	11	4	132h	200	D6	1	148		
			306d	512	214		328		
5018H	16	6	132h	200	D6	1	148		
			306d	512	214		328		
Tandon									
TM 262	21	4	267h	268	268	1	26C	12w	4
			615d	616	616		620		
TM 602S	5	4	99h	80	40	96	9A		
			153d	128	64		154		
TM 603S	11	6	99h	80	40	96	9A		
			153d	128	64		154		

```
Others:
M6085            72    8    400h    401     200     1     406    25w    5
                           1024d   1025    512            1030
R203E            40    6    280h    28A       0     1      28A   30w    3
                            640d    650       0             650
```

NOTES:
1. Half height drive.
2. Voice coil full sized drive - park automatic on power down.
3. Full sized stepper drive. Mount in any position.
4. 3.5" low power drive in 5" half height frame.
5. Autopark drive on power off.
6. For Z-100 use on the UCI EASYWIN setup, 810 cylinders must be specified; when using with Zenith's controller card set, specify 255h for this value, which will give 32.9 megs - or use the PREP/k switch for 1024 byte sectors; 64 meg max.
7. The newer half-height drives generally require about 1 amp at 5 volts and 1 amp steady state at 12 volts. Starting current on 12 volts for the first 10 seconds is about 4 amps. Full height and older drives slightly more on 5 and 12 volts, with considerably more power consumption.

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4 PREP OPERATIONS

PREP begins to prepare the surface of your Winchester disk either after displaying the initial screen messages or after you respond to the six disk characteristic prompts. PREP prepares the disk by performing 3 operations in sequence:

- Initializing the Disk,
- Testing the Disk Media, and
- Initializing the Reserved Winchester Area.

4.1 INITIALIZING THE DISK

After you have responded to the disk characteristic prompts, PREP initializes the surface of the disk for the test that will follow. While this occurs, you will see the message:

Initializing the disk...

This initialization is similar to FORMAT in that it magnetically records a map of all sectors on the disk surface. PREP normally formats the Winchester disk with 512-byte sectors. This format is compatible with all operating systems supported by Zenith Data Systems. If the /K switch was specified when PREP was invoked, PREP will format the disk with 1024-byte sectors. This allows you to use Winchester disk drives with a 64 Mb (megabyte) capacity. Note, however, that the larger sector format is NOT supported by the original Z-DOS v1 and other operating systems.

When the surface has been initialized, the message shows:

Initializing the disk...completed

and then PREP begins testing the disk media.

Note: If your Winchester disk hardware has not been properly adjusted, the following message will be displayed instead of the "Initializing the disk..." message:

Error during formatting of the drive.

The error message will be followed by the system prompt. If this message appears, you must now perform a hardware adjustment as explained in section "6 PREP Hardware Adjustments".

4.2 TESTING THE DISK MEDIA

PREP performs seven test passes to check the integrity of the disk's storage capacity. The tests are made on a sector-by-sector basis. During each test pass, PREP writes a predetermined code to each sector (the drive light will flicker) and then reads back that code to verify that it remained correct (the drive light will appear as constantly on). PREP keeps you informed of its progress by displaying the message:

Media test in progress, pass n

Where n is the number (in the range 1-7) of the pass that it is currently conducting.

PREP uses a different code on each pass it makes through the test. If PREP finds sectors containing unusable media, it stores the address of these sectors, and later places these sector addresses into a Bad Sector Table.

Be patient. This PREP operation will take about 45 minutes per 5 Mb of disk capacity, because of the large number of sectors to be tested. Larger drives will take hours!

4.3 INITIALIZING THE RESERVED WINCHESTER AREA

After completing the media tests, PREP records
and verifies the Reserved Winchester Area (see
"5 The Reserved Winchester Area") on the first
several sectors of the Winchester disk. During
this operation, PREP displays the message:

   Initializing the disk...

If PREP adds the word completed to the end of
this display, and displays the system prompt,
then all PREP operations are complete. The
display should appear as:

   Initializing the disk...completed

   A:

Then you should turn off the computer and remove
the hardware jumper from the "Format Enable"
location on the Winchester Disk Controller.
Store the jumper on pins 3 and 4 of the upper
row (there are two rows) of pins at the bottom
left of the board. This procedure will help to
protect the data on the Winchester disk from
being destroyed accidently.

Next, you should reset the system and boot up
with the bootable Winchester Utilities Disk.

Note: You will NOT be able to access any parti-
tion after using PREP until you reset the system
and boot up with a bootable floppy disk.

5 THE RESERVED WINCHESTER AREA

Note: Information concerning the Reserved
Winchester Area is not essential for use of
the PREP utility or the Winchester disk. This
information is provided for users who wish to
obtain a deeper understanding of the operations
that PREP performs in order to prepare a
Winchester disk.

When the PREP utility is run, it records units
of Winchester support software on the first 36
usable sectors of the Winchester disk. (If you
specify the /K switch so that PREP creates
1,024-byte sectors, Winchester support software
is recorded on the first 18 sectors.) These
sectors and the support software they contain
are collectively known as the Reserved Win-
chester Area. They are recorded on the disk
during PREP's reserved area initialization
operation (see section "4.3 Initializing the
Reserved Winchester Area").

These software units are vital to you during
Winchester bootup because they help you to
access a particular partition after you access
the Winchester disk itself. Users of CP/M-85 and
MS-DOS with the Winchester disk also use these
data structures to make unusable media (bad
sectors) inaccessible before FORMAT is run.

These software units are arranged as shown in
Table 2.

Table 2 Winchester Support Software Units within Reserved Winchester Area

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Sectors Used:		
512-Byte Sectors	1024-Byte Sectors	Winchester Support Software Units:
5	2	Software Boot Code (SBC)
1	1	Superblock A
1	1	Bad Sector Table A
11	5	blank
1	1	Superblock B
1	1	Bad Sector Table B
16	7	blank
----	----	
36	18	Total Reserved Winchester Area

The blanks inserted between the "A" copies of
the superblock and the bad sector table and the
"B" copies of these units help to decrease the
chance that all important Winchester support
software units could be damaged simultaneously.

If you must access any part of the reserved
Winchester area, you can determine the location
of the Winchester support software units by
examining the pointers in the software boot
code. The software boot code will begin at
sector zero regardless of the location of the
other software units.

5.1 THE SOFTWARE BOOT CODE (SBC)

The "Software Boot Code" (SBC) is a Winchester
support unit that helps locate the partition to
be booted after entry of a Winchester disk
bootup command. The SBC also helps the system
avoid bad sectors during disk access by refer-
ring to a bad sector table.

PREP records the SBC on the first 5 sectors (2
sectors if 1024-bytes) of the Winchester disk
during initialization of the reserved Winchester
area (see section "4.3 Initializing the
Reserved Winchester Area").

5.1.1 ROLE OF SBC DURING BOOTUP

When you enter a Winchester disk bootup command,
the MTR-100 monitor reads the SBC into the
microcomputer's Random Access Memory (RAM).
Once within RAM, the SBC plays a crucial part in
the successful access of a partition for the
purpose of loading the operating system into
memory. The partition that is accessed is
determined either by a bootstring or a default
boot partition. A bootstring can be specified by
the user during bootup. A default boot partition
is stored in a fixed location within the SBC
(see section "5.1.2 SBC Entries").

In order to access a partition for bootup, the
SBC must match the specified bootstring or the
default boot partition with a partition that
exists in a table of partitions stored in the
superblock (see section "5.2 The Superblock").

When the SBC finds a partition that matches the specified bootstring or default boot partition, the SBC loads the first 32 sectors of that partition into RAM. If the accessed partition contains CP/M-85 or MS-DOS, then the boot loader program begins to execute the remainder of the bootup operation.

5.1.2 SBC ENTRIES

The entries included in the first 128 bytes of the SBC are described in Table 3.

Table 3   Software Boot Code Entries
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BYTES:	SBC ENTRIES:
3	System bytes
1	PART/SBC version number (Used to synchronize different releases of software)
1	PART/SBC version number (Used to synchronize different releases of software
27	Default bootstring (16 bytes define partition name, one byte defines the semicolon, & 10 bytes define operating sys name)
3	Beginning sector address of bad sector table A
3	Beginning sector address of bad sector table B
3	Beginning sector address of superblock A
3	Beginning sector address of superblock B
2	Sector size (512 bytes per sector)
2	Sectors per track (18)
6	Reserved for future expansion
3	Number of sectors on entire Winchester disk
1	Reserved for future expansion
2	Checksum for superblock A
2	Checksum for superblock B
2	Checksum for bad sector table A
2	Checksum for bad sector table B
12	Set drive for Z-217 controller
3	Address of first user sector (1st sector beyond Reserved Winchester Area)
6	Date partitioned, or default date, when PART is run (When PREP is run, the value 00 is used for each byte)
2	Checksum of SBC (assuming initial value is zero)
2	Parking cylinder number
37	Reserved for future expansion

128	First Quarter-sector of SBC

The format for each three-byte sector number is low, middle, high byte.

Note: This table describes one quarter-sector of the five-sector SBC. The rest of the SBC consists of the assembly instructions that lead to the actual access of the specified partition.

5.1.3 SBC VERIFICATION

A checking code called a "checksum" is calculated by PREP for the SBC before PREP records the SBC on the disk. The results of these checksums are recorded in entries within the SBC.

Then, when execution of either PART or PREP is repeated on the same Winchester disk, verification checksums are performed to verify that the SBC has not changed since the original checksums were performed.

If the SBC has changed, or if it cannot be read, then an error mesage will be displayed.

The SBC also contains the checksums used to verify the other Winchester support units (the superblocks and bad sector tables).

5.2 THE SUPERBLOCK

The "superblock" is a Winchester support unit that contains information about each partition on the disk. A maximum of 17 partitions can be defined for a given disk. The superblock reserves space for the following types of information for each partition:

- partition name
- operating system name
- flag byte (to show whether PREP or PART has been run on the disk since the last time the partition was formatted)
- address of the starting sector

5.2.1 SUPERBLOCK ENTRIES

These items, recorded for one partition, constitute one superblock entry. Each superblock entry occupies 30 bytes of disk space. The 17 super-block entries (for up to 16 user-definable partitions) are structured as shown in Table 4. PART is the utility used to create or change the various Winchester disk partitions and to define the attributes (name, size, etc.) of any given partition.

Table 4   Superblock Entries
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BYTES:	SUPERBLOCK ENTRY:
30	Entry for 1st partition (incl 16-byte partition name, 10-byte system name, 1-byte flag, and 3-byte starting sector)
30	Entry for 2nd partition (incl 16-byte partition name, 10-byte system name, 1-byte flag, and 3-byte starting sector)
30	Entry for 3rd partition (incl 16-byte partition name, 10-byte system name, 1-byte flag, and 3-byte starting sector)
"	"
"	"
"	"
30	Entry for 16th partition (incl 16-byte partition name,

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              10-byte system name, 1-byte flag,
              and 3-byte starting sector)
    30        Entry for 17th partition
              (incl 16-byte partition name,
              10-byte system name, 1-byte flag,
              and 3-byte starting sector)
     2        Reserved for future expansion
   -----
   512        Total for Each Superblock
```

Note: Refer to section "5.2 The Superblock" in
the text on PART for a detailed explanation of
the components of each superblock entry and
other information concerning the superblock.

5.2.2 SUPERBLOCK VERIFICATION

During initialization of the Reserved Winchester
Area (see section "4.3 Initializing the
Reserved Winchester Area"), PREP records super-
block entries twice on the Winchester disk. The
primary copy of the superblock, called Super-
block A, is used unless some of its contents
have been damaged since it was recorded. The
backup copy of the superblock, called Superblock
B, is used if Superblock A is damaged. Each copy
is recorded several sectors apart to decrease
the chance that both could be damaged simul-
taneously.

A checking code called a "checksum" is calcu-
lated by PREP for each superblock copy before
PREP records these superblock copies on the
Winchester disk. The results of these checksums
are recorded in the software boot code (see "5.1
The Software Boot Code (SBC)").

Then, when execution of either PART or PREP is
repeated, verification checksums are performed
to verify that the superblocks have not changed
since the original checksums were performed.
A similar sequence is used during normal disk
access operations. In either case, if Superblock
A cannot be read, or if the results of the
second checksum of Superblock A differ from the
results of the original checksum, then an
attempt is made to read Superblock B. If Super-
block B cannot be read, or if the results of the
second checksum of Superblock B differ from the
results of the original checksum, then all
partitions will be inaccessible.

5.3 THE BAD SECTOR TABLE

The "Bad Sector Table" is an ordered list of the
addresses of each sector on the disk that con-
tains unusable media. The information in the bad
sector table enables the disk operating system
to avoid bad sectors (unusable media) when it
accesses a partition during your everyday
activities.

The bad sector table can include the addresses
of up to 169 bad sectors. Each bad sector
address is recorded in a three-byte entry.
Space for the maximum number of entries (sector
addresses) is reserved when the table is crea-
ted; entries that do not contain a sector
address are filled with three zeros.

5.3.1 Bad Sector Table Entries

The structure of the bad sector table is
explained in Table 5.

During media testing (see "4.2 Testing the Disk
Media"), PREP maintains a record of the location
of all the bad sectors (sectors containing
unusable media) that it finds on the disk. Then,
during initialization of the reserved Winchester
area (see "4.3 Initializing the Reserved Win-
chester Area"), PREP creates a table of all bad
sectors and records two copies of this table on
the disk.

The primary copy of the table, Bad Sector Table
A, is normally used during disk access opera-
tions unless some of its contents have been
damaged. The second copy of the table, Bad
Sector Table B, provides a backup copy of the
table. If Bad Sector Table A cannot be used due
to media or data damage, Bad Sector Table B is
used.

Table 5   Bad Sector Table Entries
```
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
    BYTES:    BAD SECTOR TABLE ENTRY:
      3       1st bad sector address found by PREP
      3       2nd bad sector address found by PREP
      3       3rd bad sector address found by PREP
      3       4th bad sector address found by PREP
      "           "
      "           "
      "           "
      3       168th bad sector found by PREP
      3       169th bad sector found by PREP
      3       Last entry in table
              (always contains 000)
      2       Reserved for future expansion
    -----
    512       Total for each Bad Sector Table
```


5.3.2 BAD SECTOR TABLE VERIFICATION

A checking code, called a "checksum", is calcu-
lated by PREP for each of the copies of the bad
sector table before PREP records these bad
sector table copies on the Winchester disk.
The results of these checksums are recorded in
the software boot code (see "5.1 The Software
Boot Code (SBC)").

Then, when execution of PREP or PART is repeated
on the same Winchester disk, verification check-
sums are performed to verify that the bad sector
tables have not changed since the original
checksums were performed.

If Bad Sector Table A cannot be read, or if the
results of the second checksum of Bad Sector
Table A differ from the results of the original
checksum, then Bad Sector Table B is read. If
Bad Sector Table B cannot be read, or if the
results of the second checksum of Bad Sector
Table B differ from the results of the original
checksum, then no bad sector table information
will be available in the Reserved Winchester
Area.

If the FORMAT utility is then used on a partition of this disk, it will assume that the disk has no bad sectors and format without avoiding any bad sectors.

If the DETECT utility is used on this disk, it will find no bad sector table to which it can append new bad sectors. Therefore, it will search the disk for all bad sectors and create a new bad sector table.

6 PREP HARDWARE ADJUSTMENTS

Before you can use the PREP utility, a hardware component, a "jumper", must be placed on the "Format Enable" pins on the Z-217 Winchester Controller Board, as mentioned earlier.

This jumper is a small conductive metal clip covered with a box-like plastic case. This kind of jumper is known as a Berg jumper.

6.1 JUMPER MOVEMENT PROCEDURE

WARNING: The internal components of your computer can cause severe electric shock if touched while the computer is running. Therefore, you should turn off your computer and unplug it from its power source before touching any hardware component within the computer's cabinet.

1. Remove any disk that may be in the floppy disk drive.

2. Turn off your computer's power and unplug it from the power source.

3. Remove the cabinet top from your computer (Refer to Appendix I of the Z-100 Series User's Manual for detailed information on removal).

4. Locate the Z-217 Winchester Disk Controller Board board in the "Card Cage".

Note: Your computer also contains the Z-207 Floppy Controller board for floppy drives. The Z-217 Winchester Disk Controller Board is the board that is connected to the Winchester disk drive and the Data Separator Board by a pair of flat, ribbon-like cables.

Note: In order to slide the Z-217 controller board upward, you might first have to temporarily unplug other cables that lie above the Z-217 Hard Drive Controller board. Carefully note the positions of the cables, where they are routed, and on the flat cables, the marked edge.

5. Using the two levers attached to the top edge of the board to pry the board upward, gently slide the board upward until the two horizontal rows of pins are visible on the lower left corner. You do not need to remove the Z-217 board completely from the card cage, nor remove any of the cables, except those that may pass over the board from elsewhere.

6. Two horizontal rows of pins are located at the bottom left corner of the Winchester Controller Board. Locate the jumper covering pins 3 & 4 of the top horizontal row of pins. Remove it by carefully sliding it away from the board. Be careful not to bend the pins.

7. Locate the two pins just below the power connector and labeled "Format Enable". Carefully slide the jumper over these pins, being careful not to bend the pins. When connected by the jumper, the pins allow the Winchester disk to be initialized by PREP.

8. Gently slide the Z-217 board downward until the bottom edge of the board is securely engaged to the horizontal connector at the bottom of the card cage.

Note: Be careful that the Z-217 board remains between the same pair of vertical card cage tracks as you slide it downward.

9. If you unplugged any other internal cables, plug them back into their appropriate sockets. Make sure that all cables are firmly connected, cover all their respective pins (not offset to one side), and have the marked edge in the proper direction.

10. Replace the top cover of your computer and make sure that it is completely latched in place.

11. Plug the computer back into the power source and turn it on.

12. Boot up the Winchester Utilities Working Disk and proceed to use the PREP utility as explained in section "2 Invoking PREP".

WHEN YOU HAVE FINISHED USING PREP, perform the above steps in reverse order to relocate the jumper to the storage position.

CAUTION: You must remove the jumper from the "Format Enable" pins before performing any other activity. If this jumper remains on the "Format Enable" pins, irregularities in the power supply can cause the Winchester disk to be automatically initialized during normal use of the disk. This initialization will destroy any data recorded on the disk.

7 PREP ERROR MESSAGES

Bad sector count exceeded for this drive.

Cause: The upper bound limit (169 bad sectors) for bad sectors has been exceeded. This could indicate a hardware malfunction.

Cure: Run PREP again. If this error message reappears after repeated use of PREP, the drive, data separator, or controller board may be faulty. Check the cables again.

Error -- Can not read superblock A.

Cause: A bad sector error has occurred in the primary superblock (A).

Cure: PREP will automatically use the backup copy of the superblock (B) and resume the operation it was conducting when the error message was displayed. However, this message indicates that only one usable copy of the superblock remains on the disk. Although you could use the disk in this condition, all Winchester disk data will become inaccessible if Superblock B is ever damaged. Therefore, it is recommended that you back up the contents of the disk when the current operation is complete and run PREP again to recreate two valid copies of the superblock. You can then restore the disk contents. Check your software manual for information about BACKUP and RESTORE commands.

Error -- Drive capacity > 32/64 megabytes!

Cause: PREP has calculated that the Winchester disk drive connected to the Z-217 controller is larger than the maximum allowable size of 32 Mb, or 64 Mb if the /K switch is used.

Cure: Run PREP again, being careful to respond with the correct values to the drive characteristic prompts. If the drive is indeed greater than 32 Mb, later versions of PREP have a /K switch to change the sector size to 1024 bytes, increasing the maximum size to 64 Mb.

Error during formatting of the drive.

Cause: This message indicates that an error occurred during PREP's initialization of all usable disk surfaces. There are three possible causes for this type of error:

    * Incorrect responses to PREP's six drive parameter prompts,
    * Improper positioning of the "Format Enable" jumper on the Z-217 controller board, or
    * A hardware malfunction.

Cure: Referring to section "6 PREP Hardware Adjustment", if you have not already done so, move the jumper to the "Format Enable" position on the Z-217 controller board. Then invoke PREP again, and double check your responses to the drive characteristic prompts, if they appear. After using PREP, remove the jumper from the "Format Enable" position.

Invalid HEX value, try again:

Cause: The value entered at a drive parameter prompt was not a valid hexadecimal number, or the value entered was outside of range.

Cure: Double check the appropriate hexadecimal value against the disk manufacturer's documentation or Table 1 in this supplement. Reenter the correct value at the prompt.

Track 0 contains bad sector(s).

Cause: A bad sector error has occurred in the reserved area of the Winchester disk. This could indicate a hardware malfunction.

Cure: Run PREP again. If this error reappears after repeated use of PREP, the drive, data separator, or controller board may be faulty. Check the cables again.

Unable to communicate with the Z-217 controller

Cause: PREP cannot locate the Z-217 controller. This could mean that the Z-217 is not firmly plugged into the S-100 bus, that the drive cable connectors are not securely fastened, or that the controller has a hardware malfunction.

Cure: Check to see that the controller card and all cable connectors are secure. Rerun PREP.

Unable to write default PART values

Cause: An error was encountered as PREP attempted to write the superblocks to the reserved Winchester area of the disk. This error condition can be caused by media imperfections at the sectors where PREP is trying to write a copy of the superblock.

Cure: Run PREP again. If this error message reappears after repeated use of PREP, the drive, data separator, or controller board may be faulty. Check the cables again.

Z-217 controller error on Set Drive parameters command

Cause: One or more responses to the six drive characteristic prompts were not valid for the particular drive connected. A hardware malfunction of the Z-217 controller is possible.

Cure: Recheck the drive characteristics and run PREP again. If this error occurs after repeated attempts to run PREP, the drive, data separator, or controller board may be faulty. Check the cables again.

I hope this has been helpful. If you have any questions or comments, please email me at:
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Cheers,

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