Atari ST®

# AdSCSI ST Series

# AdSCSI ST
# AdSCSI Plus ST
# AdSCSI Micro ST

**SCSI Host Adapters**

Owners Manual

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**Note:** The diskette included is double–sided. If you have only single–sided drives, you may return the disk to ICD at the address on the previous page for replacement with single–sided disks at no charge.

# Table of Contents

# Chapter 1

# Introduction

The ICD *AdSCSI ST*, *AdSCSI Plus ST*, and *AdSCSI Micro ST* host adapters allows hard drive systems to be connected to Atari ST and Mega computers. The ICD AdSCSI ST series host adapters and software provide unique advanced features. Hard drive systems based on these host adapters will give you fast, reliable, and convenient access to large amounts of data for your computer system.

In addition to providing state-of-the-art hardware design, all ICD AdSCSI ST host adapters come with the most advanced software available. No other hard drive system gives you more storage or greater speed.

ICD is dedicated to providing the most up-to-date hard drive systems for the ST and Mega computers. Thousands of hours have been invested in the design of the ICD AdSCSI ST host adapters and software. Every component is of the high quality you expect from ICD. The software has been and will continue to be updated as new features are developed and as new hard drives are released. ICD responds to your needs and desires.

This manual provides more than installing and operating instructions. **A Hard Drive Primer** is an introduction to hard drives in general, describing what they are, how they work, and how they can be useful to you.

**Building an ST Hard Drive System** describes the parts and actions necessary to build a hard drive system with the ICD AdSCSI ST or AdSCSI Plus ST host adapter.

**An Internal Mega Drive** tells how to install a hard drive inside a Mega computer using this smallest of host adapters.

**The ICD Hard Disk Formatter** provides complete instructions for the ICD hard disk formatting program, allowing you to prepare your drive for use.

**The Hard Disk Utilities Program** shows how this program can be used to set autoboot from the hard drive and zero directories.

**The ICD Hard Disk Driver** describes the software that allows ST and Mega computers to communicate with hard drives and other devices through an ICD AdSCSI ST series host adapter.

The appendices include information about other utilities and demonstration programs included on the ICD AdSCSI ST disk, using multiple hard drives on your system, common problems and solutions, physical dimensions of the hardware, and other subjects.

Every effort has been made to ensure that your hard drive will work accurately for many years and that the included software is easy to use and free of bugs. But there is always a chance that something will be confusing or will not work properly. If you have a problem or question, feel free to call us voice at our technical support line (815 968-2228) or via modem on our BBS (815 968-2229), GEnie (ICDINC), or CompuServe (76004,1600).

> **Note:** Before calling or writing for technical support, please make sure you know the version numbers of *all* the programs involved. Also be prepared to discuss in detail *exactly* what happens and what doesn't happen (including all error numbers, messages printed to the screen, and exactly when the errors occur).



# Chapter 2

# A Hard Drive Primer

This chapter describes what a hard drive is, how it works, and what it can do for you. Reading this chapter is not required to use a hard drive, but it should help you understand its operation.

## Inside a Hard Drive

The "Winchester" or fixed hard drive operates like a floppy diskette drive in which the diskette is permanently installed[1]. The "diskette" part, called a *platter*, is rigid and is machined to a very close tolerance. The platter spins much faster than a floppy diskette does. A floppy diskette rotates at 300 rpm or so. The platters in most hard drives rotate at 3600 rpm. Most hard drives also have more than one platter, aligned so that they rotate about the same axis. The platters are coated with a magnetic material onto which data is encoded (recorded). The stated size of a hard drive (typically 5¼" or 3½") is the diameter of a platter.

## Heads

A hard drive has one or more heads, usually with one head to each surface of each platter. These heads write information to or retrieve information from the magnetic medium on the platter surface. To write, an alternating current is passed through the head, causing it to produce a varying magnetic field. As the surface of the platter passes near the head, the magnetic particles in the storage medium are realigned by this field. When reading, the magnetic field from the surface induces a current in the head.

1 Some hard drives have removable media, meaning that the platter or platters can be changed. These drives make up only a small percentage of the hard drives in use.

*Figure 2–1*

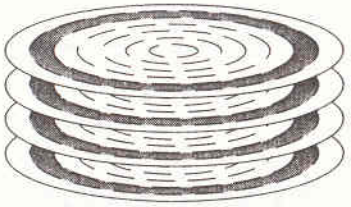


*Figure 2–2*

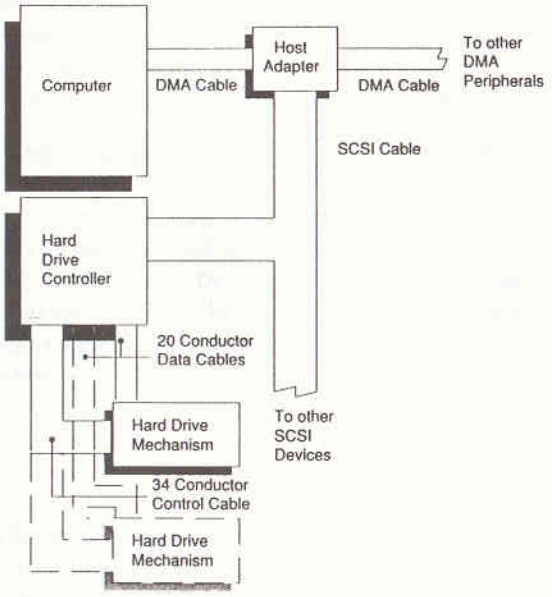



*Figure 2–3*

Each head floats on a cushion of air several microns (a micron is a thousandth of a millimeter or 0.000001 meter) above the surface of the platter. The heads are connected to a stepper motor or voice coil that allows them to be moved precisely to specific areas of the disk.





## Cylinders

The magnetic medium on each surface of a platter is divided into concentric rings, called *tracks* (see Figure 2–1). The collection of the tracks in the same position on both sides of all platters in the drive is called a *cylinder* (see Figure 2–2), since a cylinder parallel to the axis of rotation intersects all of them. A hard drive typically has over 500 cylinders, while an ST floppy diskette has 80.

## Density

There are two main density schemes (also called data–packing or encoding schemes) used to encode data on the magnetic medium of a hard drive. The less expensive is *Modified Frequency Modulation* (MFM). MFM is the density used on ST (and many other) floppy diskette drives. Typically, a hard drive formatted with MFM encoding will have 17 512–byte sectors per track. An ST floppy diskette has nine sectors per track.

The other method is *Run Length Limited* (RLL). RLL allows 1½ times the data in the same surface area. RLL formatted drives typically have 25 512–byte sectors per track. This extra storage does come at a price, though. RLL controllers typically cost more than MFM, and the drive must have a higher quality of magnetic medium to handle the more dense RLL information storage. You should use only RLL certified drives with RLL controllers.

## A Hard Drive and Your Computer

Figure 2–3 shows, in general terms, how a hard drive is connected to a computer using a Small Computer System Interface (SCSI) interface. This is the way it is done with most personal computers. Most IBM and clone hard drive interfaces, however, combine the host adapter and the Hard Drive Controller into one plug–in card.

The AdSCSI ST series host adapters act as interfaces between the computer's DMA bus and the SCSI bus. You can connect up to eight devices, each with a unique identification numbers from 0 to 7. SCSI ID #6 is used internally by the ICD AdSCSI ST series, leaving the other seven IDs for other devices[2]. Most other SCSI devices allow you to change their ID numbers. All ICD

2 The AdSCSI Micro ST host adapter allows only IDs 0-3 for other devices.

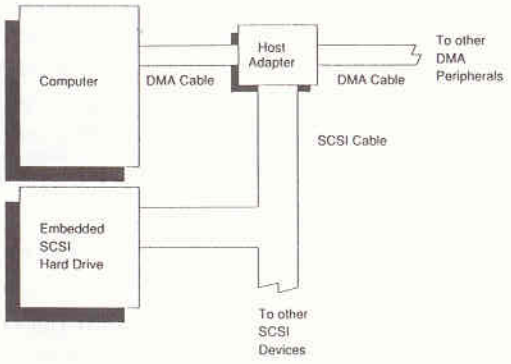



*Figure 2–4*

FA•ST Hard Drives and Tape Backup units allow the ID to be changed quickly and easily on the rear panel so that several drives may be connected and addressed separately.

There are two types of drive interfaces available to be used with an Atari ST or Mega computer. The first is the *ST506/412* type. This type of drive requires a SCSI Hard Drive Controller, as shown in Figure 2–3. These controllers will typically control either one or two drives. If an RLL controller is used, then *both* drives should be RLL certified to ensure proper operation.

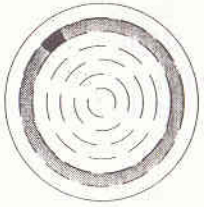


*Figure 2–5*

The second type of drive has an *Embedded SCSI* interface. This drive has a built–in SCSI controller, so that it can be connected directly to the SCSI bus (Figure 2–4). Embedded drives are usually faster, less expensive than a drive and controller, more reliable (since there are fewer parts), and consume less power, which creates less heat. Only 3½" embedded SCSI drives can be used for Mega internal installation with the ICD Micro ST Host Adapter.





## Formatting and Partitioning

Once a hard drive is physically connected to your computer, it is necessary to prepare it to accept your data. This preparation is called *formatting*. First the drive must be *low–level* formatted. The magnetic medium on the surfaces must be divided into numbered sectors that the controller can find. A *sector* is a section of a track bounded by lines perpendicular to the axis of rotation (Figure 2–5).

TOS 1.4 and later versions allow a maximum of 32 megabytes of storage per drive in normal format. Earlier version allow only 16 megabytes. Hard drives that are larger than this may be used only by dividing a physical hard drive unit into smaller logical drive units (or to use largers sectors, as described in the next paragraph). The logical drive units are called "partitions". In this way a single hard drive can appear to be two or more drives to the computer. For example, a 30 megabyte hard drive may be divided into three 10 megabyte partitions, which would be accessible from the ST as drives C, D, and E. Besides simply keeping drive sizes under the TOS limits, dividing a drive also allows partitions to be used for specific purposes, keeping the drive organized. One or more partitions may also be dedicated to non–TOS purposes, such as alternate operating systems and emulators.

Using ICD Hard Disk Formatter and ICD's Hard Disk Driver, larger partitions sizes may be used — up to 512 megabytes with TOS 1.4 or above and 256 megabytes with earlier versions. This is accomplished by using "logical" sectors that are made or two or more physical (actual) sectors. The computer cannot boot from a partition using this format, so you should have at least one regular partition in your system. Many programs assume that sectors will be 512 bytes in size, too, and will not work properly on this type of partition.

Once the low–level formatting is complete, information about how the drive is partitioned is stored on sector 0 of the drive. Then the TOS directory structure is written to each partition. This includes the file allocation tables, the main directory, and other information needed for TOS to be able to use the partition for file storage.

### Boot and Driver Software

In order for your computer to be able to communicate with the hard drive through the host adapter, a software driver must be loaded into memory. This driver program will remain in memory and control all communications with the drives. Without a memory–resident driver, the computer can't communicate with a hard drive.

When booting the computer from a floppy diskette, the program ICDBOOT.PRG must be run, usually from the AUTO folder. When booting from the hard drive is enabled, the program is called "ICDBOOT.SYS" and is in the root directory of partition C.

After the drive is formatted and the driver is loaded, you will be able to use the hard drive partitions as if they were very large, very fast floppy diskettes. After a few weeks of hard drive use, you may wonder how you managed to use your computer without one, and you might even wonder why you didn't buy a bigger one!



# Chapter 3

# Building an ST Hard Drive System

### Parts

The following is a list of the components you will need to build a hard drive system for your Atari ST or Mega computer. All of these except the drive mechanism are available from ICD either individually or as complete kits.

**Host Adapter** This allows your computer to communicate with SCSI devices.

**Hard Drive Mechanism** You will need an ST506/412 compatible drive or an embedded SCSI drive.

**Controller and Shielding** If using an ST506/412 compatible drive, you will need a compatible SCSI hard drive controller. This is *not* the type of controller normally packaged with drives intended for use with XT or AT compatible MS–DOS computers. You should also provide shielding between the drive and controller.

**Case** Your case should be large enough for the power supply, drive(s), AdSCSI ST host adapter, and controller if needed. The case should allow adequate ventilation to keep the components cool. A metal case is best since this will cut down on radio frequency interference.

**Fan** A hard drive can generate a lot of heat. You will need a quiet fan to keep things cool.

**Power Supply** A power supply rated at 45 watts or more, capable of providing 12 volts at 2.5 amps and 5 volts at 3 amps is recommended. For multiple drives you may wish to use a larger power supply.

**Cables** You will need a 50 conductor cable with appropriate connectors (except with the AdSCSI Micro). This cable should ideally be continuous. Any stubs off the main cable should be kept under five inches to conform to SCSI standard. The best method is to just add additional connectors if needed to a single cable. This cable may be up to 18 feet in length.

If you are using a drive and controller, you will also need 20 and 34 conductor ribbon cables. In addition, you may need one or more "Y" adapters to provide power to all of the devices in the hard drive assembly.

**Mounting Hardware** You will need mounting brackets, screws, and washers for mounting the AdSCSI ST host adapter, controller (if needed), and drive mechanisms.

## Termination

If you are assembling a system containing multiple drives, you will need to remove terminating resistor packs. These resistor packs are usually red, yellow, blue, or black, with a single row of pins (they look something like combs).

If you are using two drives with one controller, then the 34 conductor ribbon will connect to one drive, then the second. You should remove the resistor pack near the 34 conductor edge connector on the "middle" drive (the closest to the controller on the cable).

If you are using two or more SCSI devices (embedded drives or controllers), you should remove the two or three resistor packs near the 50 pin connector from all of them *except* the one at the end of the cable.

If the resistor packs are not socketed, it is probably best to leave them in place unless problems occur. In most cases they will be socketed and may be easily removed.





## Logical Unit Numbers (LUN)

If you are using two ST506/412 compatible drives and one controller, you will need to set one of the drives to logical unit number (LUN) 0 and the other to LUN 1. This will usually be done by change jumpers or DIP switches on the drives' circuit boards. Be aware than many drive manufacturers number the drives 1, 2, 3, and 4 (using DS1–DS4 for the jumpers) instead of 0, 1, 2, and 3, so their 1 and 2 would correspond to LUNs 0 and 1.

## SCSI ID

If you are using more than one controller or embedded drive, you will need to assign to each a unique SCSI identification number. This is usually accomplished by changing three jumpers on the controller or drive. These jumpers form a three digit binary switch, allowing IDs from 0 to 7 by shorting different combinations. SCSI ID 6 is used by the AdSCSI ST host adapter and should not be assigned to any other device.

## Parity

You should make sure that parity is disabled on your drive or controller. Many embedded SCSI drives are shipped with parity enabled. Parity can usually be disabled by removing a jumper near the SCSI ID select jumpers.

## Assembly

Before beginning assembly make sure that the power cord is not connected to the power supply. Besides the obvious shock hazard, you could easily damage your equipment.

How you mount the drive(s) and controller (if present) will depend upon the enclosure you have selected. There are a few general rules you should follow, however. Be careful to tighten the screws evenly on the drive to avoid stressing the drive's case. Use nylon washers on both sides of circuit boards if necessary to avoid shorts. Make sure that there is clearance between circuit boards and shields or the case, using spacers if necessary to lift the board. Make sure that screws do not extend too far, pressing against other components.

## Connecting the Power Cables

The connectors used for applying power to drives and controllers are standard. These have two beveled corners so they can only be inserted the correct way. They are also very difficult to disconnect, so make sure you are ready before inserting. You may also have to apply a fair amount of force to get them in all the way. Be sure to support the board under the connector when pressing it in.

The "Y" adapter provided should be connected to one of the power connectors. The small brown connector provides power to the host adapter. Make sure that this connector is centered properly and attaches to the AdSCSI ST host adapter with the ridge up, snapping into place. An improper connection here could cause damage, so be careful.

## Connecting the Ribbon Cables

By convention the side of the ribbon cable marked in red corresponds to pin one. If building your own cables, you may wish to see which way the connectors will oriented before attaching them to the cable. For keyed connectors, the red edge should be on the left if you hold the connector facing you with the key up.

Locate pin 1 on all the connections on all components. Many components will have one or more of the pin numbers actually written on the board (such as the AdSCSI ST host adapter). Pin 1 has a square pad on the circuit board instead of a round one on some components (as on OMTI SCSI controllers). If you are unsure of the pin identification, consult the documentation that came with the component.

## Controller to Drive Cables

If you are using an ST506/412 compatible drive and controller, connect the 20 and 34 conductor ribbon cable to the drive and controller. Make sure that pin 1 one matches pin 1. The 20 conductor cable for the first or only drive should connect to the LUN 0 connector on the controller. Check your controller documentation to determine which this is (it is usually the one with the lower number).





(While it may seem that too much emphasis is being placed on cable alignment, it should be noted that over 80% of all hard drive problems (from our observations) are cable related. Being a very small part of the assembly, correct cable orientation is very easy to overlook and very often is.)

If you are connecting two drives to one controller, make sure that the drive connected to the middle connector on the 34 conductor ribbon cable is the one from which the resistor pack was removed. The 20 conductor cable for the drive set to LUN 1 should go to the LUN 1 connector on the controller (usually the higher numbered of the two 20 pin/finger connections).

Note that the physical order of the drives on the cable and the LUN settings of the drives are unrelated. Either the LUN 0 or the LUN 1 drive may be the "middle" drive.

## Connecting the SCSI Cable

Make sure that pin one is connected to pin one in all cases. One end of the 50 conductor SCSI cable should be connected to the AdSCSI ST host adapter. If connecting multiple SCSI devices, make sure that only the host adapter and the device at the other end of the cable have resistor packs. The resistor packs should have already been removed from the device or devices (drives or controllers) in the "middle".

Note that the SCSI ID numbers of the drives or controllers and the order in which they are attached to the SCSI cable are unrelated.

## Final Check

Inspect the hard drive assembly to make sure that nothing is touching the surface of any circuit board. Check all cables to make sure that none will be pinched when the cover is put on the case. Check the orientation of every cable one more time.

Connect the power cable to the drive. *Never reach into the case when the power is connected.* Turn on the drive. The drive light should blink one or more times. After a few seconds the drive should reach operating speed and the light should go off. If this doesn't happens, disconnect the power cable and check all of your connections.

After assembly is complete, connect the hard drive to the computer with the 19 conductor cable. It is now time to format your hard drive.



# Chapter 4

# An Internal Mega Drive

Using the AdSCSI Micro host adapter and the accompanying mounting bracket, you can easily install a 3½" hard drive inside your Mega computer. If you didn't buy an AdSCSI Micro host adapter, then this chapter is not for you.

## Parts

Your AdSCSI Micro package includes the AdSCSI Micro host adapter, an internal DMA cable, a drive power cable, four ⅜" screws, four ¼" screws, four metal washers, and four plastic spacers. In addition, you will need a 3½" half–height low–power embedded SCSI hard drive.

## Preparing the Hard Drive

Make sure that parity is disabled on the hard drive. This is usually done by opening a jumper, often labeled **EP** for "enable parity".

Set the SCSI ID for the drive. This must be between zero and three inclusive. This is usually done by adding or removing two of three jumpers on the drive.

Remove the plastic face plate from the drive, if present. If there are any exposed circuit boards or components on the front of the drive, tape over them to prevent short circuits.

## Mounting Your Drive

Plug the supplied power cable into the drive.

Place the drive component side down into the mounting bracket. The front of the drive and the wider side of the mounting bracket should both be to the

left. Note which of the holes in the mounting bracket line up with the threaded holes in the sides of the hard drive.

Mount the drive in the bracket using the longer (3/8") screws with a metal washer outside the bracket and a plastic spacer between the bracket and the drive. This is the most tedious part of the installation, so take your time and relax.

## Opening Your Computer

Turn your Mega over and remove the nine symmetrically spaced screws holding it together. Also remove the three screws toward the front under the floppy diskette drive. Turn it right–side–up and lift the top cover. Disconnect the wires going from the battery holder in the top to the back left corner of the shielding and remove the cover.

Straighten the tabs holding the top of the shielding in place and remove it. Pinch and remove the battery connector from the upper shielding and set the shielding aside.

Disconnect the power and ribbon cables from the back of the floppy diskette drive and set it aside. Lay the computer back down.

Remove the two screws holding down the front of the power supply. Unplug the power cable from the motherboard. Lift and set aside the power supply.

> **Note:** Check under your power supply for a 7407 integrated circuit labeled **U79**. If it is present and you wish to use the boot delay feature of the AdSCSI Micro host adapter, you will need to make a slight modification to your computer. Your host adapter will work without this modification, but without the boot delay.
>
> Cut the trace going from pin 12 of **U79** to the right side of **R152**, then solder a jumper wire from the right side of **R152** to the left side of **R4**.





## Installing the Drive

Position the bracket and drive in the front left corner of the computer so that the front of the drive is to the left. Match up the holes with the standoffs on the bottom of the bracket.

Lift up the motherboard and check the lower shielding. If the small hole in the front middle is pushed in toward the motherboard, one of the mounting screws will go through it. Otherwise, it will go between the shielding and the motherboard as the others do.

Pull back the shielding and mount the drive and bracket using either three or four of the 1/4" screws. Screw the fourth in from the outside of the shielding if the hole is indented as described above. Lay the board back down.

Connect the power cable from the drive to the connector beside the one to which the power supply connects.

Attach the supplied ribbon cable to the AdSCSI Micro host adapter so that the red line on the cable connects on the pin #1 side.

Attach the AdSCSI Micro host adapter to the drive. Make sure that pin #1 connects to connector #1 and that the female connector goes into the center of the connector on the drive.

Connect the other end of the ribbon cable to the DMA connector in the back left corner of the computer, making sure that red line on the ribbon cable is on the pin#1 side.

## Reassembling the Computer

Replace the power supply, connect its cable, and screw in the front two screws.

Insert but do not tighten the two rear screws that hold the floppy diskette drive in place.

Replace the upper shielding, pushing the clock battery power cable up through the hole in the back left. Bend down the tabs holding the upper shielding in place.

Insert the remaining screw under the floppy diskette drive and tighten all three.

Replace the top cover of the computer, connecting the clock battery plug. Replace the nine screws from the bottom of the case to secure the top.

Installation is now complete. Move on to the formatting chapter and prepare it for use.

### Timing

If you are using a Seagate drive or another that requires more than eight seconds to initialize, you can lengthen the boot delay. Turning potentiometer RS1 clockwise increases the boot delay; turning in counter–clockwise decreases the boot delay.



# Chapter 5

# The ICD Hard Disk Formatter

If you have purchased a FA•ST Hard Drive assembled by ICD, then it is already formatted and ready to use. However, if you have assembled the hard drive from a kit, you will need to format the drive before it can be used. The ICD Hard Disk Formatter program will allow you to physically format the drive and set up the partitions.

If you just wish to change the partitions on the drive, you can do so with this program. Simply skip the "Formatting" section.

If you have a printer, make sure it is connected to your computer before running the ICD Hard Disk Formatter.

> **NOTE:** The ICD Hard Disk Formatter program is updated periodically. The version you have may be newer than the one presented in this chapter. Check the disk for a file named **READ.ME**. This file will contain any additional information available. The latest versions of all the ICD AdSCSI ST programs are available for downloading via modem from GEnie, CompuServe, or the ICD BBS, or they may be obtained for a nominal charge on disk directly from ICD.

### Running the Formatter

To run the formatter, turn on the hard drive and wait for it to initialize. This should take just a few seconds. Once the drive light has quit blinking (if it does blink) and the drive sounds as if it has reached operating speed, insert the ICD ST Host Adapter diskette into drive A and boot the computer. If you get a "Clock Not Present!" message, then check the power and cable connections to your hard drive.

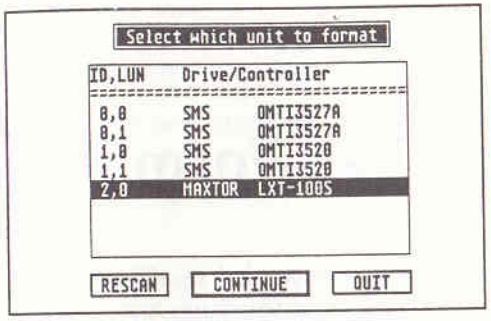



*Figure 5–1*

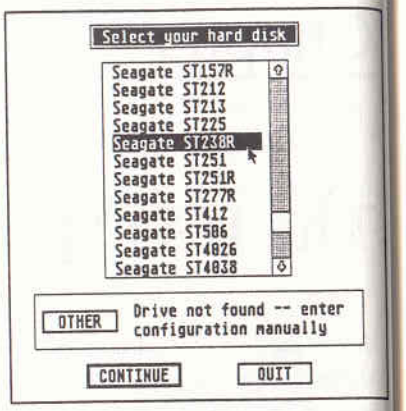



*Figure 5–2*

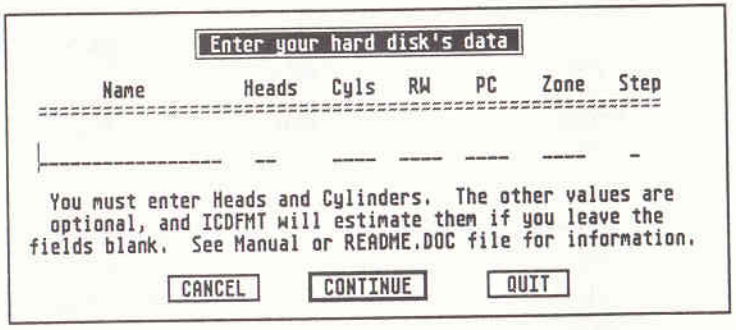



*Figure 5–3*

If you are using a color monitor, make sure you are in medium resolution. Double–click on the drive A icon, then double–click on **ICDFMT.PRG**. After the title screen the program will scan for hard drives and controllers. Those found will be listed in the selection menu (Figure 5–1).

> **Note:** The illustrations in this manual were taken from a display on a monochrome monitor in high resolution. If you are using a color monitor, the displays will be slightly different. Some of the screen displays may also have changed since the manual was printed.





Select the drive or controller and LUN you wish to format or repartition by clicking on it. Once you have selected a drive or controller, click on **CONTINUE**.

## Controller Options

If you are using a separate controller, you will then be asked to select the drive (5–2). Look for your drive, scrolling the window up and down with the arrow buttons or the slide bar if necessary. Select the drive by clicking on it, then clicking on **CONTINUE**.

If your drive is not listed, click on **OTHER**. You need to enter the number of heads and cylinders for the drive (Figure 5–3). The other information is optional and will be either calculated by the program or assumed to be default values if omitted. If you have this information, enter it. If you do not, then let the program fill it in. **RW** is the cylinder on which reduced write current will begin, while **PC** is the cylinder on which write precompensation will begin. **Step** is the step pulse width. Click on **CONTINUE** when done.

## Setting Parameters

You will be brought to the main menu (Figure 5–4) after selecting the drive. The box on the left contains information about the drive you have selected. On the right are user–modifiable parameters and the buttons for formatting and partitioning.

**Map Bad Sectors** is the first of the user–modifiable parameters. Clicking anywhere on this line will toggle between **FAT** and **SCSI**. **FAT** means that the bad sectors will be marked as bad in the File Allocation Table (FAT). TOS will then know not to use these sectors. **SCSI** will cause the bad sectors to be replaced through the controller. These bad sectors will then be "removed" from the drive and replaced with reserved sectors until the drive is reformatted. For alternate operating systems that ignore the FAT and are unable to handle bad sectors, this is the best choice.

Since SCSI mapping with Adaptec controllers requires completely reformatting the drive every time a sector is mapped out, it is not supported with these controllers.

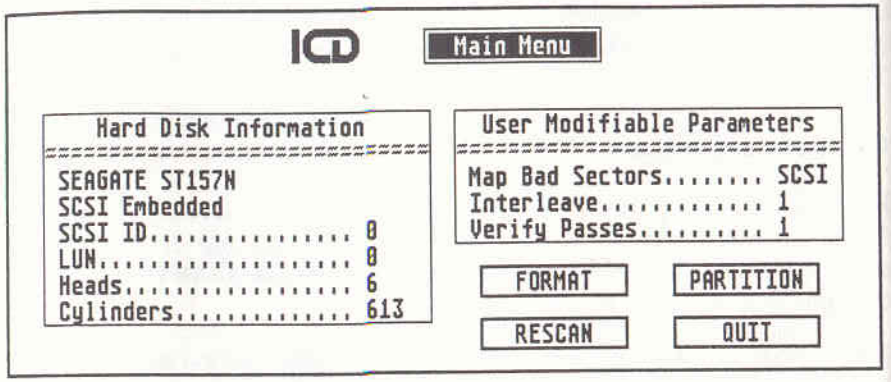



*Figure 5–4*

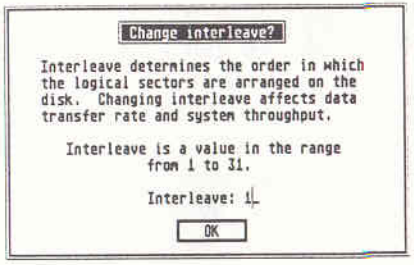



*Figure 5–5*

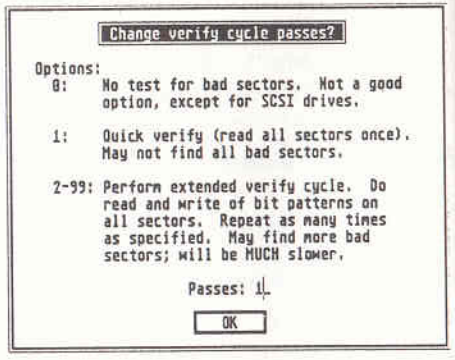



*Figure 5–6*

If you are repartitioning a drive using an OMTI controller, and the drive was originally formatted using a format program that did not offer the SCSI/FAT choice, you will have to reformat with this program to use SCSI mapping.

**Interleave** determines the way that the sectors are located on each track. An interleave of 1 means that the sectors are numbered consecutively (1, 2, 3, 4, and so on). And interleave of 2 means that consecutively numbered sectors have another between them (1, 10, 2, 11, 3, 12, and so on).

Interleave determines the maximum speed that data can be recovered by the drive. If the drive or controller can handle 1, it should be used. Some embedded drives and controllers, though, are unable to read the data fast





enough. The next sector will pass the head before the controller is ready for it. The controller will have to wait a full revolution for the sector to come back by the head. In these cases a larger interleave should be used. The extra sector between the sectors being read provides enough of a delay to allow both sectors to be read in the same revolution. Try an interleave of 1 first. If **RATEHD** (Appendix A) shows a much lower burst rate than you expected, try reformatting with an interleave of 2.

Changing the interleave will have no effect if you are just repartitioning a previously formatted drive. You must completely reformat a drive to change the interleave.

**Verify Passes** is the number of times each sector is checked to see if it is bad. Setting this to 0 bypasses this verification.

New embedded SCSI drives have already been checked for bad sectors at the factory. In most cases you can safely set the verify passes to 0 for these drives.

One pass, the default, is sufficient for most cases. Occasionally, though, drives have "flaky" sectors that will check out good sometimes and bad others. Increasing the number of verify passes will increase the likelihood that these flaky sectors will be found.

If you only wish to repartition a previously formatted drive, skip ahead to the "Partitioning" section.

Once these parameters have been entered, click on **Format**. If your drive has been previously formatted, you will see an alert box warning you that continuing will destroy the information on the drive. Click on **Yes** to continue.

## Bad Sector Entry

If you are formatting a drive with a separate controller you will be prompted to enter any known bad sectors (figure 5 –7). If you purchased a hard drive assembled by ICD then the media defect data sheet supplied with the drive contains this information. If you assembled the drive from a kit, then this information should be listed on the drive mechanism itself. On many drives the offset is listed as "Byte From Index" or simply "BFI". Enter all of these values into the table. If there are there are more bad sectors than will fit on one screen, click on **NEXT** for the next page. Click on **DONE** to continue.

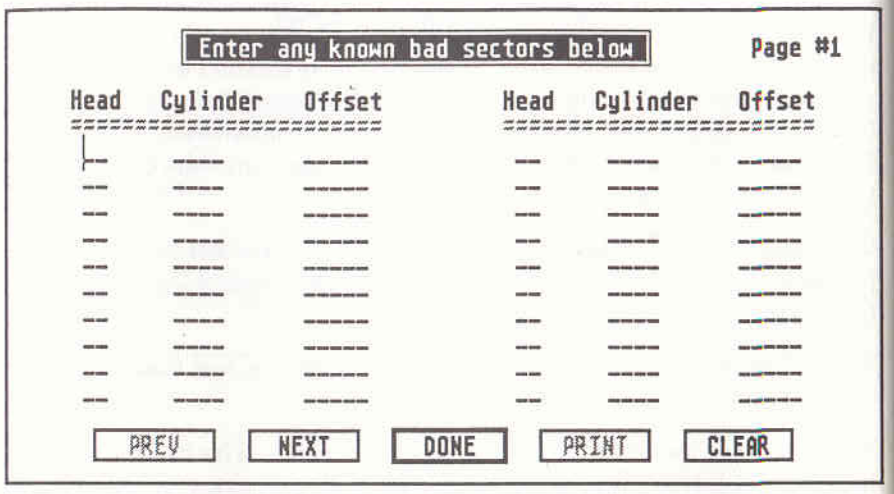



*Figure 5–7*


*Figure 5–8*





## Formatting

Before the format operation begins you are given one last chance to make sure that you have selected the proper drive (Figure 5–8). Click on **CONTINUE** to begin formatting the drive. After the drive has been physically formatted, you will be taken directly to the partitioning menu.

## Partitioning

If you are partitioning a previously formatted drive, click on **Partition** to get to the partitioning menu (Figure 5–9). If you have formatted the drive, you will be taken there directly.

If the drive has been previously partitioned, the partitions will be read from the drive. Otherwise calculated default values will be used.

Click on the button listed below or in the appropriate field for the desired operation. For entry of numbers and letters, use the standard GEM editing keys: **TAB** to move to the next field, **ESC** to clear a field, and the arrow keys to move around one character or line at a time.

Hitting the **RETURN** key or clicking on **RECALCULATE DATA** at any time will update the number at **Excess Space:**. If space allocated exceeds the space available you will be warned with an alert box that you have allocated too much space. If there is space still available, this will be shown at **Excess Space:**.

**START & END SECTORS** allows you to manually edit the start and end for each partition. There should be no partitions of zero size, and each partition should start with the sector after the one with which the previous partition ended. The first partition should start with sector one. It is much easier to use the **SIZE** option to set up partitions.

**SIZE** allows you to edit the size of each partition. If you plan to boot from this hard drive, the first partition must not exceed 16.77 MEGS or 32768 sectors. With TOS 1.4 or above, this limit is doubled. This is the limit for GEM partitions. BGM partitions, described below, may be up to 16 times as large. For alternate operating systems you should consult their manuals for recommended partition sizes.

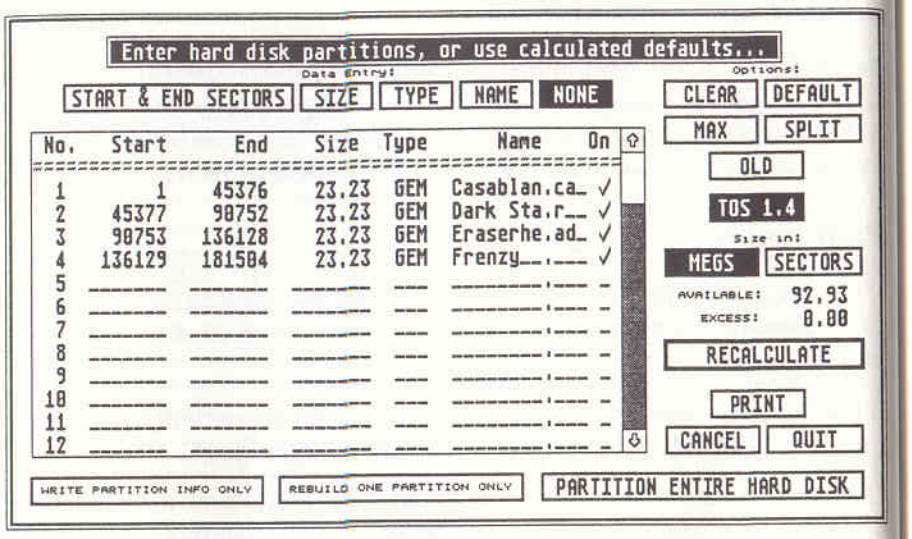



*Figure 5–9*

TYPE allows you to edit the type of the partition. This must be GEM or **BGM** for it to be used by the ST operating system. The formatter will automatically determine which of these is the appropriate type. In almost all cases you will want to leave this alone. Only if you are writing the partition sector only to a drive that has previously been used with an alternate operating system, such as Spectre 128, should you need to change the type of a partition.

BGM partitions use large "logical" sectors to extend partition sizes. The first enabled partition on the drive must be GEM if you wish to boot from this drive.

**NAME** is the volume name of the partitions. This is valid for only GEM and BGM partitions. Spaces and both upper- and lower-case characters may be used. **Show Info...** from the desktop will display this value (only to the first space). The ICD Desktop Accessory will use place this name under the drive icons on the GEM desktop.

The **On** column will contain a check mark by each partition that is enabled. Only the first 14 enabled GEM or BGM partitions will be available from the desktop. You can select which partition are enabled by clicking on the





appropriate space in this column. You may change this status later with the ICD Desktop Accessory.

**CLEAR** erases all of the partition information entered.

**DEFAULT** causes the program to calculate and enter the default partitions, clearing anything that had been entered. It will produce the smallest number of equally sized GEM partitions.

**SPLIT** allows you to divide the drive into from 1 to 64 equal partitions. You will be prompted for the number of partitions.

**MAX** will produce as many GEM partitions of maximum size as possible. Any remaining disk space will be placed in an additional GEM partition.

**OLD** will restore the partition information to the initial values.

The **TOS** button will initial display the version of TOS in your computer. If you have TOS 1.4 or above, you can click on this button to toggle between TOS 1.2 and your version. Since TOS 1.4 allows bigger GEM partitions, it is possible to format a drive with TOS 1.4 that will not be accessible on a computer with earlier versions of TOS. This button is provided to allow you to format drives that will be compatible with all versions of TOS.

**MEGS** and **SECTORS** determine how the available space, excess space, and partition sizes will be shown. **MEGS** is millions of bytes, not megabytes (1048576 bytes). Drive manufacturers use these units instead of true megabytes, so the formatter uses them to be consistent.

> **Note:** Since the **MEGS** value is rounded to two decimal places, it is possible to show 0.00 excess space while still having up to 18 sectors unallocated. To make sure that you use every available sector, switch to **SECTORS** before partitioning.

If you have a printer connected to the computer and turned on, you can click the **PRINT** button to print your partition information. This can be very useful if your partition sector gets corrupted. Using the **Write Partition Sector Only** feature described later, you can enter these values from the printout and possibly recover your data.


*Figure 5–10*


*Figure 5–11*


*Figure 5–12*

CANCEL takes you back to the main menu, ignoring any changes you have made to the partition screen.

QUIT exits the program without making any changes.

PARTITION ENTIRE HARD DISK writes the partition information you have entered to the partition sector of the hard drive. It will also write the boot, FAT, and directory information to each partition, so that TOS will be able to use the partition for storage.

WRITE PARTITION SECTOR ONLY writes the partition information you have entered to the partition sector of the hard drive, just as the previous command does. It does not write any boot, FAT, or directory information to these partitions. This option should only be used if the drive has previously been partitioned with exactly the same partitions. This allows recovery from a damaged partition sector. It will not recover from damaged boot sectors. Cleanup ST!, available separately, will allow you to save partition and boot sectors to floppy diskette and restore them should they be damaged.

REBUILD ONE PARTITION ONLY allows you to write the boot sector, FAT, and directory information for an individual partition. This is useful if the partition has been damaged beyond the point that the **ZERO** function of the Hard Disk Utilities Program can handle, or if the partition has been used with a non–GEM operating system and you wish to use it as a GEM partition. The





partition sector and the other partitions will not be changed, but all data on the selected partition will be destroyed.

You will be returned to the main menu after fully partitioning the drive or just writing the partition sector.

If you wish to format another drive, click on rescan from the main menu. Click on **QUIT** to exit the program.

The program will attempt to relog the partitions through the boot software. If this fails the program will reboot the computer.

## Setting Up the Desktop

After formatting the drive you need to add icons to the desktop for the partitions. Without these icons, the partitions will be there, but you will not be able to get to them from the desktop.

If there is no icon for partition C you must add one. Click on the icon for A and choose **Install Disk Drive ...** from the **Options** drop–down menu (figure 5–10). Change the drive letter to "C" and the name to whatever you wish to use for this partition. Click on **Install** (figure 5–9), then move the new icon to the position you desire on the desktop.

If you use the ICD Desktop Accessory, the name entered at this point will only be used if the partition does not have a volume name.

Repeat this procedure for each partition on the drive, incrementing the letter used each time. Once you have added drive icons for all partitions, save this desktop by selecting **Save Desktop** from the **Options** menu (Figure 5–10). This will write a **DESKTOP.INF** file to drive C that will be used whenever the computer is booted with the hard drive active, whether from floppy or from the hard drive.

To boot directly from the hard drive, see the section entitled "Setting Auto-boot" in chapter 5.

# Chapter 6

# The ICD Hard Disk Utilities Program

The ICD Hard Disk Utilities program performs three functions: it allows you to easily set or clear the auto–boot status of your hard drive, clear one or more partitions, map out bad sectors on the drive, and configure the ICD Hard Disk Driver.

## The Main Menu

Run the ICD Hard Disk Utilities program by opening the ICD Host Adapter Disk and double-clicking on **HDUTIL.PRG**. You will see the main menu (Figure 6-1). From this menu click on the function you wish to perform.

> **Note:** The screens in this chapter were taken from the program running on a monochrome monitor in high resolution. If you are using a color monitor, your display may vary slightly. The program may also have been changed since the manual was written. Some of the displays may be different. Look for a **README** file on one of the diskettes for information on possible changes.

## Enabling and Disabling Autoboot

Auto–boot allows your system to boot directly from the hard drive. This eliminates the need for a boot floppy diskette and lets you get the system up more quickly.

To enable auto–boot, click on **Boot** from the main menu. If you wish to boot from a partition other than C, click on that partition (Figure 6–2). In most

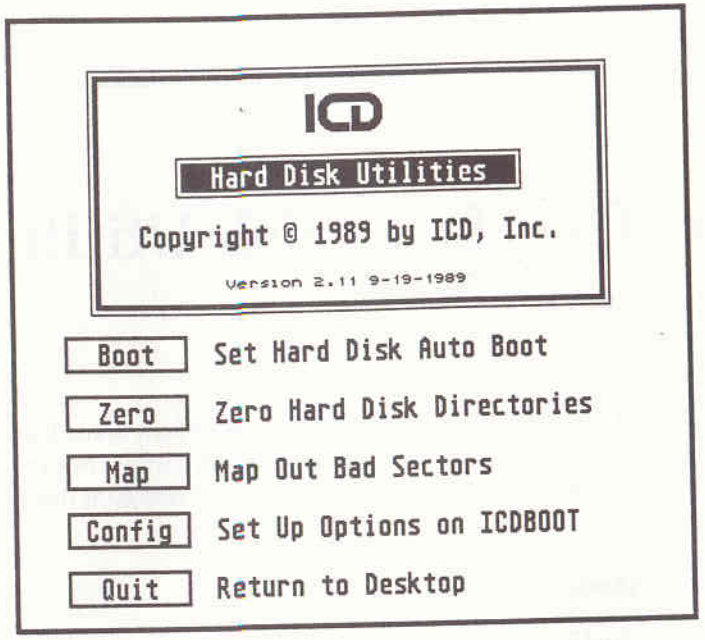



*Figure 6–1*

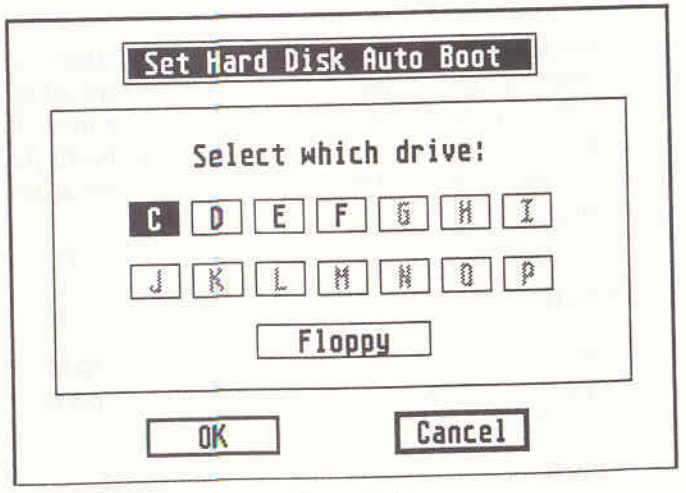



*Figure 6–2*





cases you will wish to autoboot from C. Make sure you have the ICD ST Host Adapter disk or another floppy with **ICDBOOT.PRG** in the **AUTO** folder in drive A and click on **OK**. You will be prompted to be sure that you have the proper disk in A. The boot sector of the partition will be changed, and the **ICDBOOT.PRG** file in the **AUTO** folder of A will be copied to the root directory of the partition and named **ICDBOOT.SYS**. When this is done you will be returned to the main menu.

You should *not* have **ICDBOOT.PRG** in the **AUTO** folder of partition C. If you do, the Hard Disk Utilities Program will delete it.

To disable auto–boot from hard drive and allow normal booting from floppy, simply run the **HDUTILS** program, click on **Boot**, click on **Floppy**, and click on **OK**.

> **Note:** If you wish to boot from floppy only on occasion it is not necessary to disable boot from hard drive. Simply hold down the **control**, **shift**, and **alternate** keys simultaneously while booting the computer. This will bypass auto–boot temporarily. On some newer computers it is necessary to wait for the floppy drive access light to come on before pressing these keys. To be able to access the hard drive after booting from floppy you must run the program **ICDBOOT.PRG. Putting ICDBOOT.PRG** in the **AUTO** folder on the floppy will do this automatically.

If you will not need to access the hard drive you can simply turn off the hard drive and boot off of floppy. This is useful for booting copy-protected games.

## Clearing the Directory of a Partition

The option to zero (clear) a hard drive directory allows you to quickly initialize a partition without having to reformat the drive or alter the other partitions on the drive in any way. This will write a new directory to the partition and clear the File Allocation Table (FAT) of the partition.

To zero a directory, run the **HDUTIL** program and click on **Zero**. Then click on one or more drives (partitions) you wish to clear (Figure 6–3). You may only select valid GEM hard drive partitions. Once you have selected the drive(s) desired, click on **OK**.


*Figure 6–3*

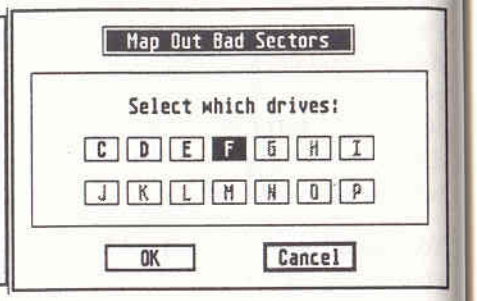



*Figure 6–4*

**Warning:** It will be very difficult if not impossible to recover data from a partition initialized in this way. Make sure that you have copied everything you wish to keep before running this option!

## Mapping Out Bad Sectors

Any bad sectors a new drive has should be mapped out during the formatting process. As a drive ages, though, it may pick up additional bad sectors. The **Map** option of the Hard Disk Utilities program will check partitions for bad sectors and mark those found in the File Allocation Table (FAT).

Click on **Map** from the main menu to search for bad sectors on one or more partitions. Then click on the partition or partitions you wish you search (Figure 6–4). You may select more than one. Clicking on a selected partition will deselect it.

Then click on **OK** to begin the test. Every sector of the selected partition(s) will be read. Any that are found to be bad will be recorded and marked as bad in the FAT.

**Note:** The ICD Hard Disk Utilities program will record up to 200 bad sectors and map them out. Any over 200 will not be mapped out. If your drive has more than 200 bad sectors, it is likely that there is something wrong with your hard drive system. Cleanup ST!, a hard drive recovery program also available from ICD, will map out more bad sectors.





The **Map** feature of **HDUTIL.PRG** will only read each sector once and will only work for GEM partitions. For sectors that are sometimes good and sometimes bad, or for bad sectors in partitions used by alternate operating systems, a more thorough test is needed. ICD's Cleanup ST! will perform extensive testing of bad sectors in addition to many other disk maintenance functions. This program is available separately, directly from ICD or from fine dealers everywhere.

## Configuring the ICD Hard Disk Driver

The ICD Hard Disk Driver, starting with version 4.0, contains many user–configurable features. Its chapter explains the purpose of each of these features and how changing them can affect system performance. This section describes how to use the ICD Hard Disk Utilities program to modify this configuration.

Click on **Configure** to modify the driver configuration. Choose the program you wish to modify: the **ICDBOOT.PRG** in the **AUTO** folder of drive A (**A:\AUTO\ICDBOOT.PRG**), the **ICDBOOT.SYS** in the main directory of your C partition (**C:\ICDBOOT.SYS**), or a driver of your choosing through the item selector. If you choose the **ICDBOOT.PRG** on drive A, make sure that you use a backup of the supplied diskette. A file chosen with the **Selector** option must exist and be a valid copy of **ICDBOOT.PRG**, though the name may be different.

The first option is **Display status messages**. A check mark in this box means that sense code and media change messages will appear in the upper right–hand corner of the screen.

**Enable write verify** means that everything written to the drive will be read back to make sure it was written correctly. Disabling this feature will double write speed but will not allow catch potentially damaging write errors.

**Enable read caching** and **Enable write caching** will turn on these features. See the next chapter for details of these features.

Use the up and down arrows to modify **Maximum logical sector size**. The **In system:** to the right of this choice shows the current maximum sector size in your system. This only needs to be changed if you have a removable media drive or another drive that is occassionally connected, and only then if the largest sector size on those drives exceeds the current.

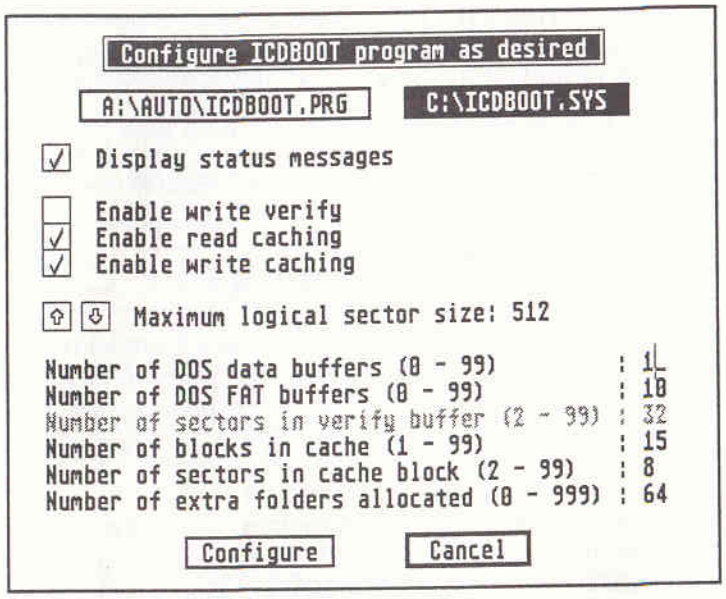



*Figure 6–5*

**Ram Used** shows the amount of memory that will be used by the driver for buffers when active. Click on **Recalculate** to update this number after making changes.

At the bottom, **Skip SCSI IDs** (not shown in figure 6–5) shows which IDs will be ignored by the driver and all ICD software. Some non–drive DMA devices, such as printers and emulators, do not respond properly to some SCSI commands. By clicking on the IDs of those devices, you can prevent these commands from being sent to those devices.

The remaining fields may be modified using the standard GEM editing keys: **ESC** to clear a field, **TAB** to move to the next field, and the arrow keys to move among and within the fields. Note that you will not be able to modify **Number of sectors in verify buffer** if write verify is disabled. The chapter on the driver describes what these various fields are for.

Click on **Configure** to write the changes. An item selector will appear with the name and path of the file you chose to modify as the default. If you wish to save the same file, simply click on **OK**. If you wish to save this modified





file as a different one, then use the item selector to set the name and path. Click on **Cancel** if you decide not to save this new configuration.

Click on **Exit** to quit. If the changes have not been saved, they will be abandoned.

## Quitting the Program

Click on **Quit** from the main menu to exit the program. If you have modified the configuration of an ICD Hard Disk Driver file, you will be asked if you wish to reboot the computer and put the new configuration into effect.

Chapter 7

# The ICD Desktop Accessory

The ICD Desktop Accessory allows you to turn hard drive partitions on and off, change the volume names, and swap the partitions around. It also puts the volume names of the partitions under their icons on the GEM desktop. Use of this accessory can greatly enhance the utility of your hard drive system.

## Purpose

There are several situation in which the ICD Desktop Accessory will prove useful.

The most obvious is for hard drive systems (with one or more hard drives) with more storage space than can be used under the ST's limit of 14 partitions. Up to 128 partitions (64 per drive) may be used with the ICD Hard Disk Driver, though only 14 may be available at any given time. With this accessory, you can select which 14 are available and change these as you desire. Up to 256 megabytes (512 megabytes with TOS 1.4) can be accessed.

The ICD Desktop Accessory allows you to turn off individual partitions, preventing them from being accessed. This should provide protection from most viruses and small children.

Partitions may be swapped, allowing completely different hard drive configurations to be enabled quickly and easily.

Partition volume names are placed under the appropriate icon on the desktop, so that swapped partitions are easily identified, and icon names can easily be changed.

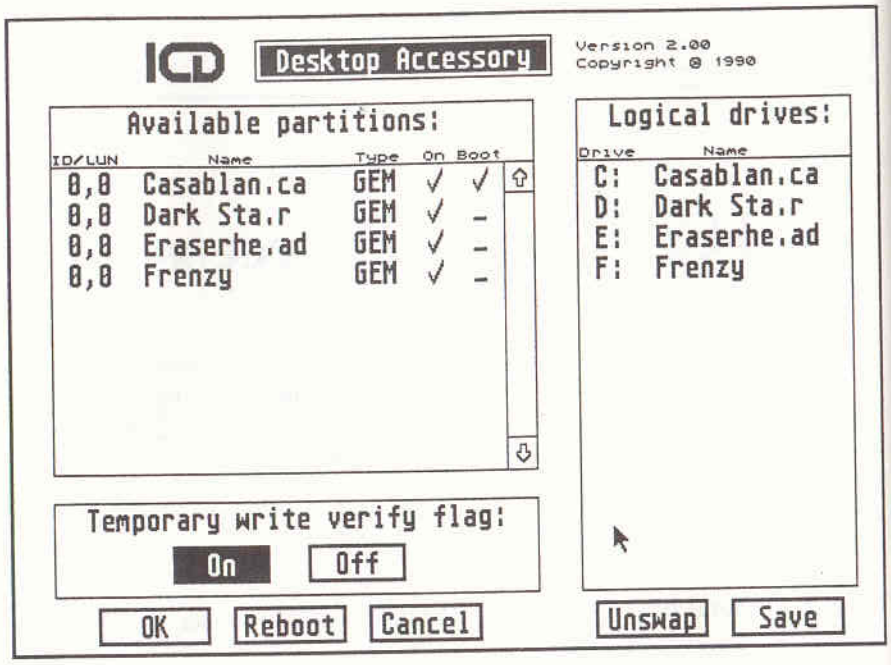



*Figure 7–1*

## Requirements

The ICD Hard Drive Desktop Accessory requires an ICD ST or AdSCSI ST host adapter, one or more hard drives, and version 4.8.0 or later of the ICD hard disk driver. Your version of this accessory may be newer than that covered in the manual and may require a higher version of the hard disk driver. Be sure to check the disk for text files (with either a TXT or DOC extension) describing changes to this and other programs.

While the accessory will run on a computer with only 512K of RAM, it will not leave much room for other programs. One megabyte of RAM or more is recommended.





## Installation

Simply copy the file **DESKTOP.ACC** to the main directory of drive C and reboot your computer. If you are using MultiDesk from Codehead Software, you may place the program anywhere and load it into Multidesk. You may also run the accessory as a program with MultiDesk. Check the MultiDesk manual for details.

## Usage

When first loaded into memory, the ICD Desktop Accessory will scan your hard drive partitions for volume names. These are the names that will be given when a **Show Info...** (from the desktop's **File** menu) is performed on the partition's icon. Note that spaces are allowed in the volume names, but the **Show Info...** function will only show the characters before the first space. The full volume names will still be used by the Desktop Accessory.

The Desktop Accessory will put these names, if found, under the appropriate icons on the GEM desktop. These names will be used instead of those in the **DESKTOP.INF** file (in the main directory of partition C). The names in the **DESKTOP.INF** file will be used for any partitions without volume names. If you save the desktop after the accessory has changed these names, the volume names will be saved in the **DESKTOP.INF** file.

To access the Desktop Accessory, select it from the **Desk** (or Atari symbol) menu. The accessory will scan your system for available partitions, then show the main menu (figure 7–1).

> **Warning!**If any files are open when the accessory is accessed, swapping partitions could lead to corrupted data. You should be *absolutely certain* that no files are open if you swap partitions with the Desktop Accessory while an application is running. You may rename partitions from within an application without danger.

## Renaming Partitions

To rename a partition, click on its name under **Available Partitions**. Once in **Rename** mode, you can move from one partition name to another with the TAB or cursor (arrow) keys, clear them with the ESC key, and perform other

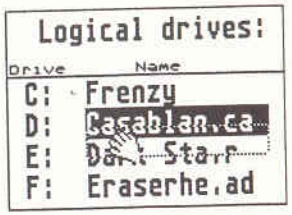



*Figure 7–2*

standard GEM editing functions. Clicking anywhere else or pressing the RETURN key will exit "Rename" mode. Volume names are supported for only GEM and BGM partitions.

Any character you can type can be used in the volume name, including little musical notes, Atari symbols, arrows, and Bobs.

## Enabling and Disabling Partitions

To enable or disable partitions, click in the **On** column under **Available Partitions**. A check mark (✓) means that the partition is enabled; an underbar (_) means it is disabled. Clicking on either character will change it to the other.

Any disabled partitions will be skipped by the hard disk driver. Only the first 14 enabled partitions will be accessible.

Disabled non–GEM partitions *should* be ignored by the programs that use them, but they may not be. Since alternate operating systems control all hard drive access, there is no way of forcing them to ignore disabled partitions if they don't do it themselves.

## Partition Boot Indicator

Partitions enabled to boot will have a check mark (✓) in the **Boot** column. This can only be changed with the Hard Disk Utilities Program, *not* with this desk accessory. It is shown here for your information only. Note that you may have multiple bootable partitions, but the system only acknowledges the *physically* first enabled one found (swapping will be ignored).





## Partition Swapping

To swap partitions, click on and drag (by holding down the mouse button) any partition name under **Logical Drives** to the position you want it to occupy (figure 7–2). The mouse pointer will turn into a hand to show that swap mode is active. If you just click in the **Logical Drives** area, the hand pointer will be enabled. To leave "swap" mode, press the RETURN key or click anywhere outside **Logical Drives**.

To restore the partitions to their physical order, click on **Unswap**.

To permanently save a new swap order, click on **Save**. The new swap order is written to the ICDBOOT.SYS file on the first physical GEM partition enabled.

## Write Verify and Cache Switching

The **Write Verify** and **Write Cache** (not shown in figure 7–1) sections show the current status. If either of these features is not permanently enabled in the hard disk driver (see **The Hard Disk Utilities Program** and **The ICD Hard Disk Driver**) you will not be able to turn them on here. If, however, they are enabled, you may turn them on and off by clicking on the appropriate button.

Turning off either feature this way will not free the memory the hard disk driver has allocated for them. It will simply disable them.

## Other Functions

Click on **Cancel** to prevent any changes made from taking effect, including those made by the **Save** function (by rewriting old values if necessary), and exit the accessory.

The **Reboot** button allows you to reboot the computer after making changes, relieving you of the need to hit the **RESET** button on the back of the computer. You will be prompted to make sure that you really wish to reboot. If you have not saved your changes, you will be asked if you wish to do so. If you do not save any changes made, they will not be in effect after you reboot.

Remember that, if you swap another partition to C, the AUTO folder, desk accessories, and DESKTOP.INF on that partition will be used when you

reboot. It is a good idea to have DESKTOP.ACC on that partition so that you can swap back when you are done.

### Compatibility

Many applications are configured to work on certain partitions and to look for support files in specific locations. After swapping partitions, many applications may not work correctly, since their configuration no longer matches the way the partitions appear. These should be reconfigured if you wish to use them with swapped partitions.

Programs that access the hard drive directly through the DMA port, rather than through normal TOS calls, may also have problems. This should only occur in hard disk formatting and related programs.



# Chapter 8

# The ICD Hard Disk Driver

The ICD Hard Disk Driver, ICDBOOT, is the most advanced available for the Atari ST. In addition to providing the basic hard drive interface and autoboot functions, the ICD Hard Disk Driver provides several unique features that make it the fastest and most versatile available. When used with an ICD AdSCSI ST or AdSCSI Plus ST host adapter, it also allows the use of the full SCSI command set.

### Disk Caching

A "disk cache" is RAM (Random Access Memory) set aside to increase the effectiveness of hard drive access. The ICD Hard Disk Driver allows you to set up a cache and use it for reads, writes, or both.

### Read Caching

Read caching is performed by reading an additional number of consecutive sectors after the one(s) requested. It is likely that the next few read requests will come from these sectors. They will have already been read from the hard drive, so they can be read from the cache instead. Since reading consecutive sectors in one operation is much faster than independent disk accesses for each sector, read caching can speed up disk read operations by several orders of magnitude.

Read caching is not effective when large numbers of sectors are being read at one time. Whenever a group of sectors larger than a cache block (see the section in this chapter entitled "Cache Blocks") is requested by the computer's operating system, the read cache is bypassed.

Read caching is most effective when single bytes or small groups of bytes are read from a track or cylinder. Database, file allocation table (FAT), and directory accesses will show noticeable improvement.

## Write Caching

Write caching works similarly to read caching. Write operations involving fewer sectors than the size of a cache block are held in memory until one of two things happens: the block is the least recently used and another is needed (see "Cache Blocks"), or a delay of about half a second has elapsed since the last hard drive operation. Then the block is written to the disk. The write after inactivity prevents data from being lost due to system reset or power loss.

When write caching is disabled, all writes go directly to the drive as they are sent by TOS to the ICD Hard Disk Driver.

As with read caching, write caching is bypassed when the number of sectors being written exceeds the size of a cache block.

> **Note:** When write caching is enabled, it is *very* important to wait a second after the last disk access before resetting or turning off the computer for the cache to be written.
>
> When using auto folder programs that rename or copy files (such as *Desk Manager* from Little Green Footballs) and programs that reboot the computer when first run (such as *Shadow* from Double Click and many recoverable ramdisks), the write cache should be disabled (by hitting the escape key) to preventing rebooting before the cache is written.

Write caching is most effective when dealing with FATs and directories. To see read and write caching at its best, create a temporary folder and copy 200 or so files to it. Then delete the directory. Since all of the disk activity in the delete operation deals with FATs and directories, most of it will occur in the cache.





## Cache Blocks

The cache of the ICD Hard Disk Driver, used by both the read cache and the write cache, is divided into cache blocks. Each of these cache blocks is used for a separate cache operation.

The size of the cache blocks determines the minimum number of sectors that will be read for any read operation and that will be saved before a physical write (unless the delay expires as described in Write Caching).

Increasing the block size will decrease drive access time to a point, though the benefits will diminish. Block sizes larger than average read and write operations will provide little improvement. Block sizes approaching or exceeding the number of sectors on a cylinder may actually slow down access due to head movement. The best block size can be determined through experimentation.

The number of cache blocks influences the length of time that the data in a cache block can remain in memory. When all cache blocks are full and another is needed, the one least recently read from or written to will be flushed (either discarded or written to disk) and used for the new data.

The number of cache blocks needed for best performance depends on individual usage. This, too, can be determined through experimentation. Having more cache blocks allocated than will be used will just wastes memory, but having too few allocated will diminish the effectiveness of the cache.

You should also keep your system memory resources and needs in mind when setting up the cache block size and number of cache blocks. Each sector in each cache block will use a half kilobyte of memory, so 32 sectors per cache block and 16 cache blocks would take 256K of RAM, an acceptable amount in a Mega 4 but a bit tight in a 1040 ST and almost unusable in a 520 ST.

## Write Verify

Only the ICD Hard Disk Driver provides full write verify. Write verify is accomplished by reading back everything that is written to hard disk and comparing that to the original data. If this test fails a "<Write Fail #xxxx>" will appear in the right-hand corner of the screen. The number will increment with each successive error. *Write failures indicate that a problem exists,*

probably a bad sector. Running the "Map out bad sectors" option of the Hard Disk Utilities program or, better yet, Cleanup ST! will remove bad sectors from the list of those available. Ignoring these messages will probably lead to loss of data at best.

Write verify may be installed or removed in two ways. The first is to hold down the ESC key when booting your system. This will disable all of the extra features of the ICD Hard Disk Driver. The second is to use the Hard Disk Utilities program to permanently turn on or off this feature. The previous chapter describes this option.

If write verify is installed in the boot driver, it may be turned off and on with the system write verify flag, which also determines whether or not write verify will be used on floppy diskettes. This write verify flag may be changed with the ICD Hard Disk Accessory (see the chapter with the same name) and many other programs. The differences between this method and the previous are that floppy write verify will also be changed and that the memory allocated to the write buffer will still be allocated to the boot driver.

With the Hard Disk Utilities program you may also set the number of physical sectors allocated for the verify buffer. This is the maximum number of sectors that may be written before the data is read back from the drive into this buffer. Making this buffer larger will always increase write speed, though the effectiveness diminishes.

Ideally this buffer should be the size of the largest writes regularly performed. Anything larger will have little effect, since the full buffer will not be needed for most writes. A smaller buffer will cause writes of this size to be delayed, since the write must be interrupted after the allocated number of sectors for verification.

The best size for this buffer depends on many factors, included the way that the drive is used and the amount of memory available. Through experimentation you can, if you choose, find the best value for your purposes.

Enabling write verify will also slow down your hard drive writes by about 50%.





## Maximum Logical Sector Size

TOS limits each partition of a hard drive to 32768 sectors (65536 with TOS 1.4). Since sectors on a hard drive are 512 bytes, this limits partitions to 16 megabytes each (32 megabytes with TOS 1.4). To get larger partitions Atari introduced AHDI version 3's *logical sectors*. ICD has implemented and improved this system.

Logical sectors are made up of one or more physical sectors (those found on the drive itself). The operating system treats the these logical sectors as it did physical sectors under previous formatting schemes. The limit on sectors per partition is the same, but the sectors are now larger. Logical sectors of up to 8192 bytes are now acceptable, allowing partitions up to 256 megabytes, 512 megabytes with TOS 1.4 and above. This allows a total of 3.5 *gigabytes* (3584 megabytes) of active hard drive storage (7 gigabytes with TOS 1.4 and above). Using the ICD Desktop accessory (see the chapter describing this desk accessory), up to 32 gigabytes (32768 megabytes) can be accessed by the system (64 gigabytes with TOS 1.4 and above). This should be enough disk storage for most applications.

The ICD Hard Disk Driver allows you to specify the maximum logical sector size the system will be able to access during the current session. The actual value used will be this number or the largest sector size in a partition in the system when booted. The maximum needs to be set in the boot driver only when using removable media devices and there is a chance that a cartridge will be put in the device after boot with a logical sector size exceeding any that were in the system when booted.

Changing the logical sector size will affect the amount of memory allocated for DOS data buffers and DOS FAT buffers. Each of these buffers is the size of one logical sector. The cache is defined in physical sectors, so the logical sector size will not affect this at all.

## TOS Data Buffers

The ICD Hard Disk Driver allows you to increase the TOS data buffers by a specified number. These allow TOS to keep data in memory instead of retrieving it from disk. Even with the cache active it still takes some time to read the data into the buffers each time it is needed. Increasing the TOS data buffers will allow more data to be kept at hand and can speed up drive access

measurably. To few or too many buffers can hurt access time. The best value can only be determined though experimentation, since it depends on the type of drive access you do.

## TOS FAT Buffers

TOS FAT buffers may also be increased. These act as the data buffers do but are used for FAT sectors only. Increasing FAT buffers can increase drive access quite a bit. While experimentation will show the best value, the number of FAT sectors in one partition is probably close. There are approximately four FAT sectors per megabyte, so a 16 megabyte partition would have about 64 FAT sectors.

## Extra Folders

One of the major problems with TOS before version 1.4 is known by many as the "40 folder bug". TOS uses a buffer for every folder accessed. The problem is that it is unable to clear old buffers. They all stay in use. When more folders are accessed than buffers are available serious problems occur. TOS 1.4 fixes this, clearing old buffers to make room for more folder accesses.

The ICD Hard Disk Driver allows you to increase the number of folder buffers allocated. Each of these takes up 128 bytes. This can be used with older versions of TOS to avoid the folder problem.

## Disabling Caches and Buffers

Holding down the ESC key while booting will disable read and write caching, the extra TOS buffers, and any folder buffers over 64 for that session only. This is useful for memory intensive programs. The next time you boot all of the features will again be set the way you configured them.

## Hard Drive and Controller Status Messages

Another unique feature of ICDBOOT is the reporting of messages from the controller (or embedded drive). These are reported as **<Sense: $*xx*>**, where *xx* is a hexadecimal number, or as words that describe the message.

These messages may be disabled with the ICD Hard Disk Utilities program.





**<Disk Change>** indicates that a cartridge has been changed in a removable media device. The drive is relogged at this point so that the new information is presented.

The rest of the messages are given simply as numbers. The following is a list of these and their meanings for several drives. These are not standardized, so they may mean something different for your drive. Adaptec controllers, for example, have different definitions.

**$01** No index/sector signal.

**$02** No seek complete.

**$03** Write Fault. The operation was terminated with an unrecovered error condition probably caused by a flaw in the medium. This indicates that there is a problem, probably a bad sector. You should run a program like Cleanup ST to check for and map out bad sectors.

**$04** Drive Not Ready.

**$05** Drive Not Selected.

**$06** No Track Zero Found.

**$10** ID or CRC Error.

**$11** Unrecovered read error of data blocks. The operation was terminated with an unrecovered error condition probably caused by a flaw in the medium. This indicates that there is a problem, probably a bad sector. You should run a program such as Cleanup ST to check for and map out bad sectors.

If this message appears while you are running Cleanup ST but no errors are reported by the program, then there are probably bad sectors that have already been mapped out. Similarly, any program that reads sectors without checking to see which are marked bad in the FAT may cause this message to appear, although there is no problem.

If new bad sectors begin to appear and it becomes necessary to map them out often, there is probably a problem with the hard drive mechanism.

| | |
|---|---|
| **$12** | No address mark found in ID field. |
| **$13** | No address mark found in data field. |
| **$14** | No record found. |
| **$15** | Seek positioning error. |
| **$17** | Recovered read data with controller/drive READ retries. |
| **$18** | Recovered read data with controller/drive error correction code. |
| **$19** | Defect list error. |
| **$1A** | Parameter overrun. |
| **$1C** | Primary defect list not found. |
| **$1E** | Recovered ID with controller/drive ECC. |
| **$20** | Invalid command operation. |
| **$21** | Illegal logical block address (LBA). Address greater than the LBA returned by the read capacity data with PMI bit not set in CDB. |
| **$22** | Illegal function for device type. |
| **$24** | Illegal field in CDB. |
| **$25** | Invalid logical unit number (LUN). |
| **$26** | Invalid field in parameter list. |
| **$27** | Write protected. |
| **$29** | Power on or reset or bus device reset occurred. |





| | |
|---|---|
| **$2A** | Mode select parameters changed. |
| **$30** | Incompatible cartridge. |
| **$31** | Medium format corrupted. |
| **$32** | No defect spare sector available. |
| **$40** | RAM failure. |
| **$44** | Internal controller error. |
| **$45** | Select/reselect failed. |
| **$46** | Unsuccessful soft reset. |
| **$49** | Inappropriate/illegal message. |

## Removable Medium Drive Support

The ICDBOOT driver also supports removable medium drives. When the cartridge or disk is changed, the driver recognizes this the next time the drive is accessed, a **<Disk Change>** message is flashed in the upper right-hand corner of the screen, and the drive is relogged. If the new cartridge or disk has more partitions than the previous, these are added after the currently logged partitions. Be sure to wait for the drive to spin up and initialize before accessing the new cartridge.

# Chapter 9

# Using Your Hard Drive

**Note:** It is assumed in this chapter that your hard drive is already assembled and formatted. If not, see the chapter on assembly and the chapters "The ICD Disk Formatter" and "The Hard Disk Utilities Program" before reading this chapter.

Connecting your hard drive to your Atari ST or Mega computer is very easy. You may place it anywhere the cable will reach. Longer cables are *not* recommended.

Once you have positioned the hard drive where you want it and have made sure that everything is turned off, connect the 19–conductor Hard Disk cable to the computer in the port on the rear labeled "Hard Disk". This is the only port on the computer into which the cable will fit. Figures 9–1, 9–2, and 9–3 show the locations of the port on the 520ST, 1040ST/ 520STFM, and Mega computers. The other end of this cable should be connected to the "In" port on the host adapter.

If you already have a device connected to the Hard Disk port of the computer, such as a laser printer or another hard drive, and this other device has a Hard Disk "pass–through" port, you can connect the hard drive to that port instead of the computer's port. You may also connect most other devices to the "Out" port on the host adapter.

**Note:** There is a practical limit of three devices that may be connected to the Hard Disk port. The actual number for your system may be higher or lower depending on several factors, such as the length and quality of cables and the design of the hard drives and other devices connected.

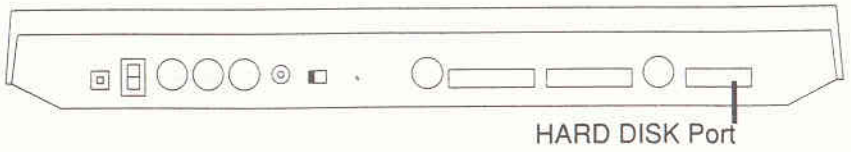



*Figure 9–1*

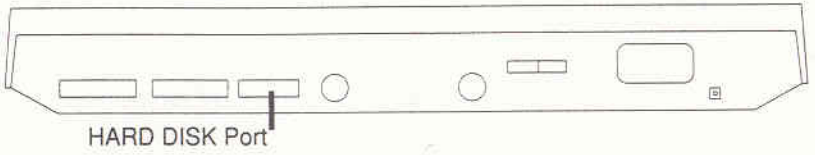



*Figure 9–2*

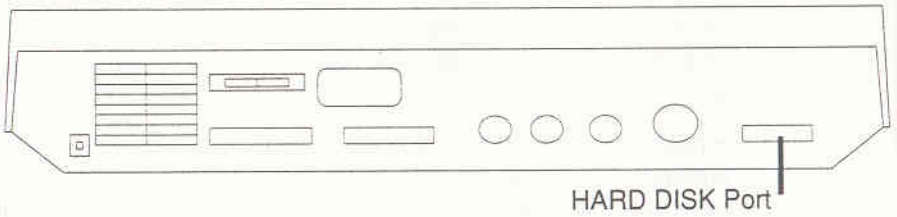



*Figure 9–3*

Once you have connected the Hard Disk cable, *make sure the power switch on the hard drive is in the OFF position*. Then connect the AC power cord to the hard drive case and a grounded AC outlet.

## Turning Everything On

It is important to power up devices connected to the Hard Disk port in the proper order. You must turn on the first device (the one closest to the computer) and work your way out to the last device. After this is done and all devices have initialized (their activity lights have gone off), you may boot your computer.





## Booting from the Hard Drive

The hard drive will boot whether or not there is a floppy diskette in drive A (if automatic booting has been enabled with the Hard Disk Utilities Program). However, the computer will boot a little faster and the light for drive A will not stay on if there is a diskette in the floppy drive. For these reasons it is a good practice to keep a floppy diskette in drive A. Any formatted diskette will do. If you do boot without a diskette in drive A, you can make the drive light turn off at any time by placing a diskette in the drive.

Turn on the hard drive. You will have to wait a few seconds for the drive(s) to reach speed and initialize. The red light on the front of the case is the power light and should light up immediately when you turn on the power. The green lights are access lights for the hard drives. If you only have one hard drive in the case then only the green light on the right will be active. You should avoid turning off the power to the drive or computer or resetting the computer while either of the green lights is on. This could damage the data on the drive.

Once the green lights stop flickering (if it does) and stay off, turn on the computer.

## Using the Hard Drive

After booting you will see two or more additional icons, labeled 'C' and up. These are hard drive *partitions*. A partition is simply a part of a hard drive that acts as an independent drive. You can use these hard drive partitions just as you would floppy diskettes.

Since these hard drive partitions are much larger than floppy diskettes, it is a good idea to spend a little time thinking about how you want them organized. This will make files much easier to find once the drive starts filling up.

If you simply choose to copy files to the main directory of your partitions, you will soon find that the drive will hold far less that its potential and that finding specific file can be very difficult. Use folders. Folders keep the number of files shown at one time lower, making it easier to find an individual file. Folders also allow you to keep similar files together. It is a good practice to create a folder for each application or group of applications

and keep all related files in this folder. This will keep the main directory of the partition from getting cluttered. You will only see the files related to that application when the folder is being displayed.

For example, if you use a word processor, you can create a folder named "WORDPRO". Then you can copy all related files for the program into the proper folder. You may also wish to create folders for different documents types ("LETTERS", "PAPERS", etc.) and other topics within the WORDPRO folder.

Even if you organize your desk well there may still be times when you can't find a particular file. The **WHEREIS.TOS** program included on the ICD ST Host Adapter diskette can help you find files quickly by searching all folders on all partitions. See Appendix A for details.

## Booting from a Floppy Diskette

There will probably be times when you will wish to boot from a floppy diskette rather than from the hard drive. If you will not need to access the hard drive during the session, you can simply leave the hard drive turned off and the computer will boot from floppy as usual.

If, however, you wish to boot from floppy diskette and still access the hard drive, you have two options. The first is to boot with the hard drive turned off as described above. Then turn on the hard drive and run the program **ICDBOOT.PRG** by double–clicking on it. This program can be found in the **AUTO** folder of the ICD ST Host Adapter diskette. The **DESKTOP.INF** file will not be loaded from drive C, so you will probably see only the A and B drive icons. If you are using a color monitor, you may use "**Set Preferences**" from the "**Options**" menu to change screen resolutions. This will read the **DESKTOP.INF** file from the hard drive. If you are using a monochrome monitor, you will have to use the "**Install Drive**" function of the desktop to access the hard drive partitions.

The second option is to use a diskette with **ICDBOOT.PRG** in the **AUTO** folder. Turn on the hard drive, wait for it to initialize, then turn on the computer while holding down the CONTROL, LEFT SHIFT, and ALTERNATE keys simultaneously. If you have a computer with the newer "blitter–compatible" ROMs, you should wait until the floppy drive access light comes on before pressing these three keys. The **AUTO** folder from the floppy





diskette, not partition C, will be used, but the **DESKTOP.INF** file from C will be used, and the accessories on drive C will be loaded.

Please note that these two methods do not accomplish the same thing. The first will not use anything from drive C (since C is not accessible when the computer boots) while the second will use the Desktop configuration and desk accessories from the hard drive.

## GEM Limitations

The GEM operating environment imposes some restrictions on the use of a hard drive. The Desktop cannot display more than 400 items in all open windows. Any over this limit will not be displayed.

The main directory of a partition can contain a maximum of 256 entries (including both files and folders). However, there is no arbitrary limit to the number of entries a folder may contain.

You may have a maximum of 14 icons representing hard drive partitions on the GEM Desktop (C – P).

## Parking the Hard Drive

All ICD FA•ST Hard Drives feature auto–parking. This means that when the drive is turned off, the heads are moved to a safe place so that a shock will not cause them to come into contact with the surfaces of the drive. If you also have in your system a drive that does not auto–park, you should park the heads of that drive before moving the drive unit. The program **MAKEPARK.PRG**, found on the ICD Host Adapter diskette, allows you to create a **PARK** program to do this. See Appendix A for details.

It will *not* harm an auto–parking drive to park it. However, this is unnecessary. This is why **MAKEPARK** allows you to select which drives to park.

## Backing Up Data

Because such a large volume of programs and data may be stored on a hard drive, it is very important that you back up this data. A buggy program or an untimely power surge could destroy some or all of the information on a hard drive. To minimize this damage, you should back up your drive often.

You can simply copy the files to floppy diskettes and store these in a safe place. You can do this "manually" from the desktop or use one of the available commercial or public domain backup programs. These programs help automate the procedure. It will still take a long time to back up a hard drive to floppy diskettes, but the drive needs to be backed up often. Failure to do this could lead to irreversible loss of data.

An alternative is the ICD FA•ST Tape Backup. This unit backs up your hard drive at better than 6.5 megabytes per minute. It features both file and image mode backup, individual file recovery, and blazing speed.



# Appendix A

# Utilities

The ICD ST Host Adapter disk contains a few utilities and demonstrations of other products that you may find useful.

## ICDTIME.PRG

When executed, this program will read the time and date from the clock in the drive and set the computer's system time and date. The program will then remain memory resident. Any time the system time is changed (legally), as with the control panel accessory, the clock in the drive will also be set to the new value.

## TIMESET.PRG

When run, this program will read the time and date from the clock in the FA•ST Hard Drive and set the computer's internal time and date. This program does not remain resident in memory. If you use this program instead of ICDTIME.PRG changing the time with the control panel will not affect the clock in the drive. Some programs have problems running with memory-resident code. TIMESET.PRG is supplied so that you may still use the drive clock even if you are using a program that conflicts with ICDTIME.PRG.

## COPYFIX.PRG

One of the problems with the ST operating system is that the time and date of a file are updated when the file is copied. On all other known systems the time and date stay the same. This memory–resident program insures that the time and date of a file are preserved when the file is copied. If you are using TOS 1.4 or later, you do not need this program, since this has been

corrected. This program is in the AUTO folder of hard drives assembled and formatted by ICD. If you do not wish to preserve the time and date of a file when it is copied, simply delete this file. As with ICDTIME.PRG, some programs have trouble working with this program present. If you are having problems, you may remove this program from the AUTO folder (or just change the extension to something other than "PRG") to see if it is in conflict with the application.

## IDCHECK.PRG

IDCHECK will scan the DMA bus for SCSI devices and report the name of each found. This is useful when connected multiple devices or when diagnosing problems.

## RATEHD.PRG

RATEHD will test each drive connected to the computer and report the calculated average access time and data transfer rate. Since manufacturers often calculate their published data in tests that favor their equipment, this program was produced to allow objective testing and comparison of drives. This program can also be used with the format program to find the best interleave for your drive.

RATEHD bypasses TOS and any drivers, so the results are not influenced by caches or buffers.

## MAKEPARK.PRG

MAKEPARK scans for SCSI devices and will generate a program to park those selected. After running the program, select the devices you wish to park and click on "PARK". A program named PARK.PRG will be generated in the current directory.

To park the selected drives, double–click on the program PARK.PRG.

Note that many drives park themselves. You do not need to park these with this program.





## COLDBOOT.PRG

COLDBOOT will cause the computer to reboot when run. This program is designed to be put in the AUTO folder of a floppy diskette kept in drive A when booting your computer system. If your hard drive fully follows SCSI specifications, it will not boot the first try after being turned on. Having COLDBOOT in the AUTO folder of A will cause the computer to reboot from the hard drive.

If you turn on your computer and hard drive at the same time from a power strip, COLDBOOT in the AUTO folder of a floppy diskette in drive A will cause the computer to reboot until the hard drive is up to speed.

## BOOTFIX.PRG

Because of a problem is TOS, some embedded SCSI hard drives will not boot the first time after being powered on (as described above). Since the Apple® Macintosh® has the same problem, some drive manufactures have included options in their drives to overcome this. **BOOTFIX.PRG** will program Quantum and Seagate drives to boot the first time. Just run it once; the changes are stored in the drives.

## WHEREIS.TOS

One of the few problems with owning a hard drive is the ease with which you can lose a file. With several partitions and dozens of folders, it is easy to forget where a particular file is. WHEREIS will search all folders on all partitions for a file matching the specified mask.

To run the program, simply double–click on it. You will be prompted to enter the search mask and any desired options. Typing HELP at this prompt will show the syntax and options of the program.

The search mask can be any valid file name with or without wildcards ( * or ?).

When running the program from a command shell, you may pass the file mask and options on the command line.

# Appendix B

# Troubleshooting

Every effort has been made to insure that assembling a hard drive system with the ICD ST Host Adapter will be easy and trouble free. However, with any assembly project problems may arise, especially given the large variety of configurations possible. The following is a list of possible problems and their most likely solutions. If you have a problem that is not listed here, or if the suggestions do not solve your problem, then contact us at 815-968-2228 or by modem on our BBS (815-968-2229), GEnie (ICDINC), or CompuServe (76004,1600).

*Nothing happens when I turn on the hard drive. The fan does not spin, the drive does not spin, and the red LED on the front of the case does not light.*

Check the power cord at the back of the case and at the wall outlet. Check the power cable connection at the ST Host Adapter and make sure that it is centered and firmly connected.

*The fan spins but the drive does not.*

Make sure the power connection to the drive is firmly in place.

*The green drive access LED comes on when I turn on the drive and never goes off.*

Check the cables between the controller and drive and make sure they have not been inverted at either end.

*When I turn on my hard drive, the light flashes a few times. Then it won't work.*

Chances are your drive or controller has failed an internal self test. You should take the drive back.

*When booting from the ICD ST Host Adapter floppy diskette, the message* "Clock not found!" *is printed on the screen, even though my hard drive is connected properly.*

Check to make sure that the 19 conductor cable between the computer and the ICD ST Host Adapter is connected properly. Check to make sure that power is being properly provided to the ICD ST Host Adapter. Make sure that the 50 conductor ribbon cable between the STHA and the controller or drive is connected properly and is not inverted at the drive. Check to make sure that power is being properly provided to the controller or drive.

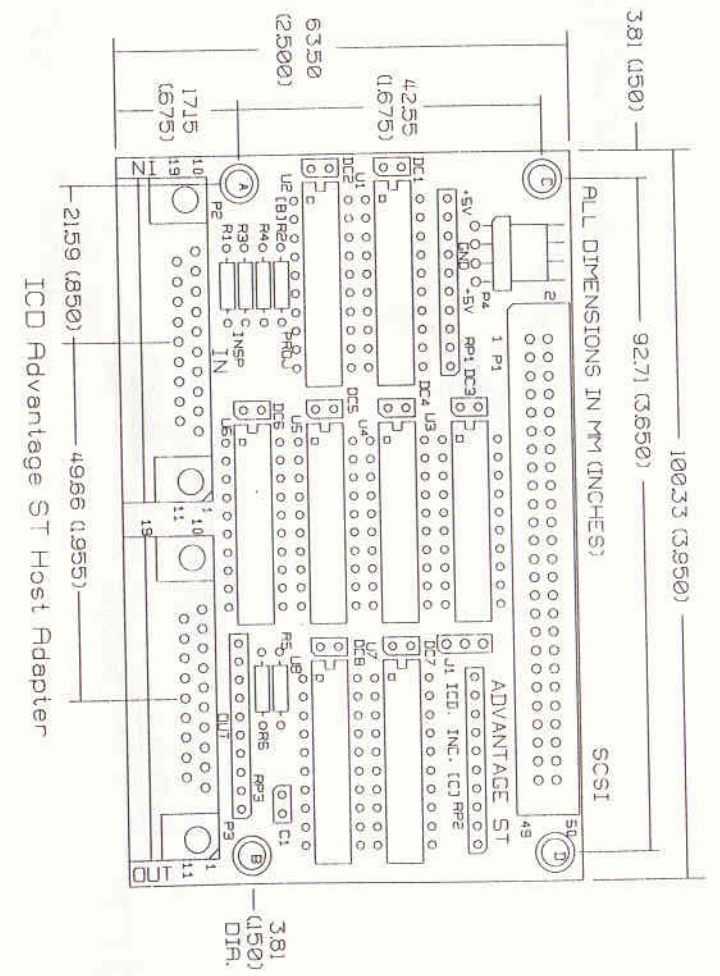
*When attempting to format the drive I immediately get a* "Drive timeout encountered while attempting to configure drive" *message.*

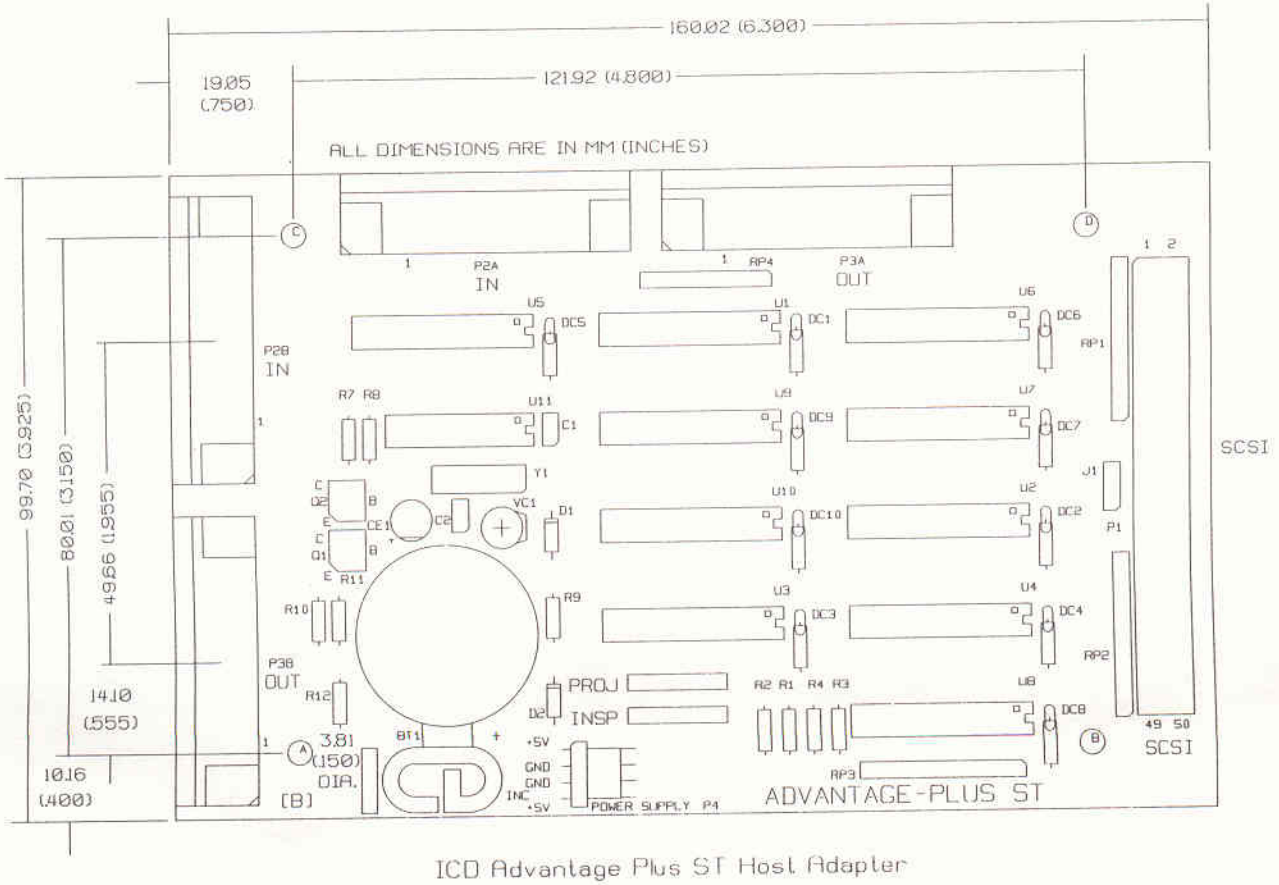
There are many things that can cause this message. Check the 50 conductor SCSI cable between the ST Host Adapter and the controller or embedded drive, insuring that it is properly oriented, that there are no shorts, and that all of the connects are good. Make sure there is power being properly applied to the controller and/or drive. Check the SCSI ID of the controller/embedded drive and make sure that it is the same you gave the formatter. Check the cables between the controller and drive if applicable.

*When attempting to format the drive, I get a* "Sense Code: *X*" *error.*

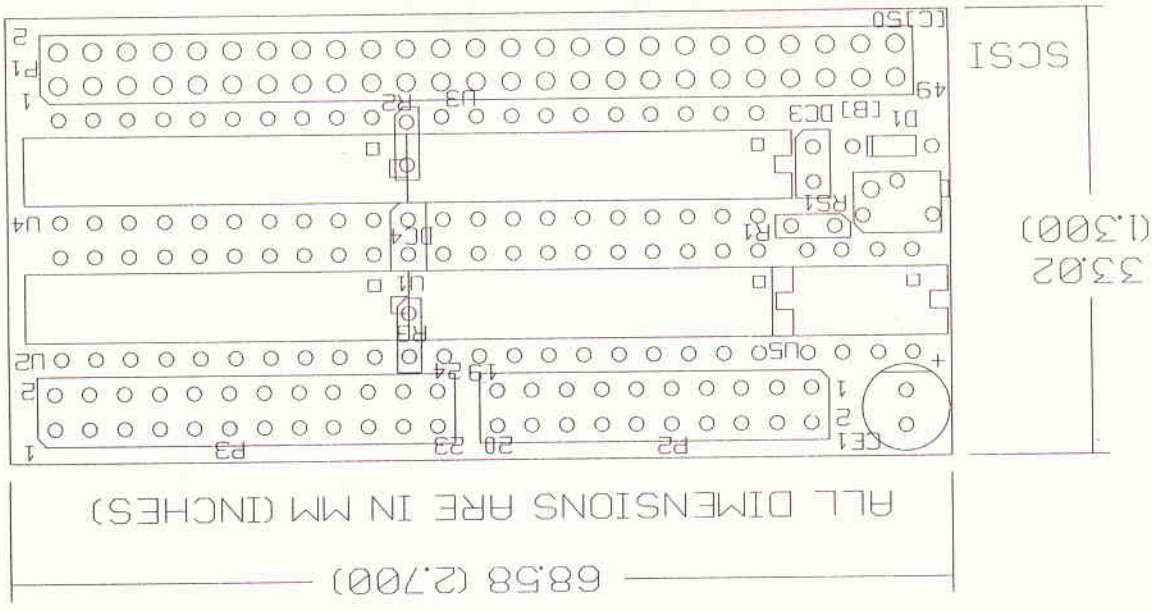
If X is 0 or 127, see above. If it is some other value, check the documentation for that particular drive or controller to see what this error means. These values vary from manufacturer to manufacturer.








ICD Advantage Plus ST Host Adapter




ICD Advantage Micro ST Host Adapter

ICD Incorporated
1220 Rock Street
Rockford, IL 61101
USA

(815) 968-2228

ICD Europe GmbH
Am Goldberg 9
6056 Heusenstamm
West Germany

06104-6403

36-90