

ANPRO
COMPUTERS, INCORPORATED

Z80
HARD DISK
SOFTWARE

USER'S MANUAL

P/N: A74015-A

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PREFACE

This manual is for users and integrators of systems based on AMPRO Z80-based single board computers, utilizing the CP/M operating system. It describes the optional hard disk software contained on the AMPRO Z80 Hard Disk Software diskette. Here is an overview of what is included in this manual:

- Chapter 1 - GENERAL INFORMATION - Features of the Z80 hard disk software. Conventions used in program operation descriptions.
- Chapter 2 - SOFTWARE INSTALLATION - Hardware setup and software configuration procedures.
- Chapter 3 - PROGRAM DESCRIPTIONS - Detailed descriptions and operating instructions for each of the hard disk software utilities.

Chapter 3 is intended to provide a convenient user reference. The program descriptions are arranged alphabetically, and each program's name appears on the bottom of the page, to aid you in locating the program description.

Each AMPRO program has a version number, and revision level. For example "Version 2.3" represents program Version 2, Revision 3. The version number is changed when a new program description is required. In most cases, the programs display their version number when you run them. This way you can tell if you have the right program description for the version of a program you are using. As new (improved or enhanced) versions of programs become available, replacement program description sheets for your manual will also be provided.

PLEASE NOTE

Specifications and descriptions are subject to change without notice. Updates are available from AMPRO at nominal charge. The contents of this document are believed to be accurate. If errors are found, please notify AMPRO at the address shown on the title page of this document.

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CHAPTER 1

GENERAL INFORMATION

1.1 INTRODUCTION

This chapter primarily describes the optional hard disk software available for the AMPRO Z80-based single board computers and computer systems. Conventions to be used in program operating instructions are defined, and references for further information are listed.

1.2 HARD DISK SOFTWARE DESCRIPTION

The AMPRO Z80 hard disk software provides support for a wide variety of hard disk system configurations. Use of the hard disk software requires either a system containing an AMPRO Little Board with an SCSI/PLUS Z80 Adapter, or an AMPRO Little Board/PLUS (with built-in SCSI/PLUS interface). AMPRO BIOS Version 3 is also required; the Version 3 BIOS contains generic SCSI (SASI) support, and has been designed to maximize the flexibility of your system's hard disk interface.

The required Version 3 BIOS is available on the Z80 System Software diskette (AMPRO P/N A60101); the hard disk software utilities necessary to format and install hard disk drives and controllers are contained on the Z80 Hard Disk Software diskette (P/N A60057). If you do not already have the Version 3 BIOS, a software update is available from AMPRO for a nominal charge. Source code for the BIOS and utilities is also available from AMPRO.

Here are some of the features of the AMPRO hard disk software:

- o BIOS supports "generic" SCSI (SASI) controllers, and Xebec 1410/1410A
- o Up to eight hard disk controllers, with up to 11 hard disk drives of any size, up to 88 megabytes total storage
- o Variable CP/M partition sizes: 0.1 to 8 megabytes
- o CP/M drive letter swapping

Although the Version 3 BIOS provides "generic" SCSI controller support, the SCSI format command has a number of "vendor unique" options which are not uniformly implemented. Consequently, only a limited number of SCSI controllers are directly supported by the AMPRO hard disk format utility (HFORMAT). Controllers currently supported are:

Adaptec ACR4000
Shugart 1610-4
Xebec 1410, 1410A, and OWL

If you wish to use an unsupported controller, you you can do this by modifying

HFORMAT to be compatible with the desired controller's format command. This usually involves a small change to the source code, which is available for a nominal charge from AMPRO, in the Z80 Software Source Code package.

Most SCSI (SASI) controllers currently being manufactured initialize themselves on powerup from parameters they write to the drive during the format process. Examples are the Adaptec and Shugart controllers, and the Xebec DWL drive. Some controllers -- like the Xebec 1410/1410A -- are not auto-initializing, and must be initialized each time they are powered on. Like the format command, the initialization command is not standardized. The AMPRO HINIT utility provides optional controller initialization for only the Xebec controllers. If you wish to use an unsupported controller that does require initialization, you will have to modify HINIT to meet your controller's requirements; source code to HINIT is available in the Little Board Source Code package.

1.3 CONVENTIONS

In the descriptions of the use of software utilities, terminal keyboard inputs which you will make to the system are shown underlined. This has been done to make it easy for you to distinguish between the computer's prompts and the operator's keystrokes. For example:

A0>HFORMAT <RETURN>

Also, certain keys on your terminal's keyboard have special uses. The control key, generally labeled CTRL, is meant to be pressed at the same time as one other key. The required control key combination will be represented as follows: <CTRL-C> = control key pressed along with C key.

Two other special keys are the "escape" key, indicated by <ESC> and the "return" key (also called the "carriage return" or "enter" key), indicated by <RETURN>. In general, all commands you enter from the CP/M (or ZCPR3) command prompt require you to press the <RETURN> key to begin the operation, as in the example above.

1.4 REFERENCES

Only brief references are made in this manual to the use and operation of some required software utilities. Whenever a software utility is mentioned, it will either be called an AMPRO utility, a CP/M utility, or a ZCPR3 utility. This way you will know where to obtain further information on the program's use.

Refer to the AMPRO Z80 Software User's Manual (P/N A74006) for further information on other AMPRO-supplied software programs and utilities.

CHAPTER 2

SOFTWARE INSTALLATION

2.1 INTRODUCTION

This chapter provides information on how to configure and install the AMFRD Z80 hard disk software. The required hard disk utilities are contained on the Z80 Hard Disk Software diskette (AMFRD P/N A60057). The AMFRD Version 3 BIOS, present on the Z80 System Software diskette (P/N A60101), is also necessary.

This chapter will guide you through the required hardware and software setup and installation procedures. Refer to Chapter 3 for detailed program descriptions and operating instructions on the hard disk software utilities, and to the AMFRD Z80 System Software User's Manual (P/N A74006) for instructions on the use of other AMFRD software.

NOTE

Any modifications to the system parameters should only be performed using your backup disks. Do not modify the disks shipped with your system.

2.2 HARDWARE PREPARATION

The AMFRD Z80 hard disk software assumes the presence of either a Little Board, with the Z80 SCSI Adapter option, or a Little Board/PLUS, with built-in SCSI interface. Be sure that conductor number 1 of the 50-conductor SCSI bus cable is plugged into pin 1 of the SCSI 50-pin connector. Often, the flat ribbon cable will have a red strip on one edge, indicating the location of conductor number 1. Also be sure that two -- and only two -- SCSI bus devices have their resistor terminator networks installed.

You may connect up to eleven drives, on up to eight controllers, to your system. The drives may be any size, up to the system maximum of 88 megabytes. Various drive and controller types may be intermixed.

You will need the following information on each drive to be used:

- o Number of cylinders
- o Number of heads
- o Step rate
- o Cylinder number to begin write precompensation (if needed)
- o Cylinder number to begin reduced write current (if needed)

In addition, each type of hard disk drive usually has a jumper configuration area, generally located near the 34-pin drive cable connector. Consult your drive's documentation to determine how it needs to be jumpered. If only one drive is connected to a controller, it should be jumpered as the first logical unit (LUN0), and connected to the connectors provided for that unit. When two or more drives are connected to a single controller, they are jumpered to

different logical unit numbers, and connected to the appropriate connectors on the controller.

Here are some notes on the installation of several controller types:

Xebec 1410, 1410A, and DWL - set the sector size jumper, labeled "SS" to the 512 byte sector position, labeled "5." Set the controller address. This is a trace cut option on either the 1410 or the DWL. The Xebec controllers are shipped jumpered for SCSI bus address 0, so if you are only using one controller use that bus address.

Adaptec ACB4000 - set the SCSI device ID jumper, J5, for the desired controller ID. The ID is specified as a 3-bit binary code, with the least significant bit corresponding to A-B and the most significant bit E-F. The associated bit is a 0 when the jumper is off. If only one controller is on your SCSI bus, you can select bus address 0 by leaving off all of the address jumpers. The jumpers near J1, labeled T, PU, R and S are used for write precompensation setup. Generally a single jumper should be inserted here, between R and S.

Shugart 1610-4 - set its SCSI bus ID jumper (jumper pairs CU1, CU2, and CU4) for the desired controller address in the same manner as with the ACB4000. CU1, CU2, and CU4 on the Shugart controller correspond to jumper pairs A-B, C-D, and E-F on the Adaptec controller. No other jumpering is required.

Adaptec and Shugart ID Jumpering

SCSI Bus ID	Adaptec			Shugart		
	D-E	C-D	A-B	CU4	CU2	CU1
0	out	out	out	out	out	out
1	out	out	in	out	out	in
2	out	in	out	out	in	out
3	out	in	in	out	in	in
4	in	out	out	in	out	out
5	in	out	in	in	out	in
6	in	in	out	in	in	out
7	in	in	in	in	in	in

NOTE

If you are using multiple controllers, be sure only one of them has its SCSI bus termination resistors installed.

2.3 SOFTWARE INSTALLATION

Make a copy of your normal system diskette, and label it as your "Hard Disk System" diskette. Copy the hard disk software utilities from the Z80 Hard Disk Software diskette onto the new Hard Disk System diskette. Use the following procedure to generate your custom hard disk system configuration.

Step 1: Configure your CP/M system size.

The more hard disk storage your system has, the more memory space CP/M requires for storage of directory-related information. As CP/M's space requirements increase, the space available to programs (called the Transient Program Area, or "TPA") decreases. The AMPRO ZMOVCPM and MOVCPM utilities are used to generate various size systems; ZMOVCPM creates systems containing ZCPR3, while MOVCPM creates systems without ZCPR3.

Here are the required sizes for various options of hard disk storage, based on the AMPRO BIOS Version 3 with the standard (built-in) ZCPR3 support:

Hard Disk System Sizes

<u>Hard Disk Storage</u>	<u>CP/M Size</u>	<u>TFA bytes</u>
(none)	60K	56,070
1-10 MB	59K	55,046
11-42 MB	58K	54,022
43-74 MB	57K	52,998
75-88 MB	56K	51,974

NOTE

A usable 60K system, without hard disk support, cannot be generated with ZMOVCPM or MOVCPM. Instead, the 60K floppy-only system is provided in bootable form on the system tracks of the standard AMPRO Z80 System Software diskette.

Determine the required system size, and use the AMPRO ZMOVCPM (or MOVCPM) utility to create a system image file configured for your requirements. (The required system size will be one or more K bytes smaller if ZCPR3 configurations other than the "standard" built-in one are to be used.)

NOTE

ZMOVCPM.COM (or MOVCPM.COM) must be run directly from the CP/M (or ZCPR3) command line, not from a shell like MENU or FRIENDLY, since it prepares a memory image which might be corrupted by the shell program. Use the shell's exit command (X, <CTRL-C>, etc.) to return to the A0> prompt before running ZMOVCPM (or MOVCPM).

For example, to create a 59K system, use the command:

```
A0>ZMOVCPM 59 *<RETURN>
```

The number "59" provides enough space for up to 10 megabytes of hard disk storage. ZMOVCPM will respond:

```
CONSTRUCTING 59K CP/M vers 2.2
READY FOR "SYSGEN" OR
"SAVE 41 CPM59.COM"
AO>__
```

Step 2: Write the new system to your Hard Disk System diskette.

At this point, the new system image is stored in memory. Use the AMPRO SYSGEN utility to write the new system image onto the system tracks of a new (preformatted) diskette, by typing:

```
AO>SYSGEN<RETURN>
```

When SYSGEN requests the Source drive, respond with <RETURN> only, to tell SYSGEN to take the source from memory. When SYSGEN requests the Destination drive, enter the desired floppy drive letter. After you specify the Destination floppy drive letter, SYSGEN will prompt you for a <RETURN>. After SYSGEN writes the system to the Destination floppy diskette, the Destination drive prompt will again appear; this time, respond with a <RETURN> or <CTRL>-C to exit SYSGEN.

Step 3: Set the powerup port configurations.

Use the AMPRO CONFIG utility to set the required port configurations and other initialization parameters on your new Hard Disk System diskette. This is required even though your current system disk's parameters may already have been set, because ZMOVCPM has created a system image containing the standard defaults (9600 baud terminal, etc.), which may differ from your system's requirements.

Step 4: Test the new system disk.

Try booting from the new Hard disk System diskette. It should indicate the CP/M system size number (e.g. 59K CP/M), and BIOS Version 3, in the sign-on message. In case of difficulty, re-boot your system with a working system disk and use the CONFIG utility to recheck the terminal port setting, step rates, etc.

Step 5: Format your hard disk.

You can now proceed to format your hard disk drive. Before you can use the AMPRO hard disk formatter (HFORMAT), you must complete the above steps, and you must have booted from the new Hard Disk System disk. HFORMAT will not run otherwise. Refer to the description of the AMPRO HFORMAT utility (Chapter 3).

WARNING! HFORMAT will destroy all data on the hard disk drive.

You need to have the following information handy when you run HFORMAT:

Controller: brand and model

Drive: number of cylinders
number of heads
step rate
cylinder at which to begin write precompensation, if needed
cylinder at which to begin reduced write current, if needed
cylinder to use for landing zone, if needed

In case of difficulty, re-boot from your Hard Disk System disk and verify from the system sign-on message that you have a 59K (or less) size CP/M system, and BIOS Version 3 or later. If these are correct, the trouble may be:

- o Faulty hard disk controller, drive, or cables
- o Incorrect controller or drive jumper settings
- o Incorrect controller or drive information given to HFORMAT
- o Incompatibility between hard disk controller and drive
- o Problem with your system's SCSI interface

Step 6: Test hard disk initialization.

Since the AMPRO BIOS supports a wide variety of SCSI (SASI) controllers and drives, as well as a wide range of CP/M drive partition sizes, the operating system must be initialized for your specific configuration. This will be done immediately after system boot, by the AMPRO HINIT utility.

Refer to Chapter 3 for information on HINIT. At this point, you should run HINIT in its interactive "menu mode," responding to the program's prompts according to the characteristics of your hardware. Keep a list of all of your keystroke responses, as you will be making an automatic command file (alias) out of them shortly. You can create as many CP/M letter partitions on each drive as you like, using up the available K bytes of formatted capacity of the drive.

After running HINIT (menu mode), try reading the directory of each of your new (empty) hard disk partitions using the DIR utility. If this doesn't work, or if the directory sizes do not seem correct, re-enter the initialization requirements with HINIT. If you still have problems, refer to the list of possible causes in the previous step.

Step 7: Bad sector lockout.

Since a hard disk drive has an extremely dense recording format, tiny defects can result in storage areas which are unusable. Typically, only several K bytes of disk storage space will be lost due to these defects.

The Public Domain FINDBAD utility (Chapter 3) performs a read of every sector of each CP/M drive letter partition you specify, logging all errors encountered during the process. After the specified drive partition is fully checked, all of the bad sectors are grouped in a single file, called [UNUSED].BAD, in user area 15. Once the defects are grouped into this special file, no attempt to read or write to those areas of the drive will be made (unless you erase the file).

Run FINDBAD once for each drive partition. For example:

```
AO>FINDBAD F::FINDBAD G::FINDBAD H::FINDBAD I:<RETURN>
```

Step 8: Create and test an automatic hard disk initialization alias.

In this step, you will use the ZCFR3 ALIAS utility to create an "alias" command file to automatically initialize your hard disk system. The required alias contains the precise set of HINIT keystrokes you used in Step 6, above, but with a comma used to represent the <RETURN> key and a period used to represent the <ESC> key. A good name for the alias you create is HARDINIT.COM. You can use a separate alias to initialize each drive or controller, or one alias can initialize them all.

For example, the following HARDINIT alias command line might be used to initialize two 5 megabyte drive partitions (F and G) on a single 10 megabyte drive, connected as logical unit 0 (LUN0) on an Adaptec controller:

```
HINIT YD010 AF5000,AG5000,.
```

Refer to the program description of HINIT (Chapter 3) for further details.

After you create the HARDINIT.COM alias required by your system, test it as follows: re-boot from your Hard Disk System diskette, to clear out the effects of Step 6; then type the command:

```
AO>HARDINIT<RETURN>
```

Then try again to access the (empty) directories of all of the drive letters your alias has just defined, using the DIR utility. (Problems? See Step 6.)

Step 9: Write your system tracks to the first hard disk partition.

Use the AMPRO SYSGEN utility to copy the system tracks from your Hard Disk System diskette to your first hard disk partition.

Step 10: Configure your system disk for automatic initialization.

In this step you will configure your Hard Disk System disk to perform all required initialization, including complete transfer of operation to your hard disk partitions. To do this, you create another ALIAS which gets everything going just the way you want it.

Here is an example. Let's assume you have created a system with two 10 megabyte drives, partitioned as four 5 megabyte CP/M drive letters, F through I. The standard system disk contains an alias which is useful for this configuration, called HSTART.COM. It contains the following command line:

```
HARDINIT; SWAP AF EG CH DI.; STARTUP
```

This performs the following three steps:

- (1) Initializes your hard disk system, according to the alias HARDINIT.COM you created in Step 8.
- (2) Reassigns drive letters, such that floppy letters A-D are swapped with hard disk drive letters F-I.
- (3) Continues operation from the first hard disk drive partition (now called "A"), based on the contents of a STARTUP.COM alias you put there.

One final touch: set "HSTART" as the system autocommand, using the AMPRO CONFIG utility. Now, when you boot from your Hard Disk System diskette, your hard disk system will automatically be initialized, the hard disk drive letters (F-I) will be swapped with the floppy drive letters (A-D), and the command line contained in the STARTUP.COM alias on the first hard disk drive partition will run. Try it!

```
.....  
:                                     :  
:           CONGRATULATIONS!         :  
:                                     :  
:   This completes your hard disk    :  
:   system installation.              :  
:                                     :  
:.....
```

CHAPTER 3

PROGRAM DESCRIPTIONS

3.1 INTRODUCTION

This chapter contains detailed information on each of the AMPRO Z80 hard disk software utility programs supplied on the AMPRO Hard Disk Software diskette. Each program's description explains what the program does and how it is used. The utilities are covered in alphabetical order, so this material can serve as a handy operator's reference.

Each program description is identified with a version number. When the utility program is run, its version number (and a revision level) appear in the program's sign-on message, for example:

```
        AMPRO Copy/Format/Verify Utility
        Copyright (C) 1984 AMPRO Computers, Inc.
        Version 1.6
```

In this case the program is Version 1, Revision 6. Revisions of a utility program having the same version number operate in the same manner. If a future version of a particular utility program requires a new description, its version number will be changed, to indicate that the old description is no longer accurate. Program descriptions for the new program version will be available, so that you can update this manual.

3.2 PROGRAM DESCRIPTIONS

The following pages contain the program descriptions of the AMPRO Z80 hard disk software utilities, alphabetically arranged.

FINDBAD

(Version 6)

Description

Since a hard disk drive has a very densely packed storage surface, minute defects can result in small areas which are unusable. Some controllers can automatically "map" these bad spots (defects) out of use during operation, while others can not. The AMPRO hard disk BIOS does not utilize this option, since each controller does this differently. Instead, the FINDBAD bad sector lockout program is used to allocate all of the bad areas of a disk's surface into a single file. As long as you never erase this file, the bad spots on the disk will never be used for program or data storage. Typically only several K bytes of disk storage will be lost due to these defects.

The FINDBAD utility is a public domain program which provides bad sector lockout. FINDBAD performs a read of every sector of the CP/M drive letter you specify, logging all errors encountered during the process. After the specified drive is fully checked, all of the bad sectors are assigned to a single file, called [UNUSED].BAD (in user area 15). Once the defects are grouped into this special file, no attempt to read or write to those areas of the drive will be made (unless you erase the [UNUSED].BAD file).

Operation

Before you can use FINDBAD, your hard disk must be formatted (see HFORMAT), and your system initialized (see HINIT). You must run FINDBAD once for each drive letter you will be using, even if several drive letters represent CP/M partitions on the same drive.

To run FINDBAD, you simply type the program's name along with the CP/M drive partition letter, followed by a colon. For example, to run FINDBAD on drive letter F, enter the following command from the CP/M command line:

```
A0>FINDBAD F:<RETURN>
```

The program will display status messages indicating its progress, and the locations (if any) at which bad disk sectors are found.

NOTE

The file created, [UNUSED].BAD, is placed in user area 15 by FINDBAD. It must be left as is. To protect it, you can use the following STAT.COM command:

```
A0>STAT [UNUSED].BAD $R/O<RETURN>
```

You can also run FINDBAD on a drive which is not empty, if you suspect that it contains bad sectors. In this case, files already on the drive will not be harmed, and the resulting [UNUSED].BAD file will collect all blocks containing bad sectors at that time.

HINIT

(Version 1)

Description

This utility performs disk controller initialization and CP/M BIOS installation for use of hard disk drives and SCSI hard disk controllers. When your system boots (on power-up or reset), a number of BIOS parameters must be set prior to access of the hard disk drives. Also, some hard disk controllers require initialization before use. HINIT provides the facility for performing these operations. HINIT has two modes of use: Menu Mode, and Command Line Mode.

HINIT provides controller initialization for only one type of hard disk controller, the Xebec 1410 (or 1410A). Most SCSI hard disk controllers currently being manufactured do not require initialization. These self-initializing controllers are referred to as "SCSI Generic." They automatically initialize themselves on powerup from parameters which they write to a reserved area on the hard disk drive when they format the drive. Controllers known to be SCSI Generic are: Adaptec, Shugart, Xebec OWL.

IMPORTANT

Since SCSI Generic controllers depend on initialization information which they write to the disk drives during format, your drives must be formatted first, before you attempt to use HINIT.

The AMPRO Version 3 BIOS classifies SCSI Generic controllers in two ways: those which can support burst data transfer over SCSI, and those which require byte-by-byte handshaking. HINIT prompts you to select either "burst-mode" or "byte-mode" for SCSI Generic controllers. As implemented, burst mode controllers provide a 10-20 percent speed advantage over byte mode controllers. The Adaptec AOB4000 can be used in burst mode, while the Shugart 1610-4 requires byte mode. These designations are specific to the AMPRO application, and are not standard terms, so you won't find this information in your SCSI controller's technical manual. It is recommended that you use any unlisted controller in byte mode, until you thoroughly exercise the system with the burst-mode specified.

Menu Mode Operation

To invoke HINIT's interactive menu mode, simply type the program's name from the CP/M command line:

```
A0>HINIT<RETURN>
```

HINIT will prompt you for all required information. The initial prompt asks:

```
Do you want to clear the existing hard disk assignments (Y/N)?   
```

This provides the option of doing all desired initialization in one run of HINIT, or using HINIT several times to initialize multiple drives or

controllers.

HINIT next displays its main menu:

Options available:

- (D) Define the Current Drive
- (A) Add a partition to the Current Drive

(ESC) Exit the program

What next (D/A/ESC)?

The steps you will perform are:

Defining the "Current Drive" - use the "D" option, to define a new "current drive." HINIT will prompt you for the controller's SCSI ID and type, and the drive's logical unit number (LUN), as jumpered on the drive. A single disk drive may contain more than one CP/M drive letter partition, as specified in the next step.

Since the Xebec 1410 and 1410A controllers require power-up initialization, when you specify one of those controllers you will be prompted to supply the same drive-related information required by HFORMAT, namely: number of cylinders, number of heads, RWC cylinder, WFC cylinder, and drive step rate. (See HFORMAT for more information.)

Defining CP/M partitions on the drive - after you define the current drive, HINIT will return you to the main menu options (D/A/ESC). Use the "A" option to define the CP/M drive sub-partitions to be built on the current drive. HINIT will prompt you for a CP/M partition letter (starting from F) and a partition size. The drive partition size, entered in Kbytes, can be anything from 1 to 8192 (Kbytes). (A Kbyte is 1,024 bytes.)

A drive partition can be thought of as a "logical" disk drive, and has its own drive letter (F, G, H, etc., up to P). A single disk drive may have as many CP/M partitions as you wish. However, there are only 11 available partitions, so use them wisely!

After each additional CP/M partition you specify, HINIT will return to its main menu, asking you if you wish to define an additional CP/M partition on the same ("current") disk drive, define a new (additional) "current" disk drive, or exit to CP/M. When you are finished specifying all the required drives and partitions, use the ESC option to exit HINIT.

NOTE

Each time you specify a CP/M drive partition size, HINIT will indicate how much BIOS buffer space remains. If you run out of space, you will need to use the AMPRO ZMOVCPM utility to make a smaller size CP/M system. If you plan to install an alternate ZCFR3 configuration requiring additional BIOS buffer space (1K, 2K, etc.), be sure HINIT indicates sufficient buffer space

remains for your requirement after the highest letter CP/M drive partition is specified.

The total formatted capacity of a given drive depends on the controller to which it is connected. Assuming the controller you are using reserves one cylinder for its own use, you can calculate the available space on each hard disk drive from the number of cylinders (CYLS), the number of heads (HDS), and the number of 512 byte sectors your controller writes on each cylinder (SECTORS), as follows:

$$\text{FORMATTED CAPACITY} = [\text{CYLS}-1] \times \text{HDS} \times \text{SECTORS} \times .5$$

The value you use for SECTORS depends on the particular controller, and, in the case of Adaptec controllers, on the interleave you specified when you used HFORMAT to format the drive. Typical values are:

Adaptec ACB4000:	18	(with interleaves of 2 or more)
Adaptec ACB4000:	17	(with interleave of 1)
XEBEC 1410, 1410A:	17	(all interleaves)
Shugart 1610-4:	17	(all interleaves)

After you run HINIT in its Menu mode, try the ZCPR3 DIR program (Chapter 5) on each CP/M partition you have created. The DIR program will show the space allocated to each CP/M partition. The number of Kbytes of space should be 32K smaller than what you specified in HINIT, due to directory space requirements. After you have established that all CP/M partitions are as you wish, run the Public Domain FINDBAD program to remove any bad sectors from usable disk space. FINDBAD will also let you know if you have attempted to use more capacity than your drive actually has.

Command Line Mode Operation

HINIT would not be a very useful program if you had to manually enter all required information every time you booted your system. However, thanks to HINIT's Command Line mode, you can create a ZCPR3 ALIAS to initialize your system for you.

To create an automatic initialization ALIAS, first run HINIT in its Menu mode, and keep a careful record of all of your keystrokes. After checking to see that everything has been initialized to your satisfaction, create an ALIAS containing a command line containing:

HINIT {parameters}

where the parameters are characters representing the precise sequence of keystrokes you used when you used HINIT in its Menu mode, with the following exceptions: substitute a comma for the <RETURN> key, and a period for the <ESC> key. Be sure to end with a period, corresponding to the <ESC> used to exit HINIT back to CP/M.

Here is a sample HINIT command line:

```
HINIT YD010 AF5000,AG5000,.
```

It does the following:

```
Y      clear any previous initialization
D      indicates a new "current drive"
0      controller SCSI ID is 0
1      controller type is SCSI burst-mode generic
0      drive logical unit number (LUN) is 0
       (space has no effect; used for clarity)
A      additional CP/M partition on the same drive
F      selects CP/M partition letter F
5000   size of CP/M partition F is 5,000K bytes
,      represents <RETURN>
       (space has no effect; used for clarity)
A      additional CP/M partition on the same drive
G      selects CP/M partition letter G
5000   size of CP/M partition G is 5,000K bytes
,      represents <RETURN>
.      represents <ESC>
```

Spaces can be used in the command line for ease of understanding; they have no effect. Both CP/M partitions defined in this example are on the same physical drive. If the two 5 MB partitions were on separate drives (e.g. LUN0 and LUN1 on the same controller), the command line would have been:

```
HINIT YD010 AF5000,D011 AG5000,.
```

HPARK

(Version 1)

Description

The HPARK utility moves the read/write head(s) of one or more hard disk drives to a predefined safety zone on the disk surface, to guard against accidental data loss due to either power on/off glitches in the drive electronics or media damage due to mechanical shock. You should always use HPARK to "park" your drives' heads prior to switching off AC power. After HPARK finishes positioning the disk heads it halts all system operation; the only recovery from system lockup after HPARK is by means of a system reset.

Menu Mode Operation

To use HPARK in its interactive "menu" mode, type the program's name from the CP/M command line:

```
A0>HPARK<RETURN>
```

For each drive you wish to park, you will be prompted the following information:

- (1) SCSI ID of the controller to which the drive is connected (0-7)
- (2) Drive Logical Unit Number (0, 1, 2, or 3)
- (3) Controller type, if listed
- (4) Block number location for head positioning. This step is skipped if your controller type is "listed" (Step 3). If your controller is unlisted, then you are prompted for a block number. Calculate the block number as follows:

```
.....  
:  
: block number = [cylinders X sectors/track X heads] - 1 :  
:.....
```

Where

cylinders = the number of cylinders on the drive; or the special parking zone cylinder number, if the drive provides one

sectors/track = the number of 512 byte sectors the controller formats per track. This depends on the controller. For example...
Xebec: 17; Adaptec: 18 for interleaves of 2 or greater, but 17 for an interleave of 1; Shugart: 17.

heads = the number of heads on the drive

NOTE

The Xebec 1410/1410A controllers do not allow HPARK to seek beyond the last cylinder number defined by the HINIT utility. One way to get around this is to define one more cylinder in your HINIT alias than you are actually using in your CP/M drive partitions. Then use this extra cylinder as your parking cylinder.

Command Line Mode Operation

Once you have tested HPARK on your drives using the program's menu mode of operation, you will probably want to create a ZCPR3 alias to park your drives, in the same way you use an alias to perform the powerup initialization of your hard disk system (see HINIT).

HPARK allows you to specify everything directly from the command line, or from within an alias. The general form of the command line mode usage is:

```
AO>HPARK {parameters}
```

As with HINIT, the "parameters" in the command line consist of the keystrokes you use in HPARK's menu mode, except that you substitute a comma for the <RETURN> key. End the parameters with a period.

Use the ZCPR3 ALIAS program to create a command file containing the HPARK command line required to park your system's drives. Here are some examples:

This HPARK command line is for a pair of Miniscribe 3012 drives connected as logical units 0 and 1 on a Xebec controller with SCSI ID 0:

```
HPARK 00#20B07,01#20B07,.
```

Here is one for the same pair of drives connected to an Adaptec ACB4000:

```
HPARK 00A,01A,.
```

The ACB4000 is listed in HPARK's controller type list, so the letter "A" takes the place of the block number.

LITTLE BOARD/PLUS SCSI BOOT EPROM

November 1, 1985

A. Introduction

The AMPRO SCSI/PLUS bus interface represents a significant advance in single-board-computer architecture, by providing a general purpose, high performance, interprocessor data channel. The most obvious use of the SCSI/PLUS bus interface is for the addition of SCSI (SASI) hard disk controllers and drives. However, this is not the only use for the SCSI/PLUS bus.

B. Boot Algorithm

In order to provide a general purpose "hook" for a variety of SCSI/PLUS applications, the Little Board/PLUS SCSI BOOT EPROM allows the board to "boot" directly from SCSI, without the need for an attached floppy disk drive. Here is what the new SCSI BOOT EPROM does when the board is RESET:

- (1) Checks for the presence of a bootable floppy. If one is present, it attempts to boot from the floppy. If this fails...
- (2) Reads its SCSI ID (0-8) from the ID Input Register, and either:
 - (3) If the board's ID is 7, performs an SCSI bus reset and then attempts to boot from SCSI device ID 0. If this fails, return to step (1).
 - or -
 - (3) If the board's ID is not 7, does not perform an SCSI bus reset. Attempts to boot from SCSI device ID 7. If this fails, return to step (1).

This boot algorithm provides a means to easily establish a master/slave hierarchy, where the device which is jumpered to ID 7 is the system master. It must be responsible to provide the bootstrap software for all devices which are jumpered to addresses other than 7. This process is very straight forward; the bus master simply emulates an SCSI hard disk controller as far as the slave processor is concerned.

C. Installation of Hard Disk Autoboot

In keeping with the general "philosophy" of SCSI, the SCSI BOOT EPROM does not make any assumptions about the type of disk controller it is booting from, nor about any characteristics of the hard disk drive (i.e., tracks, heads, step rate, etc.). For this reason, automatic booting from a hard disk can only be done when using SCSI controllers which initialize themselves automatically on power-up.

Of the controllers supported by the AMPRO Hard Disk Software, the following may be used for automatic hard disk booting:

Adaptec ADB-4000 and ADB-5000 series
Shugart 1610-A controller

The Xebec 1410 and 1410A, and the DTC 510A and 510B are not self-initializing. These controllers require the addition of installation-specific commands in either the SCSI BOOT EPROM or the boot strap loader (contained in the HGEN utility), in order to initialize the controller prior to drive access. Hooks have been provided in the SCSI BOOT EPROM code for this use.

Here is how to prepare a Little Board-based system for automatic booting from a hard disk. Replace your old BOOT EPROM with the new SCSI BOOT EPROM, and then perform the following steps:

(1) Hardware Setup: Install your system's hardware as described in Chapter 2 of the AMPRO Z80 Hard Disk Software User's Manual. In addition, for hard disk autoboot, SCSI ID's should be set as follows:

- o Initiator ID Jumpering: The Little Board/PLUS is the SCSI "Initiator." Jumper it to SCSI ID 7, as shown in Little Board/PLUS technical manual.
- o Target ID Jumpering: The SCSI disk controller is the SCSI "Target." Jumper the controller to be booted from as SCSI ID 0, according to the controller's installation manual. Also, the drive to be booted from must be connected as Logical Unit Number (LUN) 0.

(2) Initial Software Setup: Install and test the standard AMPRO Z80 Hard Disk software and hardware as described in Chapter 2 of the Hard Disk Software User's Manual. This includes:

- o Running HFORMAT, to format the drive.
- o Running HINIT, to initialize your system's BIOS.
- o Running SYSGEN, to write the operating system to the first hard disk partition. This is "F" prior to running SWAP.
- o Running SWAP, to re-assign drive letters the way that you want them. Be sure you have assigned drive letters so that the first hard disk partition is now drive "A."

(3) Final Software Installation: This is the easy part. All you have to do now is run the AMPRO HGEN utility, and respond to the program's prompt with a "y." That's all there is to it! Remove your floppy diskettes from your system, and press RESET. After a brief delay (5 to 10 seconds) to allow for floppy timeout, your system should boot directly from your hard disk.

HGEN

(Version 1)

Description

This utility modifies the system tracks on your hard drive to perform disk controller initialization and CP/M BIOS installation to support automatic booting from the hard disk drive. When your system boots (on power-up or reset), a number of BIOS parameters must be set prior to access of the hard disk drives. Also, some hard disk controllers require initialization before use. HGEN provides the facility for installing these routines on the system tracks.

HGEN provides controller initialization on reset for two types of hard disk controllers, the Xebec 1410(A), and the DTC 510(A/B). Most SCSI hard disk controllers currently being manufactured do not require initialization. These self-initializing controllers are referred to as "SCSI Generic." They automatically initialize themselves on powerup from parameters which they write to a reserved area on the hard disk when they format the drive. Controllers known to be SCSI Generic are: Adaptec, Shugart, and Xebec QWL.

HGEN provides a similar initialization mechanism for non SCSI Generic controllers. Most controllers initialize themselves to a specific default drive type. For instance, the DTC 500 series default to an ST-506 type drive, with 4 heads and 153 tracks. This default initialization is sufficient to allow reading in the boot sector and system tracks from the hard disk. Since the system tracks occupy 32 sectors, they will be completely contained on the first platter of cylinder 0. This means that it is not necessary to move the heads off cylinder 0 in order to read the system tracks on any hard drive that is formatted with at least 16 512 byte sectors per track. Once the system tracks have been read, the controller is initialized with the correct number of heads and cylinders for your hard disk.

Before running HGEN, you must have first meet the following requirements:

.1mb
.pm6

- o your SCSI boot EPROM must be version 1.3 or higher
- o the Little Board SCSI address must be set to 7
- o the hard drive SCSI controller address must be set to 0
- o the hard drive addressed as LUN 0 on this controller must have been formatted
- o the systems tracks on the hard drive must have been SYSGENed from your Hard Drive System Master floppy disk
- o HINIT must have been run to initialize the controller, and at least one CP/M partition must have been defined
- o SWAP must have been run to make the first hard drive partition drive A.

.1m8

.pm8

HGEN will only initialize the hard drive addressed as LUN 0 on the hard drive controller at SCSI address 0. All other controllers and hard drives should be initialized using HINIT after bootup.

Operation

To invoke HGEN's interactive menu mode, simply type the program's name from the CP/M command line:

```
AO>HGEN<RETURN>
```

HGEN will prompt you for all required information. The initial prompt asks:

```
Are you sure you want to continue (Y/N)? __
```

Answer Y to this prompt if you want to install the automatic boot up changes on the hard drive.

Next, you will be prompted for the hard drive controller type. HGEN supports the following SCSI controllers:

.1m8

.pm8

- o Generic SCSI burst mode controllers
- o Generic SCSI byte mode controllers
- o Xebec 1410(A)
- o DTC 500 series

.pm8

If your controller is a generic SCSI type, HGEN will go ahead and make the changes to the system track and inform you that you can now boot directly from the hard drive. For the Xebec and DTC controllers, you will be prompted for the drive characteristics of the drive addressed as LUN 0. This information is the same drive-related information required by HFORMAT and HINIT, namely: number of cylinders, number of heads, RWC cylinder, WPC cylinder, and drive step rate.

HGEN will complete the changes to the system track momentarily. Once it finishes, park the heads of the drive, press RESET, and after the floppy drive times out, your system will boot directly from the hard disk.

This library contains new versions of HGEN and SCSIBOOT. HGEN has been extended to install SCSI controller initialization in the hard drive boot sector. This allows automatic booting from non generic SCSI controllers, such as the Xebec 1410(A) and the DTC 510(A/B), as well as generic SCSI controllers.

HGEN V1.3 will not function with the V1.2 SCSI boot EPROM. A bug in the SCSI routines in the boot EPROM that prevented the SETPRAM routine from functioning has been corrected in the V1.3 EPROM.

Much of the new material in HGEN was lifted from HINIT. The corrections to the SCSI routines in the boot EPROM were taken from the V3.8 BIOS source. All source listings are copyrighted material of Ampro, Inc., and could not be included in the library for general distribution. They are available on Ampro's BBS at (408)734-2980 in the LBZ80-SOURCE section for licencees of Ampro's source code.

These programs have been tested in a Little Board/Plus, using a DTC-510B controller, connected to an IMI 5018 drive. SCSI Generic controllers should experience no problems with these new files, as they do not require specific initialization. The Xebec 1410(A) should work (based on the comments by John Lin in 1410BOOT.TXT), but has not been tested.

Files in this library

-READ.ME - this file
HG-1-3.COM - HGEN 1.3 executable file
HG-1.3.DOC - HGEN 1.3 documentation file
SBT-1-3.HEX - SCSIBOOT 1.3 Intel HEX format file
HG-1-3.ROM - SCSIBOOT 1.3 binary image file

November 3, 1988

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AMPRO BIOS UPDATE PROCEDURE

November 1, 1985

A. Introduction

When you update your system from either a BIOS binary or "hex" file, you first use the AMPRO ZMOVCPM (or MOVCPM) utility to first a system image file of the desired system "size." Then you use the CP/M DDT utility to merge the appropriate BIOS update file with your system image file.

AMPRO BIOS update files are currently distributed as binary files. BIOS update files can also be distributed in "HEX" format. The two (binary and HEX) methods are equivalent; we have switched to using the binary file scheme, since the required files are smaller, and the update procedure is easier. The two procedures below cover both cases.

Before you start, decide what "size" system you will require. The standard distribution system, based on the Version 3 AMPRO BIOS, is a "60K" system. This is a floppy-only configuration, with a minimum set of ZCPR3 functions. You can tell what system size you are currently using by observing the system signon message when you first "boot" your system.

If you are plan to install hard disk support, or extended ZCPR3 features, you will require a smaller system size than 60K, to make more operating system space available for these additional features. Consult the hard disk or extended ZCPR3 software documentation to determine what system size will be required.

The BIOS update files have names of the form: nnBIOSmm.HEX, or nnBIOSmm.BIN. The first of these represents a BIOS "HEX" file of AMPRO BIOS Version "nn" and system size "mm" Kbytes, while the second is a BIOS binary file of the same version and system size. For example, "34BIOS58.BIN" contains BIOS Version 3.4 and can be used to update a "58K" system.

Assuming you know what system size you require (60K, 59K, etc.), use one of the following two procedures to update your operating system with a new BIOS version. In both procedures, the example given assumes BIOS Version 3.4 and system size of 60K.

B. Updating your Operating System from a BIOS Binary File

1. Place a copy of 34BIOS60.BIN" on your system disk.
2. Create a system image ("OLDSYS.BIN") of your old system as follows:

```
AO>ZMOVCPM 60 *(RETURN)

CONSTRUCTING 58K CP/M vers 2.2
READY FOR "SYSGEN" OR
"SAVE 41 CPM60.COM"

AO>SAVE 49 OLDSYS.BIN(RETURN)
```

(It's always OK to save 49 pages.)

```

AO> DDT OLDSYS.BIN
DDT VERS 2.2
NEXT      PC
2A00      0100
-I34BIOS60.BIN
-R1E80
NEXT      PC
2A00      EE00
-GO

```

```
AO>SAVE 49 NEWSYS.BIN
```

(NOTE: the read offset of 1E80 is the same for all system)
(sizes, when a BIOS binary file is used.)

4. Finally, install the new system on a (formatted) diskette as follows:

```
AO>SYSGEN NEWSYS.BIN
Destination Drive? (A, B, C, or D) __
```

Then specify a desired destination diskette.

C. Updating your Operating System from a BIOS HEX File

1. Place a copy of "34BIOS60.HEX" on your system disk.
2. Create a system image ("OLDSYS.BIN") of your old system as follows:

```
AO>ZMOVCPM 60 *(RETURN)

CONSTRUCTING 58K CP/M vers 2.2
READY FOR "SYSGEN" OR
"SAVE 41 CPM60.COM"

AO>SAVE 49 OLDSYS.BIN<RETURN>
```

(It's always OK to save 49 pages.)

3. Now create a new system image file (NEWSYS.BIN) as follows:

```
AO> DDT OLDSYS.BIN
DDT VERS 2.2
NEXT      PC
2A00      0100
-I34BIOS60.HEX
-R3580
NEXT      PC
2A00      EE00
-GO

```

```
AO>SAVE 49 NEWSYS.BIN
```

(NOTE: the read offset of 3580 is based on a "60K system")
(which is standard for BIOS versions 3.x -- for other size)
(systems, different offsets are required, as follows:)

MSIZE equate value (K)	offset amount (H)
61	3180
60	3580
59	3980
58	3D80

(57	4180)
(55	4580)

4. Finally, install the new system on a (formatted) diskette as follows:

```
AO>SYSGEN NEWSYS.BIN
Destination Drive? (A, B, C, or D)___
```

Then specify a desired destination diskette.