SA series
Professional SCSI Host Adaptor
with Bernoulli Utilities

User's Manual

Preliminary
V 0.9F

Copyright

NOTE

This equipment generates and uses radio frequency energy and if not installed and used properly, that is, in strict accordance with the manufacturer's instructions, may cause interference to radio and television reception. It has been type tested and found to comply with the limits for a Class A computing device in accordance with the specifications of Part 15 Subject J, of FCC Rules, which are designed to provide reasonable protection against such interference. However, there is no guarantee that interference will not occur in a particular installation.

If this equipment does cause interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to correct the interference by one or more of the following measures:

- re-orient the receiving antenna
- relocate the computer with respect to the receiver
- plug the computer into a different outlet so that computer and receiver are on different branch circuits.

If necessary, the user should consult the dealer or an experienced radio/television technician for additional suggestions. The user may find the following booklet prepared by the Federal Communication Commission helpful:

"How To Identify and Resolve Radio-TV Interference Problems".

This booklet is available from the US Government Office, Washington, DC, 20402, Stock No. 004-000-00345-4.

Preface

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Introduction

The Comspec Hard Drive family of products provides fast access to massive storage space for your Commodore-Amiga computer. The increased speed to your documents and applications is achieved through the Small Computer System Interface (SCSI). Many types of devices may be connected to the SCSI bus, such as fixed or removable hard drives, tape streamers, optical disks, laser printers and image scanners. SCSI is the common element between the SA series SCSI Host Adaptors, and your hard drive or Bernoulli. This allows the software interface to be identical for the entire product family. The Comspec Hard Drive System gives you the power to use your Amiga more efficiently and provides increased storage capacity over floppy disks.

About this manual

This manual describes in detail the SA500, SA1000, and SA2000 SCSI Host Adaptors for the Amiga A500, A1000 and A2000 respectively. In this manual we will be referring to these products and their hard drives as "hard drive system".

The first section of this manual describes unpacking and caring for your hard drive system. The next section details how to use your hard drive system. This is followed by detailing the use of the hard drive management software and utilities. Finally, several appendices are offered to help you overcome any difficulties you might encounter in setting up or using your hard drive system.

There are some important words and concepts that you will come across in reading the manual. We suggest that you have a serious look at the Glossary of terms before you read any further.

Comspec Hard Drive System

Your new Comspec Hard Drive System is an extension to your Amiga computer. The hard drive provides fast storage space for all of your Amiga applications and documents.

Your hard drive uses the Small Computer Systems Interface (SCSI, pronounced "scuzzy"), a standardized cable system and communication protocol that allows you to connect several SCSI devices such as hard drives, tape streamers, large capacity optical disks, printer servers, and more. In the past couple of years the SCSI standard has been adopted by many computer peripheral manufacturers and the market is continuing to flourish.

The SA series SCSI Host Adaptor and its software was not only designed as a hard drive interface, but as a method of allowing the Amiga system to be expanded as the need arises. The open-ended SCSI driver allows new devices to be added easily to the system, and controlling "driver" software can be developed either in house, or by a third party.

The hard disk driver software allows up to ten hard drive units from 10 to over 300 megabytes to be connected to the host adaptor. Larger drives may be connected when available. Each drive may be given any three letter device name, and can be used from either CLI or Workbench, similar to a floppy disk. A hard drive may also be partitioned into several logical units. A maximum of 10 logical/physical units are allowed.

Hard disks are delicate storage devices. Dropping or bumping a hard disk drive can sometimes cause media defects that can render a hard drive virtually useless. With some Amiga hard drive systems, dealing with a media defect requires that the entire drive be partitioned and re-formatted around the defect which is a tedious and time-consuming procedure. The Comspec Hard Drive handles media defects differently. When the hard disk is first formatted, a small portion of the disk is reserved for later use. If a media defect occurs, the hard disk driver software automatically replaces the defective block with a block from the reserved portion of the disk. The media defect is then completely transparent to the user and the Amiga filing system.

A standard feature of the SA1000 SCSI Host adaptor is the battery backed-up clock. This clock keeps track of the time while the Amiga is turned off, and automatically sets the Amiga clock when the Amiga is turned back on.

The SA series SCSI Host Adaptors use an intelligent controller chip that handles most of the tasks related to the SCSI bus, leaving the Amiga CPU free for other duties. This means that other programs running on the Amiga are not slowed down while the hard drive is seeking for data.

The SD series Hard Drive Chassis can hold two 5-1/4" half-height drives or one 5-1/4" full height drive.

The SSD series Hard Drive Chassis can hold one 5-1/4" half-height drive and one 3-1/2" half-height drive.

Unpacking your hard drive system

Besides the SA series SCSI Host Adaptor your package should contain the following:

- 1 Warranty registration card
- 1 Amiga floppy disk
  SA500/SA1000/SA2000 Utilities Disk
- ✓ 1 Manual
  SA series SCSI Host Adaptor User's Manual

If any of these items are missing, contact your dealer immediately.

Caring for your hard drive and accessories

During operation, the hard drive must stand upright and in a well ventilated area. Do not under any circumstances, place the hard drive on it's side, jar or move it while it is in use. Also, never place the hard drive near any source of heat (i.e., direct sun light, heaters, or heat generating equipment), magnetic fields (i.e., speakers, or telephones), or radio emissions, as these may damage your files. As with any computer hardware, make sure the computer and hard drive are switched off when you connect or disconnect them.

Connecting the SA series SCSI Host Adaptor

The SA series SCSI Host Adaptor plugs directly into the expansion port of your Amiga computer.

Amiga 500

On the Amiga 500 computer the expansion port is located on the left hand side of the machine, and a cover must be removed. Slip the SCSI Host Adaptor into this port.

Amiga 1000

On the Amiga 1000 computer the expansion port is located on the right hand side of the machine, and a cover must be removed. Slip the SCSI Host Adaptor into this port and replace the cover you removed on the new expansion pass-thru.

Amiga 2000

The Amiga 2000 expansion port is located inside the computer. It is necessary to remove the cover of the computer for access to these ports. Slide the SCSI Host Adaptor into one of the empty AMIGA slots.

Connecting the SD/SSD series Hard Drive Chassis

Having already connected the SCSI Host Adaptor to your Amiga computer you must now connect the Hard Drive Chassis. Insuring that power is still off, connect the SCSI cable coming from the adaptor to the rear of the Hard Drive Chassis. There are two SCSI ports on the rear of the chassis, use the rightmost port when looking from the rear of the chassis.

The SCSI cable system

The SCSI system uses special cables to achieve fast communication between the Amiga and peripheral devices. To function properly, the combined length of the entire cable system must not exceed 6 metres (19.5 feet).

1. Always make SCSI connections firm, tightening the screws which hold the parts together. Most apparent hard drive problems are connection problems along the SCSI cables.

2. When connecting or disconnecting the SCSI system, make sure all devices have been switched off.

Connecting power to your Comspec Hard Drive System

The Comspec Hard Drive Chassis must be plugged into a grounded AC outlet using the cord provided. Do NOT defeat the safety of the three-prong plug. If yours is not a grounding-type AC outlet, have a licensed electrician replace the socket.

Any electrical equipment may be hazardous if misused. Take standard precautions when plugging in and unplugging the hard drive.

Switching your hard drive on and off

Switching On

Always switch on your hard drive before or at the same time as the Amiga. If the Amiga is switched on before the hard drive is ready, the system may not start up immediately.

Switching Off

You should always wait until all disk activity stops and the DOS activity light on the SCSI Host Adaptor has gone out before switching your hard drive off. If you are going to transport your hard drive see "Parking the hard drive heads".

Determining the AUTOBOOT volume

The AUTOBOOT volume is the partition that contains the AmigaDOS files necessary to start up your Amiga.

There are several files that are needed to make the hard drive operational. These files may be found in two directories on the Utilities disk supplied with the SA series adaptor. The first two files that are of importance are located in the **devs** directory, and are called **ComspecHD.device** and **ComspecSCSI.device**. The next file is in the **Expansion** drawer and is called **InstallHD**. You may copy these files onto your own custom floppy if you wish, but they must be in the appropriate directory or drawer.

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If your hardware has been connected properly, booting from the hard drive is simple. Set the switch on the SCSI Host Adaptor to Autoboot by moving it to the left position when facing the front of the Amiga. Now turn on the hard drive and then the computer.

The Amiga's power LED will flash as normal, then the screen will turn blue. The screen display will shift through various shades of blue as the hard drive comes up to speed. On the Amiga 1000 the display should then turn yellow while Kickstart is being read in. The screen will then turn green, indicating that Kickstart has been read in correctly.

The screen will turn grey as AmigaDOS starts up, then you will see the usual Workbench screen. At this point, the boot process has completed.

If there are any problems, the screen will flash red. The number of flashes is important -- it provides an error number that will help to correct the problem. If your screen flashes red, count the number of flashes, and consult the troubleshooting section of the manual.

Your Amiga is functionally identical to a machine that has been booted in the regular fashion, so that any (unprotected or copyable) application that runs from floppy will run from the hard drive. You may, however, have problems with applications that look specifically for drive *DF0:* when starting up, or those that do not provide a *DH0:* requestor option for loading data files. If you have a program that is not usable from the hard drive, we suggest that you contact your software dealer or the manufacturer of the software product to ask for suggestions or an updated version that does support a hard drive.

After Autoboot, the system directories (devs:, libs:, etc.) will be automatically assigned to the hard drive, which replaces DF0: as the *SYStem* disk. You should copy all the applications and utilities that you use regularly to your hard drive, and might also change the *s:Startup-Sequence* file. Remember that the Startup-Sequence MUST contain the AmigaDOS command **BindDrivers**, preferably as the first command, to ensure that the hard drive and other expansion devices are set up properly.

Using the hard drive without Autoboot

Manual boot is useful if you want to boot from a specific Workbench floppy, or use a version of Kickstart other than 1.3. Manual boot is also necessary if the Autoboot information on the hard disk has been lost. To create your own customized Workbench that boots the hard drive system see Appendix A, *Modifying an existing Workbench disk.*

If you wish to boot from a floppy rather than the hard drive you must first enable Manual boot by moving the switch on the back of the SCSI Host Adaptor to the right position when facing the front of the Amiga. Insert Kickstart and Workbench as requested, using the **SA500/SA1000/SA2000 Utilities** disk as Workbench. The hard drive will automatically be installed and the system time will be set.

Copying software to your hard drive

While working on the Amiga Workbench, you can copy files and drawers to the hard drive by dragging the file icons onto the hard drive icon or into a hard drive window - as with an Amiga floppy. You may also use the CLI *Copy* command for copying to the hard drive device.

Never copy another Workbench disk onto your hard drive unless you are replacing the original one. Some applications come with Workbench files on them. Copy only the files necessary for the application to run.

Using drawers to organize your hard drive

The Amiga and the hard drive use AmigaDOS to store files in distinct storage areas called drawers. AmigaDOS slows down when it has to keep track of a large number of files. Using drawers reduces the number of items on the Workbench and speeds up AmigaDOS.

You can use as many drawers as you like. To create a drawer, select the **Empty** drawer and choose **Duplicate** from the **Workbench** menu. You can put drawers inside drawers to organize your files further. Name your drawers by clicking on them once and choosing **Rename** from the **Workbench** menu.

Using copy-protected applications

Many applications are copy-protected in one form or another. Some copy-protected applications can be copied onto the hard drive. Some may ask you to insert a master. After you have inserted the requested disk the computer will use the version stored on the hard drive with the increased speed of the hard drive.

Some applications use sophisticated copy protection that will not allow the application to be copied at all. Ask your dealer or the software publisher about the possibility of copying these applications onto your hard drive.

Many applications will require special assignments to be made in the *s:Startup-Sequence* of your boot disk before they will work correctly. Some examples of how an assignment for an application can be done are shown below:

Assign	DPaint:	DH0:Dpaint	•	for Electronic Arts' *Deluxe Paint II*
Assign	PPage:	DH0:ProPage	•	for Gold Disk's *Professional Page*
Assign	PPageUtil:	DH0:ProPage		
Assign	STG0:	DH0:Stooges	•	for Cinemaware's *The Three Stooges*
Assign	STG1:	DH0:Stooges		

Opening and saving files in an application

While you are using an application, you can open files from different devices without leaving the application. Choose **Open** or **Load** from the **Project** menu and click on the **Drive** button until the name of the volume with the file you want appears, or type in the device name in the **Drawer** requestor. The list in the file requestor box will display the files and drawers on the disk that can be opened.

To save files directly to any volume while working in an application, choose the **Save As** option from the **Project** menu. In the Save As requestor box, you can click the **Drive** button to move from one volume to another or you can type the device name or volume name into the **Drawer** requestor. When the name of your hard drive appears, give the file a name then click on the **Save** button.

Changing your hard drive volume name

You can name your hard drive to suit your needs. When the hard drive icon is on the Workbench, click on it once and select **Rename** from the **Workbench** menu. The name can be a maximum of 30 characters and cannot contain a colon (:) or a slash (/) because these characters are used for other functions by AmigaDOS.

Backing up your hard drive

You can backup the hard drive to Bernoulli cartridges , floppy disks, tape cartridges, or another hard drive. Bernoullis, floppies and tapes are more reliable since they can be easily stored away from the computer until they are needed.

Backup your files regularly, so you will have spare copies if your data is accidentally erased or if your hard drive is damaged. To make backups of your hard drive files to floppy you may use the AmigaDOS *Copy* command. These disks must already be pre-formatted using the **Initialize** option in the **Disk** menu.

There are several public domain and share-ware hard drive backup utilities that you may use to backup your hard drive such as *SDBackup* written by Steve Drew.

There are also commercially available hard drive backup utilities. An example of one is *Quarterback* from Central Coast Software.

System Management Utilities

- Using the SetUpHD Utility
- Using the SetClock Utility
- Using the ParkDrives Utility
- Using the AddDriveTypes Utility

The SetUpHD Utility

The **SetUpHD** Utility is designed to manage the Comspec Hard Drive System. It has the following functions:

- verify SCSI communication with the hard drive
- low level format of the hard drive
- installing the hard drive
- parking the hard drive heads
- checking for media defects
- adding additional drives
- partitioning drives

Screen Gadgets

When you open the SetUpHD utility, a screen with several *gadgets* will appear that show the current configuration of your hard drive. If the SetUpHD utility fails to read the *Unit Info Configuration* file, the default settings for a single 20 megabyte Seagate ST225N are used.

As you use the SetUpHD utility, you may notice the screen flash. SetUpHD is letting you know that an error has been made, or that a value in a gadget has been changed. The title bar located at the top of the screen will display various messages.

UNIT INFO TABLE

The *Unit Info Table* is located at the lower right of the screen. The table has room for ten units allowing you to have up to ten physical and/or logical drives. Each unit has a **DOS NAME** such as DH0, DH1, ARC, etc.. The **STATUS** column will show if the unit is **ENABLED** or **DISABLED.** The settings of the unit marked ***ACTIVE*** are displayed in the gadgets located in the upper partition of the screen. You select the unit you wish to set up by clicking on the unit number.

FILE SYSTEM

The FILE SYSTEM must be set to REG for the Autoboot Volume. This field alternates between REG and FFS each time its box is clicked in. If you are using Workbench V1.3, you may wish to make an entire non boot partition a Fast File System(FFS) drive.

DOS NAME

Click in the DOS NAME gadget to enter a three character name for the drive unit. The Autoboot Volume's name must end in a zero (0).

DRIVE TYPE

Select the correct drive type by clicking in the DRIVE TYPE

DESCRIPTIONS table. The number in the Drive Type gadget and the LOW CYL and UPR CYL will be set automatically.

SCSI CONT ID** and **SCSI LUN

The **SCSI Con**troller **ID**entification and **SCSI** Logical **U**nit **N**umber must be set to correspond with the CONT ID and LUN of the SCSI drive being connected. The Autoboot drive must have both these numbers set to zero. These values increment by one each time their box is clicked in.

BOOTABLE DRIVE

Click in the YES box if you wish to make the ***ACTIVE*** drive bootable. Making a drive bootable reserves a small portion of the drive for Kickstart and for the Unit Info File. Only the first partition of a partitioned drive may be bootable. Due to limitations in 1.3, FFS partitions are NOT bootable.

The only drive that can actually be booted from is unit 0, with SCSI Cont ID = 0 and SCSI LUN = 0. However, if you have two hard drives you may wish to mark the second drive as bootable so that in the future it may be booted from without requiring an AmigaDOS format. You will only need to change the SCSI Cont ID and SCSI LUN of your second drive to zero, and choose Non-Destructive Install from the Install Drives Menu.

UNIT ENABLED

Click in the YES box to enable the unit. All enabled units will automatically be installed next time you start your system.

LOW CYL** and **UPR CYL

The **LOW**er **CYL**inder and **UP**pe**R CYL**inder numbers will automatically be set when the Drive Type is selected. These numbers may be changed to partition a physical drive into two or more logical units. See *Partitioning a hard drive.*

The SetUpHD Menus

The SetUpHD Utility has two menus: Install Drives, and Utilities. These are described below.

As you choose various menus, requestors may appear. Read and reply to these requestors.

The Install Drives Menu

All options in the **Install Drives** menu interact with the boot drive only, (i.e. unit 0).

Format and Install

Choose *Format and Install* to prepare drive unit 0 for use. Your drive's various modes will be set, and the drive will be low level formatted. The drive will then be checked for media defects. Any defects found will be replaced. And finally, the *Unit Info*, Kickstart, and the AmigaDOS boot blocks will be stored on your boot drive.

Before selecting *Format and Install*, verify that all screen gadgets are set correctly.

Note: Format and Install will perform a low level format thereby erasing all your data stored on the drive.

Non-Destructive Install

Choosing Non-Destructive Install will store the Unit Info, Kickstart, and the AmigaDOS boot blocks to your boot drive, without erasing data stored on the drive.

Read Unit Info

Choose **Read Unit Info** to read the configuration file, called *Unit Info*, from the boot drive and to set SetUpHD to these presets.

Write Unit Info

Choose **Write Unit Info** to write the SetUpHD settings to the configuration file, called *Unit Info*, on your boot drive.

The Utilities Menu

Options in the **Utilities** menu allow you to perform various functions on the ***ACTIVE*** unit as selected in the **UNIT INFO TABLE.**

Park Heads

Choosing **Park Heads** parks the heads of the active unit.

See *Using the ParkDrives Utility*, page 4-10, for the importance of parking your hard drive heads. The ParkDrives Utility is a convenient way of parking the heads of all hard drive units.

Check Media

Choose **Check Media** to check for defects in the recording media of the ***ACTIVE*** unit. Each logical block will be checked. If a defect is found, the bad block will be replaced with a block from a set of reserved blocks.

Note: - for a partitioned drive, perform the media check on the unit with the highest UPR CYL number

Format Unit

Choose **Format Unit** to perform a low level format on the active unit. A low-level format is required on most hard drives before the drive can be used to store any information. A low-level format can also be used to "re-evaluate" media defects.

Note: - Do not confuse "low level format" with "AmigaDOS" format. Low level format writes timing and control information to the media, while an AmigaDOS format prepares a drive for storing AmigaDOS files. AmigaDOS format is performed by choosing Initialize from the Workbench Disk Menu, or by the CLI Format command.

If a media error occurs when the hard drive is being used, the block in which the error occurred will be logically replaced by a defect free block. This "re-assigning" of a block will save many hours of formatting, partitioning and re-copying files to your drive, as is required with other hard drive systems available for the Amiga. The only disadvantage to reassigning blocks is that the drive heads will have to jump out to the new location every time you access the defective block. This slow down is only noticeable when a large number of defects have been found. Doing a low-level format with the *ALL DEFECTS* option will cause the drive controller to note newly discovered defects and avoid excessive head movement.

If you find that you are getting a large number of media defects, it will sometimes help to do a low-level format, since the drive heads may just have drifted out of alignment a littie, (usually by dropping or bumping the hard drive). If you have been getting a lot of defects, it might be worth trying the *MFRS DEFECTS* option, which will re-evaluate all defects found after the drive was manufactured. Some of these defects may not be defects at all, but appeared as such because of an alignment problem.

It is a good idea to choose **Check Media** after a low level format. This will verify that the drive is functioning correctly.

Request Sense

Choose **Request Sense** to send a Request Sense command to the ***ACTIVE*** unit. This command requests the drive to report any error message that it may have. It is useful after you have made changes to the SCSI hardware configuration, to find out if your drives are connected properly. What you want to see is *'Unit is ready'* in the title bar of the SetUpHD screen. If you see an error message, consult *Appendix A - Troubleshooting* for a list of error codes.

As a general rule of thumb, you should do a number of *Request Sense* commands until you get *'Unit is ready'*. However, some SCSI drives continue to post an error message until a command other than Request Sense is issued. In this case, try issuing the *Parkheads* command and then issuing the *Request Sense* command.

Mode Select

Choose **Mode Select** just before performing a low level format on a brand new drive to set up various configuration options.

Some controllers, such as the Western Digital, need to have a mode select command sent to them if you change the type of drive that is connected to the controller. In this case, you will have to use the AddDriveTypes utility to set up an appropriate DriveType.

Setting up the hard drive

If your system fails to boot properly, or if you are setting up a new hard drive for the first time, you will need to use the SetUpHD utility to configure your system. Proceed as follows for a simple, single drive system.

Boot manually (see *Determining the AUTOBOOT volume*) using the SA series Utilities V34.804 (or later) disk. Open up the volume by double-clicking on its icon. Open the drawer labeled *HD_Utilities*, and then run **SetUpHD** by double-clicking on its icon.

The SetUpHD screen will appear showing the current configuration of your hard drive system. If the SetUpHD utility failed to read the *Unit Info File*, the default settings are for a single 20 megabyte Seagate ST225N hard drive with the AmigaDOS name *DH0:*.

First select the ***ACTIVE*** drive that you want to modify. Usually this appears first on the list.

If you want a name other than DH0:, select the **DOS NAME** box on the screen and type in your new name. Use the Back Space or DELete key to

remove the name currently in the box. The name must be three characters in length and the Boot Drive, unit zero, **must** end in a zero (0).

If you have a Comspec 40 megabyte hard drive, you should select the Seagate ST251N DriveType from the DriveTypes display. If you have any other type of drive, select the DriveType for that drive, or if there is no DriveType for your particular drive, see *AddDriveTypes* further in this section.

LOW CYL and UPR CYL are set automatically according to the DriveType selected. They may be changed if you wish to partition your drive. See the example below if you wish to make partitions.

The SCSI ID and SCSI LUN must be set to zero for the Boot Drive. These values increment by one each time their box is clicked in. Other drives may have a SCSI ID from one to six and a LUN from zero to seven.

The FILE SYSTEM must be set to **REG** for the Autoboot volume. This field alternates between *REG* and *FFS* each time its box is clicked in. You may wish to make an entire non boot partition an FFS drive, however, you must be using Workbench V1.3.

The BOOTABLE box must be set to **YES** in order to boot from the startup volume. Making a drive bootable automatically reserves a portion of the drive for Autoboot information.

Set the UNIT ENABLE box to YES.

Once you are certain that the information for your drive is correct, you are ready to perform the install. There are two types of installation to choose from.

If your drive has never been used before, or if you wish to remove ALL stored information from the drive, choose **Format and Install** from the *Install Drives* menu. This option will perform a low-level format of the boot drive, check the drive medium for defects, and repair any bad blocks found. Kickstart, the Unit Info File and the AmigaDOS boot blocks will be stored on the drive.

Note: *Be certain that you want to do a Format and Install before you do it!* ***All data on your hard drive will be permanently erased when you choose this option.***

If your drive contains DOS files that you don't want to lose, choose **Non-Destructive Install** from the *Install Drives* menu. With this option, only the information necessary for Autoboot is written, and the information stored on the hard drive is left intact.

You will be requested to insert a Workbench disk in the df0: floppy drive. The SA series Utilities disk is suitable.

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If you have done a *Non-Destructive Install*, and the DOS files on your boot drive are intact, you need only to turn your Amiga off, enable Autobooting, and turn your Amiga back on.

After a *Format and Install*, or if the DOS files on your boot drive have been corrupted, you should do the following:

1. *Disable Autobooting.*
2. *Boot the Amiga with the SA series Utilities disk.*
   You should see the following message as the Amiga boots;
   InstallHD: Installing ... DH0:, complete.
3. *Format the drive via the DOS format command.*
   e.g. ***format drive dh0: name "HardDisk"***
   If you are using Workbench V1.3 you may use the quick option of the format command.
   e.g. ***format drive dh0: name "HardDisk" quick***
4. *Copy the entire contents of the SA series Utilities disk via the DOS copy command.*
   e.g. ***copy df0: to dh0: all***
5. *Copy the icon for your hard drive from your SA series Utilities disk using the DOS copy command.*
   e.g. ***copy df0:HD_Utilities/HDDisk-info to dh0:Disk.info***
5. *Turn the Amiga OFF.*
6. *Enable Autobooting.*
7. *Turn the Amiga back ON.*

The Amiga should now boot from the hard drive. **Remember that Autobooting is not possible with a V1.2 Amiga 500 or Amiga 2000.**

Partitioning a hard drive

It is possible to have more than one AmigaDOS device using the same physical drive. This is done by setting up a portion of the physical drive to be used for each logical device. This portion of the physical drive allotted to a logical device is called a *partition*. The usual case is a single partition, in which the entire physical drive is used by one logical device.

Partitioning is useful when the capacity of your drive is greater than the maximum size that a particular filing system will allow. For example, the Amiga regular file system allows a maximum partition of 50 Megabytes. If you have an 80 Megabyte drive you may partition the drive into two 40 Megabyte partitions.

Another popular use for a partition is to get around the problem of not being able to boot from a Fast File System partition.
See *Appendix D - Using the FastFileSystem.*

The **SetUpHD** utility provides for drive partitioning via the *LOW CYL* and *UPR CYL* fields of the display screen. These values determine the portion of the physical drive that will be used by the logical device. It is essential that the values for two different partitions do not overlap, since this will cause AmigaDOS to become very confused.

An example partition is:

Active Unit	LOW CYL	UPR CYL	SCSI CONT ID	SCSI LUN	BOOTABLE
DH0:	8	309	0	0	YES
DH1:	310	612	0	0	NO

611

This divides a 20 megabyte hard drive into two 10 megabyte partitions call DH0: and DH1:

Since DH0: is bootable, LOW CYL is automatically set to eight to reserve room for Kickstart and the Unit Info File. In the example above, DH1: has one more cylinder that DH0:. The DH1: UPR CYL could be set to 611 to make the two partitions exactly the same size. This will allow the diskcopy command to be used between the two partitions.

Note - Only the first (lowest) partition of a drive may be bootable. Currently FFS volumes are not bootable.

Adding another drive

This section tells you how to add more hard drives to an operating Comspec Hard Drive System. If you have the *HD_Utilities* drawer on your hard drive, you can run the **SetUpHD** utility from there. If not, put the **Comspec SCSI Utilities** disk into any drive and run the program from floppy.

A screen will appear that shows the current configuration of your hard drive system. When **SetUpHD** is run, unit zero is the ***ACTIVE*** unit, i.e. the information for unit zero is displayed on the screen. To add another drive, you must select a unit number from the *Unit Info* table by clicking in its area of the table. The STATUS of the unit you select will now be ***ACTIVE***, and the screen display will show the information for the new unit. You can use any unit number from one to nine for your new drive.

If you are installing a second SCSI drive into your system you must ensure that the three terminating resistors that are on the drive are removed. **There must always be a set of these resistors on the last SCSI drive in the chain.** If you are using an SD or SSD series Hard Drive Chassis then the terminating resistors are located on the printed circuit board inside the chassis and not on the drive. When adding another drive to one of these chassis you need only remove the resistors from the drive.

To configure your new drive follow these steps:

1. *Select an AmigaDOS name for the drive by clicking in the* **DOS NAME** *box.*
2. *Select the type of drive you are adding by clicking the* **DriveTypes** *display box. If there is no DriveType for your drive, see Using the AddDriveTypes Utility further in this manual.*
3. **LOW CYL** *and* **UPR CYL** *will be set automatically according to the DriveType selected. If you wish to partition your drive you must set the LOW CYL and UPR CYL.*
4. *The* **SCSI ID** *and* **SCSI LUN** *must be set to correspond to the SCSI Cont ID and LUN of your drive controller. (Consult the manual for the specific drive you are adding to determine how to set the Cont ID and LUN).*

***Note** - The SCSI Adaptor has a SCSI ID of 7. Your SCSI devices may not use this ID.*

5. *The* **FILE SYSTEM** *must be set to either REG or FFS.*
6. *The drive can be made* **BOOTABLE** *by clicking the* **YES** *portion of the* **BOOTABLE?** *box. Even though you will not be booting from this drive, you may wish to make it Bootable, so that it will be possible to boot from the drive in the future without having to re-format the DOS portion of the drive.*
7. *Next the drive must be* **ENABLED**, *i.e. the* **YES** *portion of the* **UNIT ENABLED** *box must be selected.*
8. *Now make unit 0* ****ACTIVE**** *and select* **Write Unit Info** *from the* **Install Drives** *menu to update the system configuration. The next time you reset the Amiga, your new drive will be mounted.*
9. *Re-boot the Amiga.* The new drive will be installed.
10. *The new drive now requires an AmigaDOS format.*
    e.g. ***Format drive DH1: name "Second_HardDisk"***
11. *Once the format is complete, you should copy the DHDisk-info to the new hard drive and rename it to Disk.info. This will make the disk icon look like a hard drive.*

If the drive you are adding has never been used before, you may want to use the **Utilities** menu of the **SetUpHD** utility to do a mode select, a low-level format, and medium check on the drive. A new drive will always need to be AmigaDOS formatted once the system is reset. The proper order to issue these commands is **Mode Select** first, if the mode select has returned an **OK** message, then you may issue a **Format MFRS DEFECTS**.

The SetClock Utility

The SA 1000 SCSI Host Adaptor comes with a battery backed-up real-time clock. While your Amiga is off, the clock in the SA 1000 continues to operate and the Amiga date and time are set once the system is turned back on.

Amiga 500/2000 users should consult their respective User Manuals to set their Amiga's internal real-time clock.

Setting the battery backed-up clock

To set the time and date in the SA1000 adaptor follow these steps:

1. *Run the* **SetClock** *utility by double-clicking on its icon in the HD_Utilities drawer.*

2. *Click in the requester and enter the date and time as follows, and press return:*

   dd-mmm-yy hh:mm:ss

   e.g. 01-JAN-88 13:00:00 is January 1st, 1988 @ 1:00pm.

dd - day of the month,	*e.g. 1 is the first of the month*
mmm - month of the year,	*e.g. JAN is January*
yy - year,	*e.g. 88 is 1988*

   hh - hour of the day, 24 hour time, e.g. 13 is 1 pm
   mm - minutes
   ss - seconds

3. *Now click on the* **SET** *gadget to set the real-time clock and the current AmigaDOS system date and time. Then click the* **EXIT** *gadget to exit the program.*

The ParkDrives Utility

Before moving a hard drive, it is important to park the heads. This ensures that no data will be lost due to the drive medium being damaged while in transit.

The ParkDrives utility will access all drives in the Comspec Hard Disk system and move the heads to an area of the disk where no data is stored.

Some hard drives automatically park the heads when the drive is turned off, and therefore do not need to be parked manually. The Comspec 40 megabyte hard drive has this feature, and the Comspec 20 megabyte hard drive does not. Typically drives that *auto-park* make a "grinding" or "bumping noise when turned off.

Parking the hard drive heads

To park the hard drive heads follow this easy step:

1. *Run the* **ParkDrives** *utility by double-clicking its icon, or by typing* **ParkDrives** from the CLI.

A window will open and inform you that the hard drive heads are being parked for each unit attached to the system.

Note *- Once the hard drive heads have been parked, turn off your computer and hard drive. If you perform any action that accesses a hard drive, the drive becomes "unparked" and it is no longer safe to move.*

The AddDriveTypes Utility

The **AddDriveTypes** utility allows the Comspec SCSI system to be used with any SCSI hard drive. Its use assumes a knowledge of hard drive technology and terms.

SCSI is a *standard* interface, but like all standards, some hard drive manufactures have only partially applied the standard. It is likely (but not certain) that any SCSI hard drive will work with the system. The only way to find out is to try. The list of drives that have been tested and found to work can be seen by running the **SetUpHD** utility and examining the *DriveTypes* display.

Adding a new drive type

If you want to add a drive which is not currently in the SetUpHD list, you must use the **AddDriveTypes** utility in the *HD_Utilities* drawer. This program may be run from the CLI or from Workbench. The form of interaction is of "prompt and type" style.

The first thing you will see is a menu. Select **Add** to add a new drivetype, use **Modify** to examine or change an existing drivetype.

If you want to add a drivetype, here is a description of the meaning of each of the parameters that the system asks of you.

NAME — A 38 character descriptive name.
e.g. Seagate ST225N

NUMHEADS — The number of heads in the hard drive, excluding the servo head(s).

NUMCYLS — The number of AmigaDOS USABLE cylinders on the drive. Some have reserved portions for defect mapping, some give you control over the number of usable cylinders via a Mode Select command.
e.g. the Seagate ST225N has 613 cylinders

BLKS/TRK — The number of blocks per track.
e.g. the Seagate ST225N has 17 blks/trk

BLOCKSIZE — The number of bytes in a block. Enter 0 for 512, or 1 for 256 byte blocks.
e.g. the Seagate ST225N has a 512 byte blocksize

REMOVABLE — Enter 0 for a normal, non-removable device, or 1 for a removable device such as a Bernoulli drive. If a drive is marked as removable, the hard disk device will set up a task to watchdog it for disk changes.
e.g. the Seagate ST225N is not removable media

INTERLEAVE This is an empirically derived number, usually three or four works well with the average hard drive. Those with a large buffer can use an interleave of one.
e.g. the Seagate ST225N uses an interleave of 4

PARM_LIST_LEN
The length of the Mode Select parameter list in hexadecimal bytes. The SetUpHD utility will send a Mode Select command during the Format and Install procedure. You will have to look at the myriad of operations offered by your drive and decide what needs to be sent. If this field is zero, no Mode Select command will be set.
e.g. the Seagate ST225N parameter list length is $0C

MODE SELECT
BYTES A series of HEXadecimal bytes that make up the Mode Select command for your drive. The ModeSelect Bytes will vary widely from drive to drive. The following should help in compiling your HEXadecimal bytes.

-disable USGE, enable UNIT ATTN in page 0
-set byte 2 of page 1 to zero
-page 3 and 4 must be set for SCSI to ST506 Controller card

Keep in mind that NUMHEADS, NUMCYLS and BLKS/TRK are parameters sent to AmigaDOS and do not necessarily have to reflect the physical characteristics of the hard drive. However, they must be chosen such that:

- for 512 byte blocks
  NUMHEADS x BLKS/TRK x NUMCYLS <= RCP + 1

- for 256 byte blocks
  NUMHEADS x BLKS/TRK x NUMCYLS <= (RCP +1)/2

where: RCP is the capacity of the drive in logical blocks as returned by the Read CaPacity command.

The Comspec Bernoulli System

- The Bernoulli Drive

- Using the BCopy Utility

- Using the BDiskChange Utility

The Bernoulli Drive

The Bernoulli B20 disk drive is a 20 megabyte, high performance, direct access data storage device using 5-1/4" flexible media. The drive, with Small Computer System Interface (SCSI), uses a controller with an intelligent host-level interface.

The Bernoulli cartridges behave similarly to floppy disks in every respect, however, they have the increased speed and capacity of hard disk drives. Use it as you would a floppy, from Workbench or CLI. System requestors referring to a Bernoulli cartridge appear as they would for a floppy disk.

The cartridge consists of a durable plastic enclosure containing two flexible disks. The cartridge, which contains the Bernoulli plate, protects the media and serves as a handy, transportable package for the user. The cartridge access door to the media opens when the cartridge is inserted into the drive.

Proper use and care of the cartridges is important for the preservation of data integrity and assurance of long cartridge life.

The cartridge is loaded by inserting it into the drive, shutter end first. The cartridge edge containing the shutter faces towards the stop button on the front of the drive. Interlocks in the system prevent improper cartridge insertion. **Drive power must be on before the cartridge can be inserted.**

When the cartridge is in place, the drive spins up and the green LED on the front of the drive begins to blink. As the drive motor reaches operating speed, the green LED glows steadily.

NOTE -The yellow LED will flash briefly as the drive reads initialization information from the disk. If the drive fails to initialize correctly, an error condition exists. If this occurs, re-insert the cartridge to ensure proper seating. If this doesn't correct the problem, the media may need to be re-formatted, or the drive may need to be serviced.

To remove the cartridge, push the stop button. The green LED will begin to blink as the motor spins down. When the motor has come to a stop, the green LED turns off and the latch pin disengages. Once this happens, it is safe to remove the cartridge.

Caring for your Bernoulli

Do not leave the cartridge partially inserted in the drive unit. This increases the possibility of damaging the cartridge or drive.

Although the cartridge protects the disk from most accidental damage, the following cartridge handling rules should still be observed.

* ***Never*** *move the drive without the protector inserted.*

* ***Never*** *move the drive while there is a cartridge inserted.*

* ***Never*** *try to open the cartridge shutter when it is outside the drive.*

* ***Never*** *insert objects into the cartridge.*

* ***Never*** *expose the cartridge to direct sunlight or moisture.*

* ***Never*** *expose the cartridge to large magnetic fields.*

* *Remove the cartridge from the drive after use and store it in its protective jacket.*

* *Protect the cartridge from dirt, spills and harsh environments.*

* *Avoid handling the front edge of the cartridge, since oils can be transferred from the hands to the cartridge disk.*

Periodic cleaning of the read/write head is important for prolonged head and cartridge life. A special cleaning kit available for this purpose includes a head cleaning cartridge, wiper pads, and head cleaner solution. The head cleaning cartridge inserts into the drive like a standard data cartridge. Instructions for the cleaning operation are included with the head cleaning kit.

To prolong head and cartridge life, the head should be cleaned after 50 hours of use (more frequently in dusty environments). Continued operation with a dirty head causes damage to the data surface of the cartridge disk. If the head is not cleaned, contaminants eventually cannot be removed completely from the head, and the drive becomes inoperative.

If a cartridge performs abnormally, head cleaning is recommended before use of another cartridge.

Formatting a Bernoulli cartridge

When using a NEW Bernoulli cartridge it is required that you perform an AmigaDOS format. The format will erase the entire disk and prepare it for the Amiga's use. Insert the new cartridge into the Bernoulli drive and select its icon. Choose the **Initialize** option from the **Disk** menu in *Workbench*. From *CLI* use the AmigaDOS format command:

e.g.**format drive <disk> name <name>**
where <disk> is the AmigaDOS name of the Bernoulli cartridge and <name> is the Volume name.

Under AmigaDOS 1.3 you may use the QUICK option:
e.g. **format drive <disk> name <name> quick**

After formatting the cartridge you should create an icon for it by copying the *BNDisk-info* file to the cartridge as *Disk.info.*
i.e. **copy :HD_Utilities/BNDisk-info <disk>:Disk.Info**

Note - If this file is not created, the BCopy utility will not function properly when choosing Duplicate from the Workbench, and the Bernoulli's icon will appear only as a regular disk icon.

Write protect

The write protect switch is located in the corner of the cartridge The cartridge is write protected when the switch is in the position shown. THE SWITCH SHOULD NEVER BE MOVED WHILE THE CARTRIDGE IS IN THE DRIVE.

Power Down Cartridge Removal

If a cartridge is locked into the drive because of power failure or other causes, the following procedure makes it possible to remove the cartridge from the drive.

1. *Power to the drive must be turned off to guard against the power being restored during cartridge removal.*
2. *The motor access panel must be removed from the front panel of the drive, using a small flat-blade screwdriver.*
3. *The eraser end of a pencil is inserted into the space behind the motor access panel, and the eraser is pressed against the motor housing on the right side of the space. The motor is rotated until the dot on the motor housing is aligned with the dot on the pencil shield.*
4. *With the dots aligned, the end of a straightened paper clip is inserted in the small hole below the stop button on the front of uhe drive. The paper clip is pressed firmly into the space; simultaneously, the cartridge is pulled out to remove it from the drive. Pressure must be maintained with the paper clip until the cartridge is fully removed.*
5. *The motor access panel is then placed back in the front panel.*

CAUTION: *Attempts to remove the cartridge without first aligning the dots on the motor can cause damage to the drive and/or the cartridge.*

The BCopy Utility

The **BCopy** utility is designed to allow the users of single Bernoulli cartridge systems to backup a cartridge with only one drive. BCopy can be used to make copies of your work cartridge to new cartridges or to used cartridges containing files that are no longer needed. **When you use BCopy, any information previously stored on the destination cartridge is erased.** While many other computer systems require that new cartridges be specially prepared before use, BCopy automatically prepares, or *formats*, cartridges as the information from the original disk is copied. Use BCopy regularly to make backup copies of your work cartridges.

Note - The BCopy utility uses the largest chunk of fast memory available in the system as a buffer. To reduce the number of swaps close all applications and drawers, or reset your system, before opening BCopy.

Copying a single Bernoulli

If you want to copy a single Bernoulli cartridge you must use the **BCopy** utility in the *HD_Utilities* drawer. This program may be run from the CLI or from Workbench.

You can use either of these sequences to backup one of your Bernoulli cartridges:

From the *CLI* you may type **BCopy <AmigaDOS Name>** and then be prompted to place the cartridge that you wish to copy into that drive ,for example **BCopy BN0:** will copy the cartridge in **BN0:**. Follow the instructions as they appear. You are prompted to insert the master cartridge (the cartridge you are copying information from). Then, as the copy progresses, BCopy asks you to insert the copy (the cartridge you are backing up information onto), swapping master and copy in and out until all of the cartridge has been duplicated.

You may also run this program from *Workbench* by selecting the icon for the cartridge, then making an extended select on the **BCopy** icon. Follow the instructions as they appear and proceed to swap the master and copy as requested.

Note - When you use this program the Amiga will only make use of one Bernoulli drive even if there are two or more.

The BDiskChange Utility

The **BDiskChange** utility lets AmigaDOS know when you've changed the cartridge in the Bernoulli drive. It is only required on Bernoulli cartridges that have been formatted with FFS. Under FFS these drives are not recognized as normal drives in the Amiga system, the Amiga cannot tell when a cartridge has been removed or inserted. Therefore, when the system issues a prompt like *Please insert volume Bernoulli in drive 1*, it has no way of telling if you've complied. You must use the **BDiskChange** command to let AmigaDOS know you've changed the cartridge, so in turn it can check to make sure you've complied, and then continue.

Changing the Bernoulli Cartridges formatted with FFS

To change the Bernoulli cartridge follow these easy steps:

1. *Run the* **BDiskChange** *utility by double-clicking on its icon or by typing* **BDiskChange** *in the* **CLI**. *You may find the icon in the HD_Utilities drawer.*

2. *A window will appear on the screen that contains ten small boxes. Each box with an AmigaDOS name represents a removable media unit. Any time that you wish to change a cartridge in a unit click in its appropriate box and AmigaDOS will automatically know that you have removed or inserted a cartridge. You may leave this utility running, as it takes little memory and CPU time.*

Appendices

Troubleshooting

In a complex system, there are often many things that can go wrong. To help determine the cause of a problem, the Comspec SCSI and Hard Drive system reports valuable status information on many different operations. There are three main groups of Status Information. They are: Boot Status, SCSI Status, and Sense Key Status.

SCSI Status and Sense Key Status codes will typically only be seen when using SetUpHD. The SA Series software will handle most status codes automatically.

If you are using an Amiga 1000, or an Amiga 500 or Amiga 2000 with Kickstart V1.3, the Amiga system will be able to boot from the hard drive.

When your system is turned on, the Amiga will wait for the hard drive to spin up and perform its selftest. During this waiting period the Amiga screen will fade from blue to red. The hard drive should be ready by the time the screen is completely red. If the drive is not ready, or if the correct information can not be read from the drive, the screen will flash red a number of times. The number of flashes indicates the cause. The Amiga will then retry to access the hard drive.

Note: *If the drive is turned on after the computer, the drive may not be ready by the time the Amiga screen is completely red. The screen will flash, and the Amiga will then retry to access the drive. To avoid this extra delay, turn the hard drive on before or at the same time as the computer.*

Boot Status

Number of screen Flashes	Description
2	**Could not select boot drive**. The boot drive (with SCSI CONT ID = 0, LUN = 0), could not be selected. The drive may be off, disconnected, have the incorrect CONT ID and LUN setting, or may still be performing its selftest.
3	**Could not get "Test Unit Ready" OK** The hard drive was not ready in the alloted time. The drive may still be performing its selftest, or a cartridge was not inserted in the Bernoulli drive.
4	**Could not read "Unit Info File"** A Unit Info file, (or configuration file) was not readable. Use the SetUpHD Utility to write the Unit Info file.
5	**Could not read Kickstart** Kickstart could not be read from the hard drive. Use the SetUpHD's Non-Destructive Install to store Kickstart on the hard drive.
6	**SCSI reset failed** The SCSI Bus is being held in the Reset state. One of the SCSI devices may be powered off.
7	**Kickstart ROMs present** Your Amiga 1000 has had Kickstart ROMs installed, or your Amiga 1000 is defective. The ROMs will have to removed to be able to Autoboot from the hard drive.
8	**Mode Sense failed** Your hard drive failed the Mode Sense command. Your drive may not support this command or if it is a bernoulli system, the cartridge may not be inserted.

SCSI Status

SCSI Error Number	Description
0	Command completed with GOOD STATUS.
1	Command completed without GOOD STATUS.
-1	Command did not complete.
-2	Command did not complete, and an expected PHASE was encountered, so the SCSI Bus was Reset.
-3	Selection of target drive failed.
-4	An unexpected interrupt occurred.
-5	The SCSI Bus was reset by a device other than the Amiga.
-6	The SCSI Bus Controller received an incorrect message, status or command byte/
-7	Command failed due to a parity error.
-8	The SCSI Bus Attention has been asserted.
-9	The watchdog timer expired.
-10	The battery-backed time was unreadable.

Sense Key Status

Sense Key Status is status information issued by a SCSI device connected to the bus. Sense key status is returned by the Request Sense option of the Utilities menu of SetUpHD. A list of Sense Keys is given below.

Sense Key	Description
1	**RECOVERED ERROR** Indicates that the last command completed successfully with some recovery action performed.
2	**NOT READY** Indicates that the drive cannot be accessed. Operator intervention may be required to correct this condition. No cartridge in a drive will give this status.
3	**MEDIA ERROR** Indicates that last command terminated with a non-recovered error condition. A defective block will be reassigned.
4	**HARDWARE ERROR** Indicates that the drive detected a non-recoverable hardware failure. The drive may require servicing.
5	**ILLEGAL REQUEST** Indicates that an illegal request was made. The drive may not support the failing operation.
6	**UNIT ATTENTION** Indicates that the drive was reset or that a cartridge was removed since the last command.
7	**DATA PROTECT** Indicates that the drive is in a write protect mode.

Saving your software

The custom driver software that comes with the Comspec Hard Drive System works under both versions of the operating system that are currently available, V 1.2 and V 1.3.

In order to correctly update your hard drive from version 1.2 to 1.3 you must delete all of the AmigaDOS 1.2 files from it. It is a good idea to first create a backup copy of certain files, which you will want to retain after the upgrade. Of all the files that are of any value to the efficient re-creation of your hard drive the *Startup-Sequence*, *Mountlist,* and *system-configuration* files are the most important, and are fully compatible with both AmigaDOS versions.

The *Startup-Sequence* is located in the **s:** directory of your hard drive. The *Mountlist* and *system-configuration* files are located in the **devs:** directory of your hard drive.

To make a backup of your files you can use the AmigaDOS *Copy* command. A much easier way to backup your files is to use a public domain disk management program such as *DiskMan* to visually see what you are copying.

Using the FastFileSystem

There are two filing systems that can be used on the Amiga. The second version, called the *FastFileSystem*, is considerably more efficient than the original version. The new file system may be used on any hard drive by clicking in the **FILE SYSTEM** box of the *SetUpHD* utility. The display alternates between *REG* for the original file system, and *FFS* for the FastFileSystem.

When changing from REG to FFS or vice-versa, note that the change will not take effect until the next time the system is booted. Also note that the two file systems are not compatible, i.e. a drive formatted under REG file system **MUST** be re-formatted for FFS before it can be used.

Autobooting and FFS

It is NOT possible to boot from an FFS volume. If you want your boot drive to operate under FFS, you must first create a boot partition on the drive. This is a small area that AmigaDOS will use to start up the system and must be formatted for the REG file system. The remainder of your boot drive can be set for FFS.

Installing FFS

In order to install FFS onto your hard drive it is recommended that you follow this boot partition creation method:

You will most likely want about one megabyte of storage for your boot partition. This size must be translated into the number of cylinders on the hard drive that will be taken up. The easiest way to do this is to use the *SetUpHD* utility to look at the current **UPR CYL** value for your boot drive.

The number of bytes per cylinder is the total size of the drive divided by the number of cylinders. On a 20 megabyte ST225N, the standard drive shipped with SD 20 Hard Drive Chassis, the numbers are:

$$\frac{\text{Total Size}}{\text{UPR CYL}} = \frac{20\text{M}}{612} = \text{approximately 33K per cylinder}$$

$$\text{For a one megabyte partition: } \frac{1\text{ M}}{33\text{K}} = 30 \text{ cylinders}$$

You should therefore set your *LOW CYL* to **eight** (to allow for the Autoboot information) and your *UPR CYL* to **38**. The settings for your FFS partition should be as follows, LOW CYL to 39 and UPR CYL to 612.

Now that you have setup the hard drive to use FFS, you must format the drive using the new AmigaDOS Format command. First you must format the non-FFS partition of the drive, then the FFS partition.
ie. *format drive dh0: name "Boot Partition"*
format drive dh1: name "FFS Partition" ***ffs***

After you have formatted both partitions you must copy your **Workbench** disk to the partition that you wish to be your **SYS**tem disk. Of all the files that are important to make your FFS volume work correctly you must copy the **FastFileSystem** file in the **L:** directory of your **Workbench** disk to the **L:** directory of your **SYS**tem disk.

For more help with setting up partitions read the section *Partitioning a drive*, earlier in this manual.