

# Hard Disk Encyclopedia



# **Jasmine Hard Disk Encyclopedia**

**Jasmine Technologies, Inc. • 1740 Army Street • San Francisco, CA 94124**

**Sales: (800) DIREC 2 U • Customer Service: (415) 282-1111**

**Technical Support: (415) 282-9555**

**This manual is copyrighted with all rights reserved. Under the copyright laws, this manual may not be copied, in whole or part, without written consent of Jasmine Technologies, Inc. Under the law, copying includes translating into another language or format.**

**© Jasmine Technologies, Inc., 1988  
1740 Army Street  
San Francisco, CA 94124**

**July 1988**

<b>Preface</b>	Welcome to Jasmine v How to contact us v A word of thanks v
<b>Introduction</b>	About This Manual vi Acknowledgments vi An overview vii
<b>Chapter 1</b>	<b>Hard Disk Basics 1</b> For the novice 1 Getting started 4 Copying files onto your hard disk 4 Some precautions 5 Copy protected software 6
<b>Chapter 2</b>	<b>Folders and File Systems 7</b> Using folders to organize your hard disk 7 Hierarchical File System 8 Macintosh File System 9 Partitioning software 10 Using Find File 10
<b>Chapter 3</b>	<b>Backing Up 13</b> The facts of life 13 Backing up to a tape drive 14 Backing up to another hard disk 14 Backing up to 800K disks with the Finder 14 Using a backup utility 15
<b>Chapter 4</b>	<b>Configuring Your System 17</b> The System file and the Finder 17 The current startup disk 17 Replacing the system files 17 Setting the startup application 19 Installing fonts and desk accessories 19 The Font/DA Mover 20 Installing desk accessories in an application 20 Rebuilding the Desktop file 20

# **Contents**

---

<b>Chapter 5</b>	<b>A Technical Peek Inside 23</b>
	The Small Computer System Interface 23
	The SCSI bus 23
	SCSI ID numbers 24
	SCSI bus terminators 25
	Platters and heads 25
	Tracks and sectors 26
	Formatting and interleave 26
	The disk driver 28
	Files and the disk directory 28
	Fragmentation 29
<b>Chapter 6</b>	<b>Useful Utilities 31</b>
<b>Chapter 7</b>	<b>Troubleshooting 33</b>
<b>Chapter 8</b>	<b>The Raising of the Dead, Part II — a file and disk recovery tutorial by Steve Costa 35</b>

### **Welcome to Jasmine**

---

Greetings! We are pleased that you have chosen a hard disk from Jasmine Technologies, Inc. Jasmine is a leading supplier of affordable, high-quality products that enhance not only the power and usefulness of your Macintosh but also your own enjoyment and productivity. We are confident that you will be pleased with your purchase.

### **How to contact us**

---

Our commitment to high quality includes our service as well as our products.

For customer service, call (415) 282-1111 from 8:00 AM to 5:00 PM (Pacific Time) on Monday through Friday. Our customer service representatives will be able to check on the status of orders that you have already placed. For sales, call (800) DIREC 2 U. Our sales staff would be delighted to tell you about our products or to take an order.

For technical support, call (415) 282-9555 from 9:00 AM to 5:00 PM (Pacific Time) on Monday through Friday. Our technical support staff stands behind all our products with accurate, timely, and courteous answers to your questions. And if we don't know an answer, we'll do our best to find out!

An excellent way to provide us with feedback is through our technical support electronic bulletin board system, which is on-line 24 hours a day. This BBS is also a means for us to distribute updated versions of our proprietary software. The BBS number is (415) 648-1269. It is a modem-only line; set your modem to either 300, 1200, or 2400 baud.

Please address written correspondence or shipments to

Jasmine Technologies, Inc.  
1740 Army Street  
San Francisco, CA 94124.

### **A word of thanks**

---

Once again, thank you for joining Jasmine's world of quality products at affordable prices. Enjoy your Jasmine disk and keep in touch with us. We like to hear from our customers, as your suggestions help us continue to be a leader in the Macintosh market. We have many new and exciting products in the works.

## About this guide

---

This manual is a compendium of useful information for Jasmine hard disk owners. It covers topics relevant to any Jasmine hard disk drive. If your Jasmine drive is your first hard disk, plan to spend some time looking through this Encyclopedia. It includes essential information about copying files, using folders, backing up, and configuring your system. Experienced hard disk users — as well as novices — will be interested in the chapters dealing with technical aspects of hard disks, useful utilities, troubleshooting, and file recovery. We encourage you to make use of this Encyclopedia because the more you know about your hard disk, the better you will be able to use and enjoy it.

For information specific to *your* Jasmine hard disk, refer to the accompanying Owner's Guide. It will tell you how to set it up or install it in your Macintosh, how to start up and shut down your system, how to use the drive with other SCSI devices, how to take care of it, what software is included with it, and how to use the Jasmine utility software. The Guide also contains Jasmine's policy on software upgrades, the warranty for your drive, and instructions on how to return your drive for service.

Both manuals assume that you are already familiar with basic Macintosh concepts such as pointing and clicking the mouse, choosing commands from menus, opening applications and documents, and copying files. If you have just bought a Macintosh and a Jasmine hard disk, we suggest that you first go through the tutorials in the Macintosh manual.

## Acknowledgments

---

This manual was written, edited, and composed by Jackie Taylor, Gordon Smith, Thom Benge, and Mark James using an Apple Macintosh™ and an Apple LaserWriter Plus™.

We are indebted to Nell Anders, Jack Benge, Arthur Britto, Alan Brunner, Steve Costa, Christian Jacobsen, Marcia Mason, Keith Moreau, Michael Shapiro, Bryan Speece, Tim Standing, and Kirk van Druten for their technical and editorial contributions. George Spicer Bredehoft deserves our special thanks for his invaluable contributions.

And, of course, special thanks to Apple for giving us the Macintosh.

## **An overview**

---

This Jasmine Hard Disk Encyclopedia is organized as follows:

Chapter 1, "Hard Disk Basics," covers fundamentals such as what a hard disk is, what its advantages over 800K disks are, and how to copy files onto it.

Chapter 2, "Folders and File Systems," explains how to use folders to organize the files on your hard disk and increase the efficiency of your disk. It also discusses the two file systems, MFS and HFS, that the Macintosh uses to manage files.

Chapter 3, "Backing Up," discusses the importance of backing up the files on your hard disk to protect against losing them.

Chapter 4, "Configuring Your System," deals with the System file and the Finder. It discusses changing the current startup disk, replacing the System and Finder, setting the startup application, installing fonts and desk accessories, and rebuilding the Desktop file.

Chapter 5, "A Technical Peek Inside," covers topics such as SCSI (the Small Computer System Interface), how a hard disk works, and how to cope with file fragmentation.

Chapter 6, "Useful Utilities," is a short list of some software of interest to hard disk owners, with brief descriptions.

Chapter 7, "Troubleshooting," discusses some common hard disk problems and what to do about them.

Chapter 8, "The Raising of the Dead, Part II" is a tutorial on how to recover files and disks that have been corrupted by a system malfunction. This chapter is a reprint of an article written by Steve Costa for the Berkeley Macintosh Users Group Newsletter and appears in this manual courtesy of BMUG and Steve Costa.



# Hard Disk Basics

This chapter covers basic information about your Jasmine hard disk: what it does, what its advantages are, and how to copy files to it. It's a good place to start if you have just bought a Jasmine hard disk and are wondering what to do with it.

### For the novice

---

Here are some questions and answers for first-time users:

#### ***What does a hard disk drive do?***

It stores information for use with your Macintosh computer.

#### ***What kind of information?***

Three kinds, really. There are "documents" containing information you create, such as a letter you write or a picture you draw. Then there are the "applications" with which you create your documents — programs such as MacWrite and MacPaint that instruct the Macintosh how to act like a word processor or an electronic easel. Finally, there are "System files," information that tells the Macintosh how to be a Macintosh.

#### ***I've heard of "software" before. What does it mean?***

"Software" refers to any information in a form that a computer can use. Applications like MacWrite and System files are examples of software. "Hardware" refers to the actual equipment — like the Macintosh and your Jasmine hard disk — that manipulates the information.

#### ***I thought that a Macintosh had its own memory to store information in.***

Actually, the Macintosh has two kinds of built-in memory: ROM and RAM.

#### ***What's ROM?***

The ROM, or "Read-Only Memory," contains much of the information that makes a Macintosh act like a Macintosh. Essentially, the ROM gives the Mac its "personality." The information in the Macintosh ROM is permanent. It can't be changed, and it stays there when you shut down. As an example, the instructions that tell the Macintosh how to move a window are in ROM.

### ***What's RAM?***

The RAM, or "Random Access Memory," is where the Macintosh stores information it's currently using. The information in RAM is temporary. It can be created, altered, or deleted through applications or System software and it goes away when you shut down. As an example, when you are writing a short letter, the application you are using stores the text in RAM. Everything you see on the Macintosh screen is in RAM. When you save information to hard or floppy disk, the information in RAM is written to the disk.

### ***If the Mac has ROM and RAM to store information, why did I buy a hard disk?***

A disk provides something that neither ROM nor RAM does: storage for changeable information that you want to keep after you shut down. For example, you may want to store a letter after you write it so that you can edit it tomorrow. You can't use ROM because you can't change what's stored there. You can't use RAM because of its "volatility," which means that information stored there disappears when you turn the power off.

### ***Can't I use those little plastic-covered disks for that kind of storage?***

Yes. A floppy disk (sometimes called "3.5 inch disk", "800K disk", or "floppy") holds files of information — documents, applications, and system software — that the Macintosh can use. When the Macintosh needs information — like the letter you wrote yesterday — it "reads" it from the disk into RAM so you can edit it. When you save the letter after you are finished editing, it "writes" the new version of the letter from RAM back to the disk.

### ***So how is a hard disk different?***

Hard disks can store much more information than a floppy disk, and the Macintosh can read and write to them much faster.

### ***How much more information?***

The floppy disks that the Macintosh currently uses hold up to 800K of information. Even the smallest Jasmine hard disk holds about 20,000K, or 25 times as much.

### ***What's a "K"?***

"K" stands for "kilobyte," which is enough storage space for about one thousand characters of text. The exact number is 1024; because computers use a binary number system instead of our usual decimal system, they prefer  $2^{10}$  to  $10^3$ . Another common unit of storage capacity is the "Megabyte." It is often shortened to "Meg." That's 1024K, or enough space for about one million characters. A "twenty-meg" hard disk holds about 20,000K or about 20,000,000 characters.

***So I can put all my files on one disk instead of on all those floppies I've been using?***

That's right. All the applications you like to use can be together on a single disk. Your documents from months ago are right at your fingertips. And you only have a single set of system files to configure. All your fonts and desk accessories are always where you want them.

***Do you mean that I only need one System Folder to use with all my applications?***

Correct. You should only have one System Folder on your entire hard disk, no matter how large the drive is. If you have more than one System Folder, you risk damaging your data. (The one exception is a disk that is partitioned with Jasmine's DiskWare™ software, which is discussed in Chapter 2.)

***Is there a catch?***

You can't carry a hard disk in your pocket. (Yet.)

***Ha-ha.***

More seriously, to make a high-capacity, high-speed hard disk it's necessary to attach the motor directly to the spinning platter on which the information is magnetically stored. You can't "eject" the disk — it's fixed in the drive. If you fill up a hard disk, you can't just insert another one. You can transfer some files to floppy disks or DC-2000 tape cartridges to free up space on the disk. Or, you can buy another (or a larger capacity) hard disk drive.

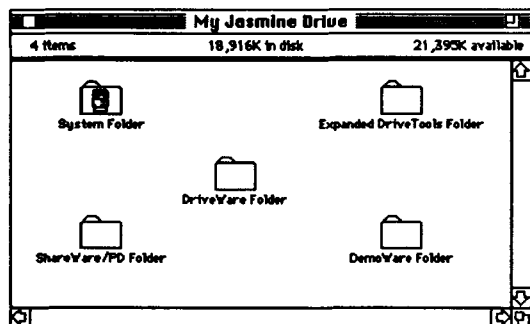
***One last question. What's "scuzzy" about my hard disk?***

A SCSI (pronounced "scuzzy") disk is one which uses the Small Computer System Interface, an industry-standard way for peripheral devices to communicate with small computers. The first hard disks for the Macintosh, back in the days of the original Macintosh and the Macintosh 512, were slow "serial" disks which attached to a slower serial port on the back of the Macintosh. All Macintoshes since the introduction of the Macintosh Plus have SCSI ports for high-speed hard disks and other devices.

## Getting started

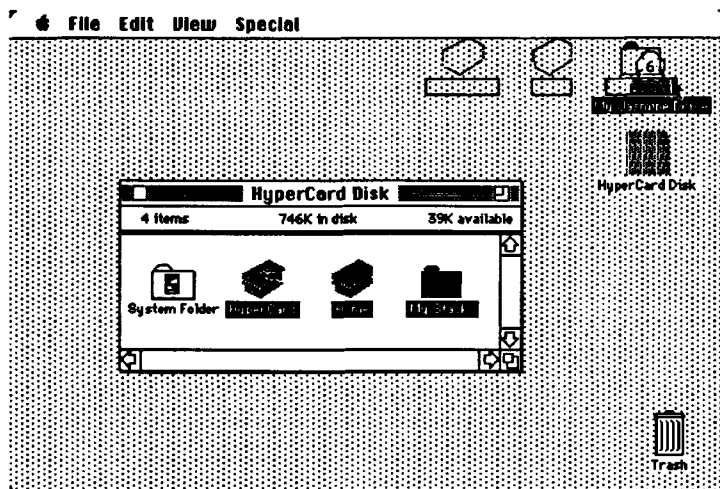
To get started using your Jasmine hard disk, please refer to the accompanying Owner's Guide to find out the following information about your particular drive:

- How to set it up and connect it to your Macintosh;
- How to start up your Macintosh from it, and how to shut it down;
- What software should be on the drive.



When you start up from the hard disk, the familiar desktop will appear with the icon for the hard disk in the upper-right corner. It has a distinctive appearance so that you can tell it's a Jasmine hard disk. The icon behaves like an icon for an 800K disk. Select it and type in a name. Then open it into a directory window by double-clicking the icon. Notice the large amount of disk space available on your hard disk drive.

## Copying files onto your hard disk

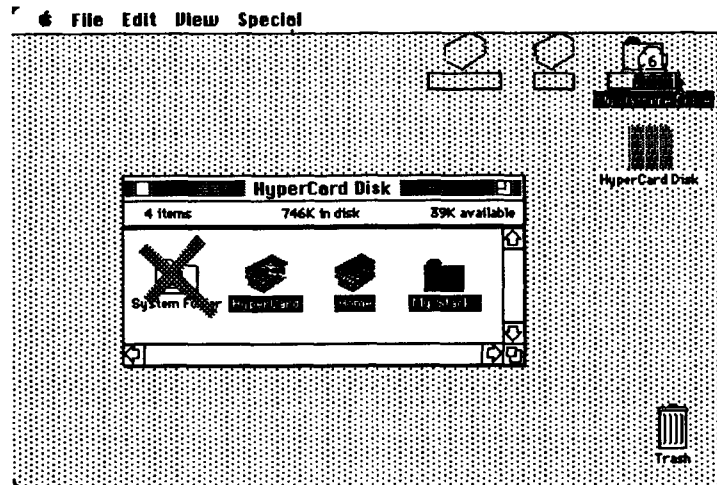


Copying files to and from a hard disk is essentially the same as copying files to and from a floppy disk. For example, to copy files from a floppy disk onto your hard disk, first insert the disk and double-click its icon to open its directory window. Select those files and folders you want to copy. (Remember, you can select more than one file or folder by dragging a selection rectangle around them or by Shift-clicking them.) Drag them onto the hard disk icon and release the mouse button when the icon becomes highlighted.

A dialog box shows you the progress of the copy. You can also drag the icons directly into a directory window on the hard disk — or onto a folder in a directory window — rather than onto the hard disk icon.

## Some precautions

There are a few precautions you need to be aware of when you copy files onto any hard disk.



- Never have more than one System and Finder on a single volume.

A hard disk, a floppy disk, or a true SCSI partition of a hard disk is considered a Macintosh volume. Multiple true SCSI partitions, which can be created on your Jasmine hard disk with Jasmine DriveWare, are treated as separate hard disks. For more information on True SCSI partitions, see Chapter 2.

The System file and the Finder, which are usually found in the System Folder, are crucial files that the Macintosh needs to access frequently. Having more than one System and Finder is virtually certain to confuse both you and your Macintosh. Don't even think about doing it! (The only safe way is to partition the disk into multiple volumes with Jasmine's DriveWare™ software, or other software that creates true SCSI partitions as discussed in Chapter 2).

You must be careful not to inadvertently copy an extra System and Finder onto the disk. Even if they are in another folder (or are named differently) they can cause problems. If you do accidentally copy an extra set, drag them into the Trash and empty it.

- Drag files and folders — not other disks — onto your hard disk.

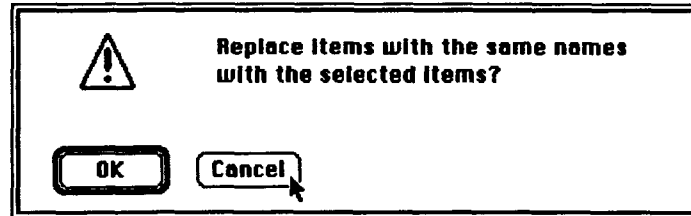
Dragging the icon of an 800K disk onto your hard disk is not a good idea. It will add the contents of the 800K disk to the hard disk. (It will be placed in a folder with the same name as the 800K disk.) Although this is a convenient way to copy the disk onto your hard disk, it is also a very easy way to inadvertently copy over an extra System file or Finder. You may not realize that the second set of system files is hidden inside the new folder until they have caused problems. If you are absolutely sure that the disk you are copying has no System or Finder, then it is safe to drag the disk icon to copy all the files.

Incidentally, you might have expected that dragging an entire floppy disk onto your hard disk would erase your hard disk. After all, dragging one 800K disk onto another 800K disk erases the second one and copies the first one onto it. The Finder treats hard disks differently in this case.

- Don't replace a folder unless you want to replace all the files inside.

When you attempt to copy a folder to your hard disk you may see the following alert box:

This is a warning that you already have a folder with the same name on the hard disk. *If you click OK, the entire folder will be replaced, even if it does not contain the same files.*



For example, suppose that on your hard disk you have a folder titled Graphics containing ten MacPaint files. On an 800K disk you have a folder titled Graphics with one SuperPaint file. If you copy this latter folder to your hard drive and click OK when the above dialog box appears, *the Finder will erase the Graphics folder and all ten MacPaint files before copying the Graphics folder with the one SuperPaint file.*

## Copy-protected software

---

Unfortunately, some software publishers still copy-protect their programs. Although the intent of copy protection is to prevent illegitimate copies, it also makes life difficult for hard disk owners. There are various ways in which copy protection can complicate matters:

- You may be able to copy a program to your hard disk in the normal way, but you will be required to insert the master disk each time you open the copy on the hard disk. (Or every tenth time, or once per hour, or whatever.) This scheme is annoying, but safe — it should not cause any problems with your hard disk.
- In some instances you may be able to copy a program to your hard disk in the normal way, but the program will intentionally damage the files on your hard disk when you run it. This may result in your having to erase the entire hard disk. Needless to say, read the manual carefully (before your purchase, if possible) and don't use such programs on your hard disk.
- A special installer may be provided that will copy the program to a hard disk some limited number of times. These schemes frequently lead to eventual software problems — sometimes subtle ones — on your hard disk. We recommend not using such installers.

Probably the best way to deal with copy-protected programs is to use a de-protecting program. There are utilities available which effectively remove copy protection from many commercial programs. Removing the protection is the best way to be sure that it won't cause problems! But please don't abuse these programs by making illegitimate copies for others. Software piracy is not only a crime; it's simply wrong.

# Folders and File Systems

This chapter discusses how you can use folders to organize the files on your hard disk and increase the efficiency of your Macintosh. It also explains the two file systems that the Macintosh uses to manage files.

## Using folders to organize your hard disk

The storage capacity of a hard disk is so great that it can easily hold hundreds — even thousands — of files. It's convenient to have all your applications and documents immediately available at a click of the mouse, but hunting for the one you want can be like looking for a needle in a haystack. It's not practical to have too many files displayed in a single window, unless you really enjoy scrolling.

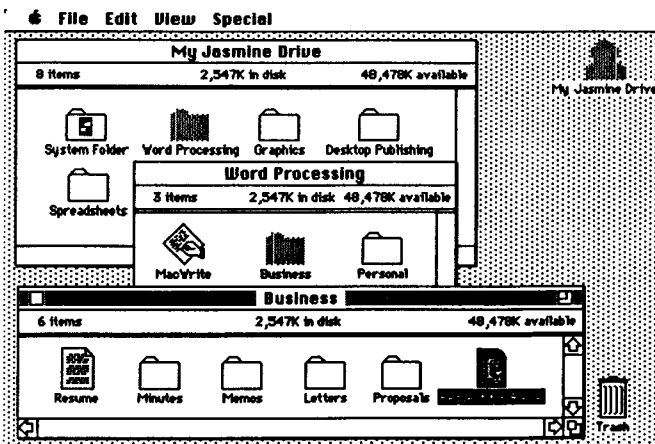


Word Processing

Folders provide a convenient way for you to group related files together, just like real manila folders do in a file cabinet. For example, you could create a folder called Word Processing and place all your word processing applications and documents in it.

That way you would know where to look when you need to revise that letter you wrote last week. Instead of all the separate file icons taking up space in the directory window, there is now only a single folder icon.

You can put as many files as you want into a folder. If you have a lot of them, though — say, more than ten — it's a good idea to organize them further by creating folders inside folders. For example, you could create Business and Personal folders inside the Word Processing one to categorize your work, and then proceed to subdivide each of these into smaller categories.



A folder can hold any combination of files and other folders. You can nest folders within folders into dozens of levels. But don't get carried away, or you will waste time opening too many folders to get the file you want. Half a dozen levels is a practical maximum.

There is no best way to organize folders — use whatever way makes sense for you. We have already suggested one scheme which organizes folders according

to the nature of particular tasks, such as Word Processing, Graphics, Desktop Publishing, Spread sheets, Databases, Programming, Entertainment, and so on. Another popular scheme is to organize folders around different applications; you might create a MacWrite folder, a MacPaint folder, etc. Or, you could devote a folder to each project you're working on, such as Business Plan or Great American Novel. After a little experimentation you will be able to create a folder hierarchy which best suits your needs.

If the concepts of creating and using folders are new to you, please read and become familiar with the relevant sections of your Macintosh Owner's Guide. If you have not used folders in the past to organize your files, you should start now. Using folders appropriately can save you time both in searching for files and in minimizing "desktop clutter." In addition, it can make your Macintosh perform more efficiently, as we discuss below.

## Hierarchical File System

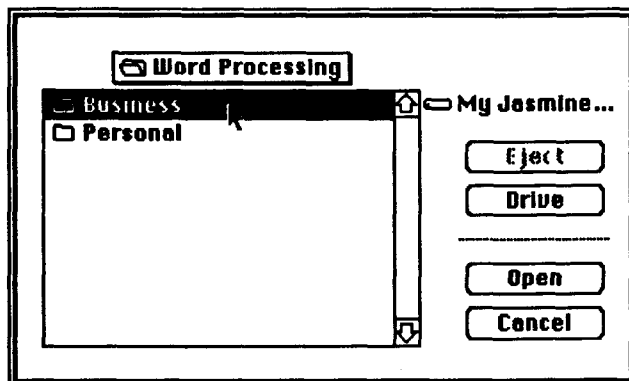
---

Managing hundreds of files can slow down your Macintosh significantly — unless you take advantage of folders. If you want to understand why folders speed things up, you will need a bit of background about Macintosh file systems. The file system software in the Macintosh ROM keeps track of what files are where on each disk that is on the desktop.

Current Macintoshes use a file system known as HFS, for Hierarchical File System. ("Hierarchical" refers to the fact that folders can nest inside other folders to create an organizational hierarchy.) The main feature of HFS is that it narrows the Macintosh's attention to the contents of one single folder at a time.

For example, if the current folder is Word Processing, the Macintosh can ignore everything in the Graphics folder and all the other folders outside the current one. Nor does it have to deal with what is inside subfolders like Business or Personal — it can treat each subfolder inside the current folder as a single item until one of them becomes the current folder.

The advantage of this scheme is obvious. The Macintosh isn't burdened with knowing at all times about each of the hundreds or thousands of files on a large disk. It deals with the few files and subfolders inside the current folder. The fewer files the Macintosh needs to manage, the faster it can operate.

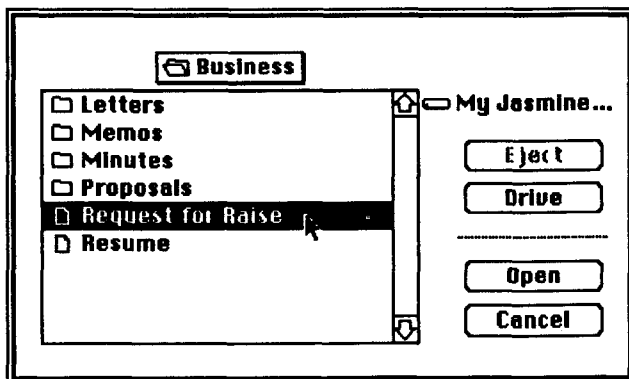


To see how this works, suppose you are using MacWrite and you decide to work on your request to your boss for a raise. When you choose Open from the File menu, the standard file dialog box appears. The directory title shows the name of the current folder, which we will suppose is Word Processing. The box below lists the items you can open in the current folder. Other than MacWrite itself (which MacWrite knows is not one of its documents), the only things in the Word Processing folder are the two subfolders Business and Personal, so those are what you see.

When you select the Business subfolder and click Open (or double-click Business), it becomes the current folder and you see only *its* contents. (See following page).

One of the files inside it is the Request for Raise document that you are looking for. Notice that you never had to scroll through all the files in Graphics or Personal or other irrelevant folders.





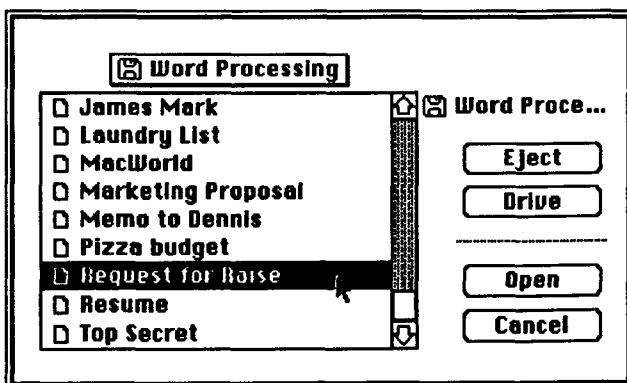
Incidentally, if you want to "back out" of the current folder, position the pointer on the directory title, and press and hold down the mouse button. A pull-down list will display the sequence of folders which contain the current folder. You can make any one of these current by choosing it. You could return from Business to Word Processing in this way.

## Macintosh File System

Early Macintoshes (specifically, the 128K and 512K models with the original 64K ROM) used a file system known as MFS (Macintosh File System). Like HFS, MFS allowed you to organize your desktop with folders; however, these folders were only for the sake of appearances. Unlike HFS, MFS required the Macintosh to keep track at all times of every file on a disk.

This was fine for the old 400K diskettes, which typically have only a few dozen files. In fact, even the newer Macintoshes still use MFS on 400K diskettes. However, MFS is unwieldy on 800K diskettes and completely impractical on hard disks. The Macintosh is overburdened with managing too many files and slows down unacceptably.

Consider the example in the previous section again, but suppose you are working from a disk using MFS. You are in MacWrite and you want to find your Request for Raise document. You choose Open from MacWrite's File menu and a file dialog box appears which displays an alphabetical listing of all the MacWrite documents on the disk.



There is no "current folder," and in fact no folders appear in the list. You have to browse through all the files on the disk to find the one you want. Although the Finder allows you to use folders for cosmetic organization, the MFS file system does not recognize them.

## Partitioning software

Back when MFS was the only file system for the Macintosh, some hard disk vendors offered utility software which would partition, or divide, their hard disks into multiple "volumes." Each volume could be mounted, or made to appear on the desktop, as though it were a separate disk. By mounting only the volumes that were needed, the remaining volumes were hidden from MFS. Since MFS then had fewer files to manage at a time, it worked much faster.


Hard disks can also be partitioned with the current HFS Macintoshes. If you have sensitive files stored on a hard disk, storing these files in a volume protected by a password would effectively limit access to authorized people only. If your hard disk is being used as a file server, the need for this type of setup is even more pronounced, as many people will be accessing the drive. Also, the speed of large capacity hard disks (say, 50 megabytes and above) will improve through partitioning, for essentially the same reason that using folders will speed up a disk. (See Chapter 2, "Folders and File Systems," for details on how this works).

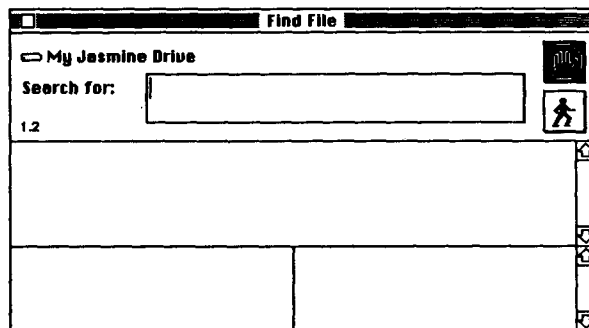
Apple's current standard for partitioning (referred to as *true SCSI partitioning*) defines fixed contiguous areas on the drive that will be treated as separate disks. The size is fixed once the partition is created. Since a partition must occupy a contiguous area of the hard disk, deleting a partition will necessitate remapping the remaining partitions to consolidate the free disk space. Under Apple standard, each partition can also have its own file system (HFS, MFS, UNIX, etc.), so there can be a separate set of system files on each partition. Applications that only run under an older System can be placed in a separate partition that contains that System version.

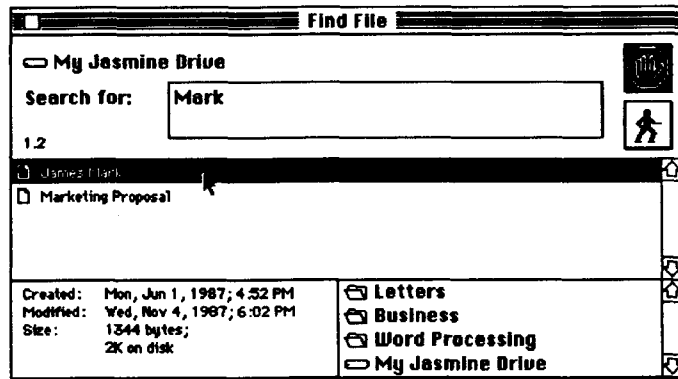
Jasmine DriveWare allows you to partition your Jasmine hard disk into true SCSI partitions that can be password-protected, write-protected, or manually mounted on the desktop (meaning that you can only put their icons on the desktop with DriveWare). Although these partitions physically reside on the same drive, the Macintosh treats them as independent volumes that are unrelated to each other. For example, using the Find File desk accessory to search one partition for a file will not find a file located in another partition.

## Using Find File

Sometimes you may lose an application or document by accidentally filing it in the wrong folder or by simply forgetting what folder you keep it in. There is no need to go through every folder by hand — the Find File desk accessory can find it for you. Here's how:

- Choose Find File from the  menu. The Find File dialog box appears:
- If the name of your hard disk isn't in the upper left corner, click the drive icon until it appears.
- If you want to limit the search to a particular folder, choose Search Herefrom the Find File menu; otherwise, the entire disk will be searched.





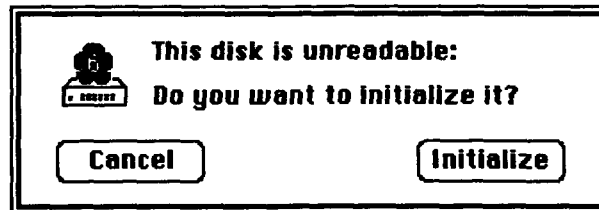
- Type the name of the file or folder you want to find (or any part of it) in the Search For box and click the running man icon (or press Return). The search will begin.
- Any files or folders whose names contain the characters you have typed will be listed in the middle panel as they are found. The Macintosh will make an alert sound when the search is complete. (It may take a few minutes to finish the search if you have hundreds of files. You can work in another window during the search.) Click the Stop icon to cancel the search.
- Click a file or folder in the middle panel to display the hierarchical path to it. (You don't have to wait until the search is complete.) The lower left panel shows when it was created and last modified, as well as its size. The lower right panel shows the folder hierarchy so you can find it.
- As an easier alternative, you can move the file (or folder) out of the folder it's in and onto the desktop by choosing Move to Desktop from the Find File menu. Later, you can use the Put Away command in the Finder's File menu to return the item to its folder.
- Click the close box to close Find File.

# Backing Up

This chapter discusses the importance of backing up your hard disk and various backup methods. For those of you who aren't familiar with the idea, backing up is the process of creating copies of your files on another disk in case the ones on your hard disk get damaged. Back up whenever you can't afford to restart your work from the beginning.

## The facts of life

The large storage capacity of a hard disk is one of its great advantages — when everything is as it should be. Its size is also one of its great disadvantages — when you have a malfunction and your whole disk suddenly becomes unreadable.



Here's the scenario: The directory was corrupted. All your files are lost. Weeks or even months of work have vanished. You didn't back up.

We hope that you are reading this chapter before you have experienced this scenario. If not, see Chapter 8 for a tutorial on file recovery. The author of the tutorial, Steve Costa, is alleged to have whispered "Real men don't back up their drives." Don't believe him! Steve can say this because he is an expert at recovering files. The rest of us, however, may not be as gifted. Besides, even an expert like Steve can't always recover lost files.

## ***Back up your hard disk!***

The facts of life in the Macintosh world are that its complex, rapidly evolving, synergistic software environment makes occasional crashes pretty much inevitable. Despite the best efforts of developers and the best intentions of users, the same qualities that make Macintosh software both powerful and fun make it somewhat fragile. We can all hope that this isn't some law of nature that will forever be true, but for now the sensible approach is to accept it, be prepared, and enjoy the wonderful machine that Apple has produced. If you value your work and you don't want to risk losing it, back it up. The more often, the better.

*Back up whenever you can't afford the time or expense involved in starting over.*

There are several methods you can use to back up:

## **Backing up to a tape drive**

---

Tape backup is a convenient method of backing up your hard drive, as it is relatively fast and effortless. Tape backup systems are fairly new to the Macintosh industry, and Jasmine was once reluctant to recommend tape as a method of backup. However, recent breakthroughs in tape technology have made this a highly reliable method of data archival that we can endorse. Unlike backing up with floppy disks, backing up with tape usually does not require the user to be present once the backup starts. Also, the compact DC-2000 tape cartridge is a convenient alternative to large sets of floppy disks.

If you plan to back up your data with tape, we recommend that you consider the highly reliable and portable Jasmine DirectTape, one of which can be shared among multiple systems. Up to 44 backup sessions can fit on a single tape cartridge. A single backup session can also span multiple tapes. The versatile DirectBackup software allows you to select files according to many different characteristics. For example, you can back up files according to a character sequence in the name of the file, the file's type or creator, or the date the file was created, last backed up, or last modified. DirectBackup's extensive error checking option will ensure that the data on the tape exactly matches that of the source volume.

## **Backing up to another hard disk**

---

Few people consider using a hard disk to back up another hard disk. Considering the low price per megabyte of hard disks, this option deserves a serious look.

Connect a second hard disk to the one you want to back up and drag all your files over to the backup disk. It's simple and fast. It is best to keep the backup disk disconnected so a system crash could not make both disks unreadable.

## **Backing up to 800K disks with the Finder**

---

Backing up with 800K floppy disks is a simple method for saving your recent work. During a work session you can insert an 800K disk and use the Save As (or Save a Copy) command in the File menu of many applications. At the end of a work session, simply insert an 800K disk and select all the files on the hard disk that you want to back up. (Remember, you can drag a selection rectangle around a group of files to select several at once. Shift-clicking a file will add it to the selected group.) Drag the selected files over to the floppy disk. It's that simple.

If you want to back up more than 800K of files, you'll need more than one 800K disk. Using this procedure for a complete backup can be rather time-consuming and tedious. If you regularly back up your entire hard disk, a backup utility (as described in the next section) will make the procedure much more efficient.

The major limitation of this method is that you can't use the Finder to back up a file larger than 800K onto 800K disks. It also requires that you keep track of which files are on which backup disk.

## Using a backup utility

---

Backing up an entire hard disk or large portions of it becomes much easier with the assistance of a backup utility specifically designed to aid in that task. The Redux backup utility included with Jasmine hard disks provides various options for selecting files to back up. For example, you can select files by their names, by their creation or modification dates, or by what types of files they are. A particularly handy feature is the ability to perform an incremental backup — that is, to back up only those files that have changed since the last backup. You can also split files larger than 800K onto multiple 800K disks for backup. A disadvantage of backing up with floppy disks is that the user must be present to “swap floppies” as the backup proceeds. Also, for larger hard disks, the huge sets of floppy disks can be quite cumbersome.

Some backup utilities create backup files which you can copy or open with the Finder; others compress files to save space and conserve disks. Some delete old versions of files to reclaim disk space; others archive all the versions so that you can revert to a previous one. Choose a backup program which is quick, easy, and reliable — and use it regularly.

When you use a backup program, it's a good idea to initialize the backup disks in advance (even if the program doesn't require this), as one bad disk could ruin your whole backup with some programs. It's also a good idea to verify the disks if that option is available. (Verifying a disk checks that it's in good shape for storing information.)

For extra security, use a second set of backup disks the next time you do a backup. Alternate the two sets from then on. If you have to rebuild your hard disk and the most recent backup set fails to restore your files properly, you can use the other slightly older set.

# Configuring Your System

This chapter deals with the System file, the Finder, and other Macintosh system files. It discusses replacing your System and Finder, setting the startup application, installing fonts and desk accessories (DAs), and rebuilding the Desktop file.

## The System file and the Finder

The System file and the Finder, located inside the System Folder, are the two most important files on your hard disk.



The System file contains resources shared by all Macintosh applications. It tells the Macintosh how to be a Macintosh. The Finder is the application that displays your files as icons and manages the desktop for you. The Macintosh usually runs the Finder as the Startup application (see the section in this chapter "Setting the startup application" for details). The System Folder also contains a number of other important system-related files. See your Macintosh Owner's Guide for details on these files.

## The current startup disk

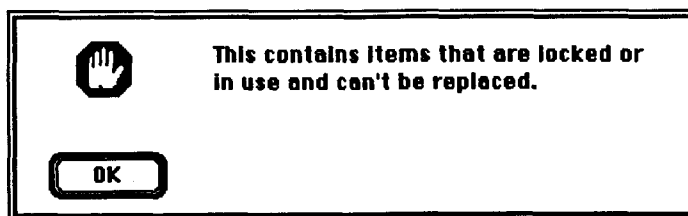
If you have several disks on the desktop, each of them may have a System and Finder, but only one disk's System and Finder are actually being used by the Macintosh. The disk with the System and Finder that the Macintosh is using is known as the current startup disk. The icon of the startup disk is the one in the upper-right corner of the desktop (unless you have moved it).

## Replacing the system files

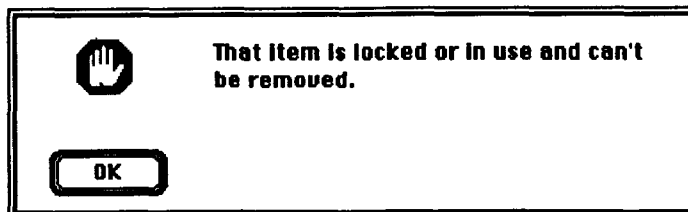
On occasion you may need to replace the System, the Finder, and other essential system files. This may be necessary either because Apple has released an updated set of system files or because the system files on your hard disk have been corrupted by a crash.

If you need to replace the system files on your hard disk because they have been corrupted, we recommend replacing them with the current released version of the system files from Apple. If you have spent a lot of time installing your favorite fonts and desk accessories, it's a good idea to keep a copy of your customized System file on an 800K disk. Then, when necessary, you can simply replace the corrupted System file with the fresh copy.

If your hard disk is the current startup disk, the system files are in use and you cannot replace or discard them. If you try to drag new system files from an 800K disk into the System Folder on your hard disk, the following alert appears:



If you try to drag the system files on your hard disk into the Trash, you get a similar alert:



What do you do? You have to make another disk the current startup disk, so that the system files on your hard disk are not in use and can be replaced or discarded. The easiest way to do this is to start up from a floppy disk containing the new system files. Follow these steps, starting with your system turned off:

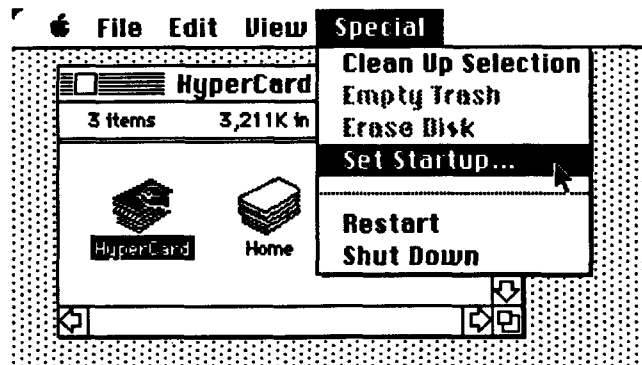
- First insert the floppy disk with the new system files.
  - Start up your system.
- The icon of the floppy disk will appear in the upper-right corner of the desktop, indicating that it is the startup disk. The hard disk icon will be below it.
- Open the System Folder on the hard disk, select the system files you want to replace, and drag them into the Trash.
  - Empty the Trash.
  - Open the System Folder on the 800K disk with the new system files. Select the ones that you want to copy and drag them into the System Folder on the hard disk.
  - Choose Restart from the Special menu.

The Macintosh will eject the 800K and start up from the hard disk using the new system files.

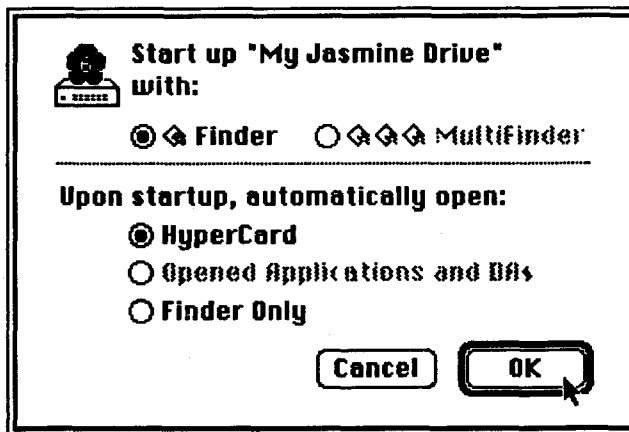


## Setting the startup application

Normally, when the Macintosh starts up it runs the Finder to display the desktop and let you see what's on your disk. However, it is possible to bypass the Finder and immediately open another application upon startup. Here's how: In the Finder, select the application you want to become the startup application by clicking it. Then choose Set Startup from the Special menu.



The following dialog box appears:



Click OK. When you restart the Macintosh, the selected application will be opened automatically. To revert to opening the Finder when you start up, choose Set Startup again and choose Finder Only. (It will be the only choice if no applications were selected when you chose Set Startup.)

Some applications will cause problems if they are set as startup applications. If a dialog appears asking you to insert a hard disk or restart, you should set a different application as the startup.

## Installing fonts and desk accessories

One of the major advantages of a hard disk over 800K disks is that there is plenty of room for fonts and desk accessories. Furthermore, you only need to install the fonts and DAs into a single System file. From then on they are always available to every application.

Working with the same System on the same drive at all times makes certain desk accessories much more useful. Imagine trying to effectively use a calendar-type desk accessory with 800K disks. Each time you make an entry with a calendar DA, that information is stored on the current startup disk. If you make different entries on different startup disks, you will soon find that the only way to check all your appointments is by checking all your different startup disks. No such problems arise with a hard disk, as the related files are always available.

## **The Font/DA Mover**

---

The Font/DA Mover is Apple's utility for installing and removing fonts and desk accessories. If you are not familiar with the uses of the Font/DA Mover, please refer to your Macintosh Owner's Guide. The standard Apple system software requires that fonts and desk accessories be installed in the System file. (There are utilities available that simplify this process.) A font or DA file has a suitcase icon:



Monaco



Find File

### *Font and desk accessory files*

The latest version of the Font/DA Mover, which is included in the System Folder of your hard disk, allows up to fifteen desk accessories to be installed in the System file (some utilities allow you to use unlimited numbers of fonts and DA's and do not require that they be in the System file). There is no "official" limit on the number of fonts you can install in the System file, but be aware that some applications can cause system crashes when confronted with excessive numbers of fonts.

If you plan to make major modifications to your System file, it's a good idea to do so on an 800K disk. Some desk accessories, especially larger ones, may be incompatible with others. Copy a current System and Finder onto an 800K disk and make all your desired modifications. Start up from the disk a few times and make sure all DAs work properly. It should then be safe to replace the old System on the hard disk with the newly modified System. Remember to never have more than one System and Finder on your hard disk.

## **Installing desk accessories in an application**

---

Desk accessories are usually installed in the System file. However, you may find that there are certain desk accessories which you only use with certain applications, such as a spelling checker that only works with MacWrite. There is a way to install these application-specific DAs within the corresponding applications.

Double-click the desk accessory file you wish to install. The Font/DA Mover will display the contents of that file in its left panel. Hold down the Option key and click on the Open button located below the empty right panel. Select the appropriate application and then copy the desk accessory into it. The DA will appear under the Apple menu only when the application is opened.

## **Rebuilding the Desktop file**

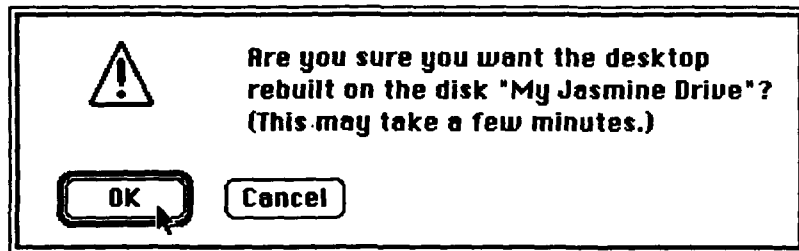
---

The Desktop file is an invisible file found on every Macintosh disk. The Finder uses it to store information about the look of the desktop, such as what directory windows are open and where, what all the file icons look like and where they are, comments you have entered into the Get Info box, and so on.

As files are copied onto a disk, their icons are stored in the Desktop file. However, when the files are eventually deleted, their icons remain in the Desktop file. The Desktop file will steadily grow in size. Since the Finder accesses the Desktop file constantly, the Macintosh will eventually slow down as the Finder takes more time to read and write the ever-larger Desktop file.

Suspect a Desktop file problem when you detect steadily declining drive performance. For example, it may start taking an excessive time for a file or folder to open once it is double-clicked. There may be a long delay returning to the Finder after quitting an application. Startup could take longer than usual. (Adding more files to your hard disk will slow things down somewhat, but it should not be that significant.)

You can rebuild the Desktop file by holding down both the Option and the Command keys any time you enter the Finder. At startup time (if the Finder is the startup application), press the keys when the "happy Mac" appears. You can also press them when you quit from any application that returns you to the Finder. In either case, keep the two keys held down until this alert box appears:



Click OK. This procedure can take awhile if many files are stored on the hard disk. Never turn off the Macintosh while the Desktop file is being rebuilt, or you may lose some files. When the Desktop file is rebuilt, the desktop will appear. Your hard disk will now be able to better perform at an optimal level.

If you regularly add and delete files and applications, your hard disk will require regular rebuilding of the Desktop file. Rebuilding the Desktop file deletes the extraneous icons and minimizes its size. It also has an unfortunate side effect: Rebuilding the Desktop file will delete any comments you may have written in the Get Info box of each icon. Despite this, if your hard disk has a lot of file traffic, we recommend that you rebuild the Desktop file periodically to keep your Macintosh operating efficiently.

Sometimes the Desktop file becomes corrupted. If you notice any erratic behavior or malfunction in the Finder, try rebuilding the Desktop file as a precaution. For example, the icons on the desktop will sometimes change in appearance. What was once a unique icon becomes a "generic" application or document icon. This is often the first sign that things are going awry in the desktop management. Another sign is an alert such as "Disk is too full to record changes." Always use the Shut Down command at the end of a work session to ensure that the Desktop file is properly updated.

*Sum Keeney*

# A Technical Peek Inside

This chapter covers some of the more technical topics related to hard disks. You don't need to understand this information in order to use your Jasmine hard disk, so you can safely skip this chapter if you want. However, the discussion here will give you considerable insight into how your drive works. It can also help you keep your drive running at optimum efficiency.

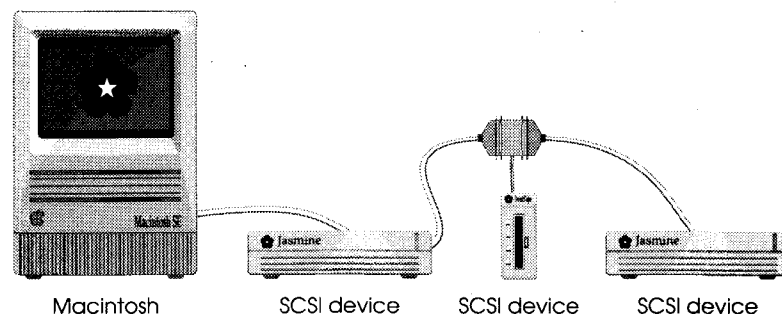
## The Small Computer System Interface

Your Jasmine hard disk is called a "SCSI device" because it communicates with the Macintosh using an industry-standard set of hardware and software specifications known as the Small Computer System Interface. (Most Macintosh users pronounce the acronym "scuzzy." Any device that follows these specifications — that is, any SCSI device — should be able to communicate with any other SCSI device it is connected to. SCSI devices can include hard disks, tape drives, optical disks, printers, plotters, scanners, and virtually anything else that can be connected to a computer.

The SCSI standard grew out of an earlier specification known as the Shugart Associates System Interface, or SASI. This fast, simple interface was pioneered by a company named Shugart and Associates, which needed a way to connect its products together. Fortunately, Shugart also wanted to create a standard for the entire industry to follow. The American National Standards Institute (ANSI) modified the SASI specifications (to allow for additional flexibility, features, and options that other manufacturers wanted) and renamed it SCSI. As the industry matured, this interface underwent several revisions. Currently SCSI is defined by ANSI specifications X3.131-1986.

## The SCSI bus

Up to seven SCSI devices can be connected to a Macintosh in what is called a "daisy-chain" arrangement.



The cables running from one end of the chain to the other like a bus line are known as the "SCSI bus." The places where the cables connect to the SCSI devices are known as "SCSI ports." The SCSI bus can manage a total of eight SCSI devices, with the Macintosh computer counting as one of them. (The Macintosh always is at one end of the bus, because it only has one SCSI port.)

Most SCSI devices have two 50-pin SCSI ports. To connect the first external SCSI device to your Macintosh you need a SCSI cable with a 25-pin connector on one end and a 50-pin connector on the other. To attach additional SCSI devices to the chain you need cables with 50-pin connectors on each end. You can buy cables from an authorized Apple dealer or from Jasmine.

When you use multiple SCSI devices, you need pay attention to SCSI ID numbers and termination. If you do not, it is possible that you could damage your Macintosh or lose information on your hard disk.

## SCSI ID numbers

---

The various SCSI devices communicate with each other by sending electrical signals along the bus. If the Macintosh sends a signal along the bus, every device on the bus can detect it. Therefore, there needs to be a way for the various devices to know which signals are for them and which device is sending the signals.

This problem is solved by assigning each of the devices on the bus a unique ID number between 0 and 7. (Remember, the bus can have at most eight devices attached.) The Macintosh always has the number 7. Suppose your hard drive has the number 3. To get the attention of your hard disk, the Macintosh will send a signal out its SCSI port that says, in effect, "This is device number 7 calling device number 3. Are you there?" Devices 0, 1, 2, 4, 5, and 6 will ignore that signal. Device number 3, your hard disk, will respond by sending an acknowledgment back to device number 7, the Macintosh, and then they can get down to business.

You can see that it's critical for each SCSI device on the bus to have a different device number assigned to it so that they don't get confused which is which and interfere with each other. The physical order of devices in the chain does not have to be related to their ID numbers.

The device numbers serve another purpose as well. Only one device can control the bus at a time, so there has to be a rule for which device "wins" if more than one contends for the bus at the same time. The SCSI rules say that the device with the highest ID number gets priority when there is a conflict. Therefore these device numbers are also known as priority numbers.

You must make sure that all the devices have different ID numbers so that they do not interfere with each other. If you attempt to start up with two devices set to the same ID number, the system may freeze and information on either or both devices may be corrupted.

SCSI ID numbers determine the priorities of SCSI devices at startup. When you turn on your Macintosh, it first checks any inserted floppy disks. Next, on Mac IIs and SEs, it checks any Startup Device selected in the Control Panel. Finally it checks the devices connected to the SCSI port, in order of decreasing ID number from six to zero. It will start up from the first device in this sequence that has a System and Finder.

## **SCSI bus terminators**

---

The SCSI bus requires special resistor packs known as terminators to create enough difference between low and high signal levels for the devices on the bus to communicate. These terminators are also needed to reduce or eliminate line echo, standing waves, and interference on the bus. The SCSI specifications call for termination at the two ends of the bus. The Macintosh itself does not count as an "end," however. If you have one SCSI device (not including the Macintosh), it should be terminated. If you have two or more SCSI devices, two should be terminated.

Because termination is required for the SCSI bus to function, most drives are shipped with terminators installed (and they may or may not be removable). This works fine with one or two devices; however, with three or more, problems occur because the signal increases in intensity with each terminator in the chain. This signal level increase can and will eventually cause damage to the sensitive components in disk drives.

This is why there must only be two terminators in the chain — one on the first device and another on the last device. Damage may result if more than two terminators are present on the bus. Additional devices in the middle of the bus should have their termination removed. If there is a device on the SCSI bus that requires termination (and does not have it built in), a cable terminator can be attached to a 50-pin SCSI port. Cable terminators are available through Jasmine or your authorized Apple dealer.

We have said that the Macintosh itself does not count as an end of the SCSI bus for termination purposes. However, the Macintosh SE and Macintosh II have "active termination," which turns itself off and on as needed. If there is one missing terminator in the SCSI bus, the SE or II will turn the termination on. The SE or II can only make up for one missing terminator.

## **Platters and heads**

---

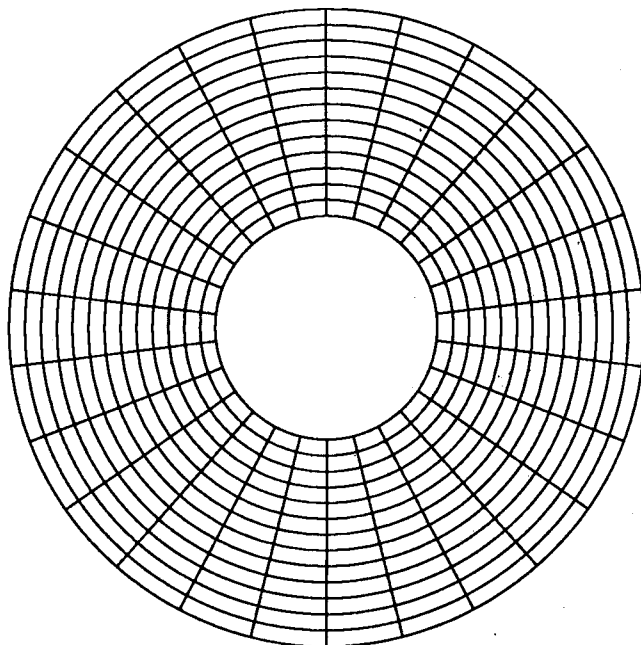
Have you ever wondered how a hard disk stores all those megabytes of information? Inside the drive box are one or more rigid metallic disks, called platters. These platters are coated with a thin surface of material, known as the media, that can be easily magnetized. A tiny electromagnet called the head sits above the media. By passing an electric current through the head, the drive controller circuitry magnetizes the media in various patterns which represent the data the Macintosh sends to the drive. The media stays magnetized indefinitely until the head writes a new pattern, so the drive continues to store your data even when you turn it off. The controller can later read the data by detecting the electric current induced in the head by the media's magnetism.

A positioning mechanism can move the head radially in or out, while a motor constantly spins the platter at high speed beneath the head. The controller can access any portion of the media simply by positioning the head at the proper radius and then waiting until the area it wants rotates underneath.

## Tracks and sectors

---

Since the disk spins much faster than the head can move, data on the platter is organized in concentric rings called tracks. All the data in a track can be quickly read or written without moving the head. Each track is subdivided into 512-byte sectors because that amount of information is more efficient for the Macintosh to work with.



*Tracks and sectors*

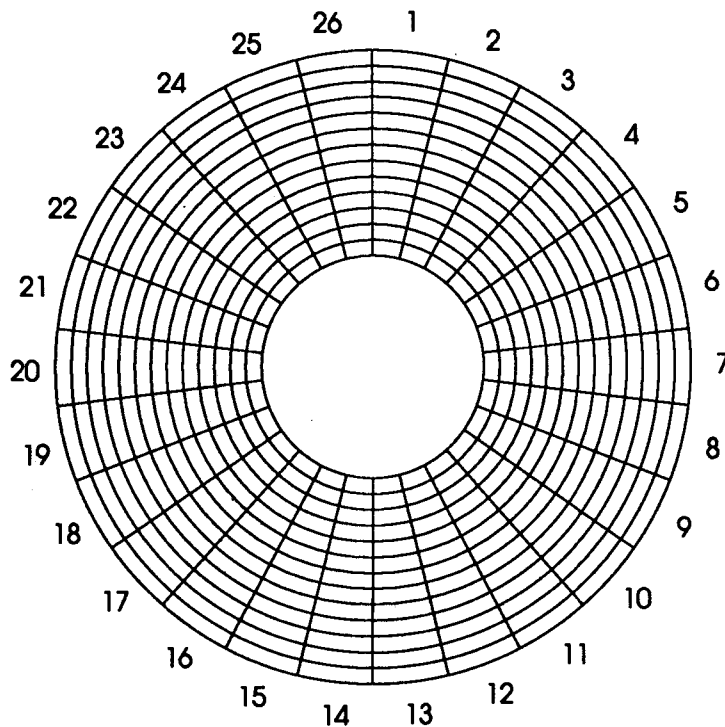
A sector is the smallest chunk of information that the SCSI controller in the drive will read and write. Even if just a single byte in a sector needs to be read, the controller will send the entire sector to the Macintosh.

## Formatting and interleave

---

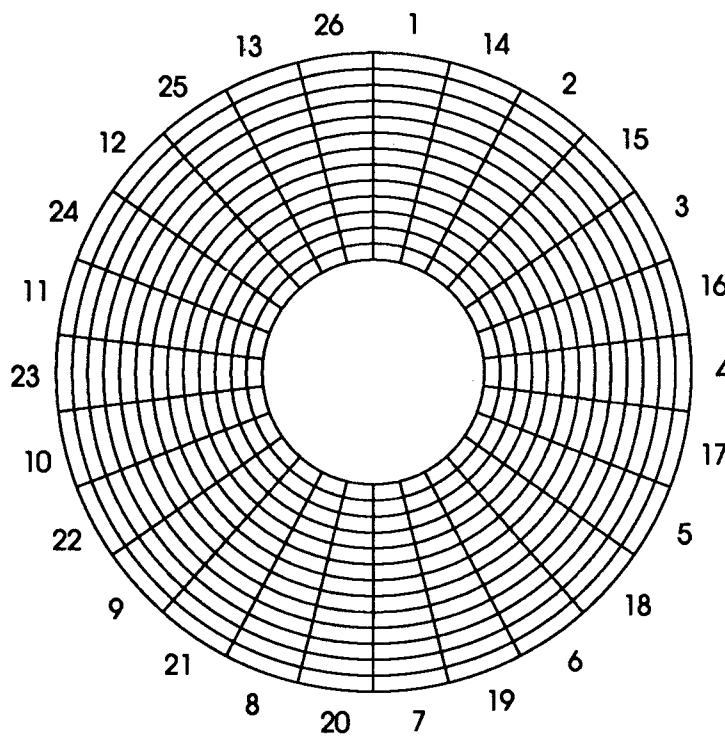
The process of preparing a disk to store information is known as formatting. When a disk is formatted, all the information stored on it is erased and only empty sectors remain. During formatting, the media is usually scanned for defects — “bad sectors” in which data cannot be reliably stored. A list of the known defects is kept on the disk itself. The controller uses this list to avoid using the bad sectors for storage. Instructions for formatting are in the Owner’s Guide for your drive.

In some drives, formatting establishes the “interleave,” or the order in which sectors are numbered. For example, if sectors 1 and 2 are physically adjacent on the platter, then the disk is said to have a “one-to-one interleave.”



*1:1 interleave*

If sectors 1 and 2 are separated by another sector, the disk is said to have a "two-to-one interleave," and so on.



*2:1 interleave*



Although it seems like a 1:1 interleave is the most sensible, some disks work better at 2:1, 3:1, or even 4:1 interleaves. This is because after the head has read sector 1 from the platter, it takes some time for the controller to verify and send that information to the Macintosh. In the meantime the platter is spinning. With a 1:1 interleave, sector 2 is already beneath the head. If the controller is busy still processing sector 1, it will have to wait one entire disk revolution to read sector 2. By having other sectors interleaved in between successively numbered ones, the controller can be ready for sector 2 in time.

## **The disk driver**

---

The software that the Macintosh uses to send read and write commands to the controller and oversee the actual data transfer is called the disk driver. It is also the first piece of information the Macintosh looks at on a hard disk when you start up the system.

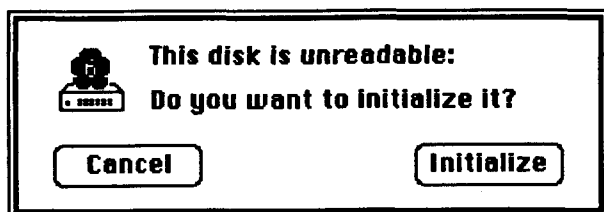
When you start up the Macintosh, it expects to find a disk driver to use in a special location on the disk itself — usually in the outermost track. The drive cannot operate if the driver is missing or has been overwritten during a system crash. A driver was installed when your disk was formatted at Jasmine, but you will not see an icon for it because it is not part of any file. Instructions for replacing the driver are in the Owner's Guide for your drive.

## **Files and the disk directory**

---

Although the data on a disk is physically organized into numbered sectors, it is logically organized into named files. This organization is imposed by the file system in the Macintosh ROM. The file system treats the disk as a collection of storage areas called blocks. (Each block consists of some small fixed number of adjacent sectors.) It keeps track of not only what files are on the disk but also which blocks belong to each one. It stores this information on the disk itself in an area known as the disk directory.

When you want to open a particular file, the file system uses the directory to determine which sectors to ask the driver to read. The directory, like the driver, is critical information on the disk; if it gets overwritten during a system crash the Macintosh may not recognize the disk and will probably want to initialize it.

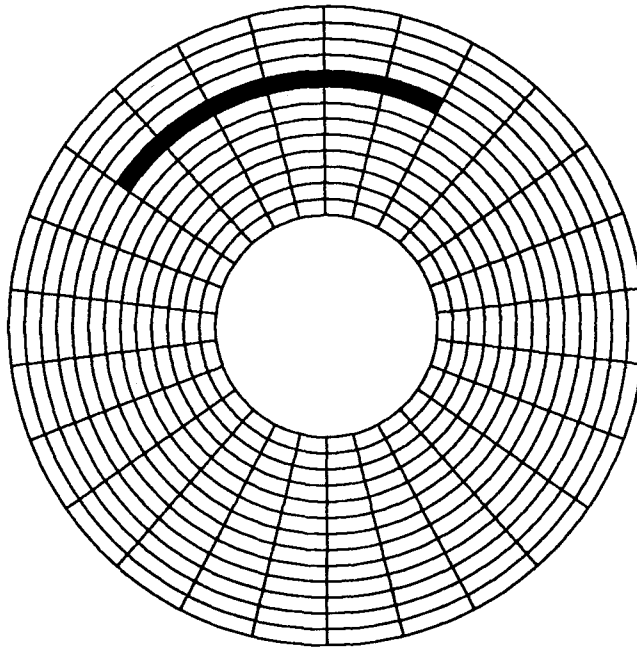


If you have not made a backup of your data, you may want to try to recover the data. There are data recovery programs that are included on Jasmine hard disks or available through your authorized Apple dealer.

## Fragmentation

---

When information is stored on a hard disk, it is divided into block-size chunks and then written to whatever blocks are not in use on the disk. If there are plenty of contiguous blocks available, as there are when the disk is new, an entire file can be stored in a single "extent," or set of adjacent blocks.



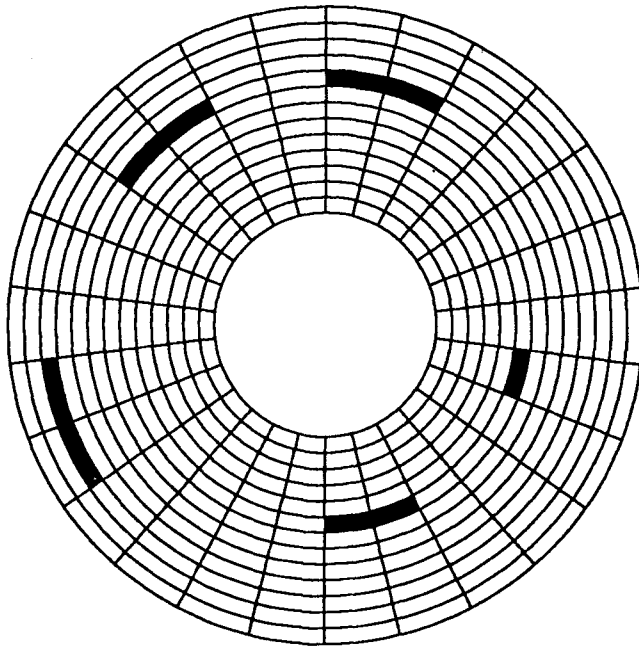
*A file with one extent of six blocks*

As the disk fills up, contiguous blocks will become scarce and the only disk space left will be in scattered, noncontiguous blocks that have been freed by deleting old files. If a file is too large to fit in a single extent, the file system must store it in several extents in various areas of the disk. (See following page.)

This process is called file fragmentation. Fragmentation makes the hard disk operate more slowly, because the drive heads need to move to the file's various extents to read and write its blocks. A hard disk that is heavily fragmented can cause a significant increase in the time it takes to open and save files. A heavily fragmented disk will also be more likely to lose data.

There are disk optimization programs designed to eliminate fragmentation by gathering all the blocks of fragmented files and rewriting them contiguously on the drive. Some of these disk optimizers will also prioritize the order in which your files are rewritten, in order to minimize future fragmentation. HD TuneUp is a defragmentation program included with your Jasmine hard disk.

You can do the same thing without an optimizer utility. To begin, back up everything and erase the disk. This will give you a clean slate. Restore the System Folder first, since you want to ensure a contiguous System and Finder. (Try to stabilize your System file as much as possible beforehand; that is, decide which desk accessories and fonts you want to use and install them before restoring.) Next, load the applications that you use most often. Then load utilities and other less often used software. Finally, you can load documents onto the disk.



*A fragmented file with five extents*

The purpose of this order is to place those files which have the least potential for changing size — such as system software and applications — at the beginning of the disk. Those most likely to change — such as documents — are placed at the end. This type of file order helps to slow down future fragmentation. It will keep your hard disk operating at high speed.

---

## Useful Utilities

This chapter lists and briefly describes some utility software which hard disk owners may find useful. Most of these programs are very reasonably priced, and some are included as a courtesy with your Jasmine hard disk. Since some of these programs are powerful tools which can damage your files if used without the proper understanding, we recommend thoroughly reading the manual for each program before using it.

- DEScriptor™**      A rigorous encryption utility for protecting sensitive files. (Jasmine Technologies, Inc., Incl. with Jasmine Disks)
- Disk Express™**      A utility which optimizes hard disks by removing file fragmentation and prioritizing files. It also helps to diagnose problems with drives. (ALSoft, Inc.)
- Disk Tools II™**      A desk accessory which makes many functions of the Finder — such as renaming, copying, deleting, and launching files — available from within an application. It can set file attributes, find files, etc. Part of the Battery Pak DA collection. (Batteries Included)
- Fedit Plus™**      A utility for viewing and editing volumes and files at the sector level. (MacMasters Systems)
- HFS Locator™**      A desk accessory which locates a file anywhere on a disk. It also makes many functions of the Finder — such as renaming, copying, deleting, and launching files — available from within an application. (PBI Software)
- Power Op™**      Another utility which optimizes hard disks by removing file fragmentation and prioritizing files.
- Redux™**      A reliable, sophisticated, hard disk backup utility. Redux provides extensive file selection methods plus a powerful scripting language. (Microseeds, Inc., Incl. with Jasmine disks)
- ResEdit™**      A utility for editing resources. It can change icons, dialog boxes, menus, etc. to customize applications. (Apple Computer, Inc.) This is included on Jasmine hard disks.
- Suitcase™**      An INIT file which makes it possible to have an unlimited number of fonts and DAs available in the menu, without using the Font/DA Mover to install them in the System file. (Software Supply)

### **Symantec Utilities for Macintosh™ (SUM)**

A comprehensive disk utility package. It contains utilities for sophisticated file recovery, disk optimization, hard disk partitioning, file editing, virus protection, etc. (Symantec, Inc., Incl. with Jasmine Disks)

# Troubleshooting

This chapter suggests ways to correct some common problems with hard disks. If difficulties persist, please contact our Technical Support staff at (415) 282-9555.

- Multiple copies (5 to 7) of the drive icon appear on the desktop.

This occurs when a SCSI device is set to SCSI ID number 7. This is the same ID number as the Macintosh and causes a conflict. Make sure the SCSI ID number is between 0 and 6.

- The performance of the drive has slowed considerably.

Normally, as more files are loaded on the drive, the Finder will require a little more time keeping track of everything. However, this should not significantly slow down a drive. If it really feels sluggish, try rebuilding the Desktop file as described in Chapter 4. We suggest that you do this routinely.

Also, be certain that you have only one set of system files on the hard disk. (The Find File desk accessory is useful for finding extras. See Chapter 2 for instructions on using it.) It's easy to accidentally copy an extra System Folder onto the drive if you are in the habit of dragging 800K disk icons onto it. (See Chapter 1 for a warning about this.) If you find more than one set, it's best to restart from an 800K disk with a good System Folder, drag all the ones on the hard disk into the Trash (and empty it), and copy the good System Folder onto the drive. (See Chapter 4.)

If these steps do not help significantly, your disk may be highly fragmented or may have some bad sectors. Use a defragmentation utility to solve this.

- The drive makes an occasional high-pitched squeal.

This usually indicates that a static charge is building up on the hard disk. Make sure you are using a grounded power outlet. If the squeal continues or gets louder, call Jasmine technical support at (415) 282-9555.

- On startup from the hard disk, the Macintosh screen alternates between the "happy Mac" icon and the blinking-question-mark icon.

This symptom usually indicates that the System file is corrupted and needs to be replaced. See Chapter 4.

- The Macintosh doesn't start up from the hard disk.

There are many factors which lead to this symptom. Often the System file has been corrupted and needs to be replaced or the driver needs to be rewritten.

If you are using a Jasmine hard disk, shut down and restart from the Jasmine Driveware floppy disk. If the drive does not appear on the SCSI bus, refer to the section "How to mount a partition manually" in the Owner's Guide.

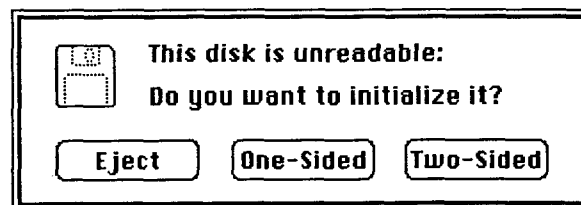


# The Raising of the Dead, Part II

by **Steve Costa**  
BMUG Software Librarian

It's late at night, mere hours before your paper is due. You glance up as the lights dim and flicker. You've lost track of the hours you've spent sitting in front of your faithful Macintosh. Wondering, "When did I last save?", your hand races to the menu to save your file. You make it just as your Mac's screen breaks up and then restarts...

The drive makes a few strained attempts to make it to the Finder and then you see the horrible message that you've been dreading come up.



*A Mac owner's worst fear realized*

You begin to realize you might have a real problem here. Your palms break out in a sweat, your heartbeat quickens, you are reaching the point of being overtaken by an uncontrollable urge to panic. Hours of work are on the verge of being lost. Your mind races. You remember the title of an article that you never thought you needed, *The Raising of the Dead-Part 2*. Papers fly as you discover the first few pages.

*It's late at night, mere hours before your paper is due. You glance up as the lights dim and flicker. You've lost track of the hours you've spent sitting in front of your faithful Macintosh. Wondering, "When did I last save?", your hand races to the menu to save your file. You make it just as your Mac's screen breaks up and then restarts...*

Hmmm, looks like something you've read before but you just can't quite place it. You begin to read...

In these fast changing times, the world of hard disk drives and file recovery has changed as quickly as everything else. Two years ago there was very little that one could do to prevent or to recover from a hard disk or drive crash other than backing it up every day or, for those brave pioneers who learned how, to use MacZap.

These days, with a little bit of forethought and care, just about anyone can recover files on a disk from almost any software-related crash. The same tools used to recover hard drives can also recover damaged floppy disks.

Just say **No!** when your disk proclaims the infamous "Would you care to initialize me and lose all your un-backed up files?" You will usually be able to get everything back in full-working order. With a hard drive, go ahead, initialize it, make it a day that you will long remember (just kidding, **don't** do it to a hard drive either if you can help it). Almost any MacWrite file can be recovered; almost any M/S Word file can be made to open; almost any kind of file can be resurrected (to a certain extent).

Under no condition do you want to click on either of the initialize buttons. Unless you've installed the Guardian and Shield INITs you will lose everything on the disk for good! If you have a hard disk, you may be able to retrieve most of your data.



**Recover HFS**  
1986 to 1988

I've recovered over 250 hard drives and hundreds of floppies with the MacZap series of programs over the last 18 months.



You should only have one System and one Finder on your hard disk. If you can still mount your hard disk check with Find File DA to see how many you have.



You are about to zap the PRam.

Most parameters such as the default boot device will be changed when the system is re-started. Do you want to do this?

Yes

No

I can't stress enough how important it is to back-up your files, particularly data files. The Finder is probably the easiest way to back-up your data. Just drag over the file that you've been working on and copy it to a floppy disk. Make it a habit and it will surely save your life one day.

I'll first go over what you can do to recover your hard drive without spending any money. Do the more obvious things: make sure the SCSI cables are tight; check to see if there is more than one system on your hard drive; try to boot your Mac with a floppy disk and use the SCSI "cdev" to mount your hard disk drive. Every now and then Apple's *Disk First Aid* application will repair your hard drive.

Try and reinstall the SCSI drivers to your hard drive using the utility that came with your drive or by using Apple's *HD installer*. Lastly, if you have a SE or a Mac II, clear your PRAM (Parameter RAM) by holding down the Cmd., Option and Shift keys at the same time and selecting the *Control Panel* from the Apple Desk Accessory menu. If you've done it right, you should see the PRAM box come up. Answer yes, and reboot. (This is usually a problem with the Mac II's.)



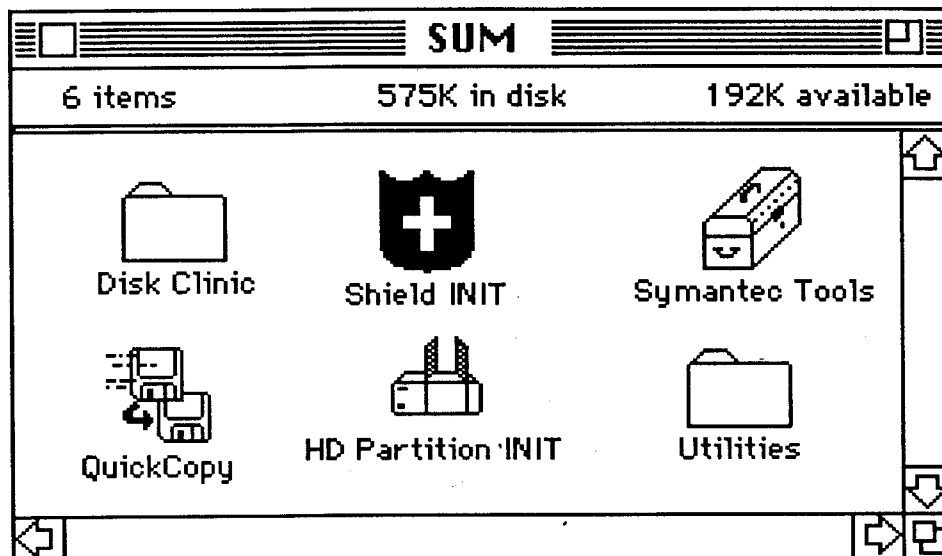
SCSI

PAUL MERCER

ShareWare \$5

SYMANTEC CORP

10201 Torre Ave  
Cupertino, CA 95014  
408-253-9600



A real Symantec Utilities for the Macintosh disk

This is as far as you can go without the correct tools. That means in order of importance you need *Symantec Utilities for the Macintosh (SUM)*, (*MacZap* as licensed by Symantec and almost completely reworked), *Copy II Mac*, or *1<sup>st</sup> Aid*. If you want to attempt to recover files from your hard drive, turn it off and go out and spend the hundred or so dollars to buy one of these programs.

As a rule, the current version at this date of *1<sup>st</sup> Aid* isn't very useful in recovering hard drives, but it is good with floppies and extracting data from individual files. *SUM* or *MacZap* shine when it comes to hard disks and do great with floppies too. They're not as good as *1<sup>st</sup> Aid* in extracting data from crashed data files. But there are other PD and shareware programs out there that can do the job. I'll show what can be done later in this article.



Guardian

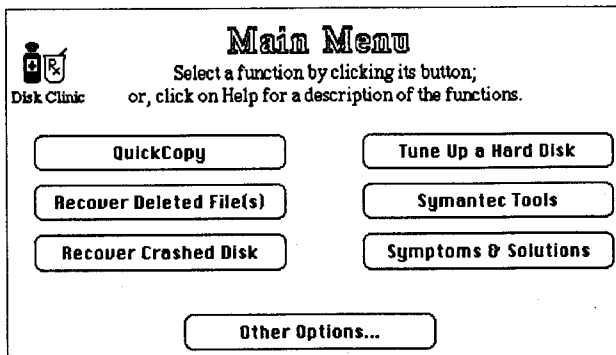


Shield INIT

Guardian and Shield are the two most important parts of SUM.



## HARD DISK RECOVERY



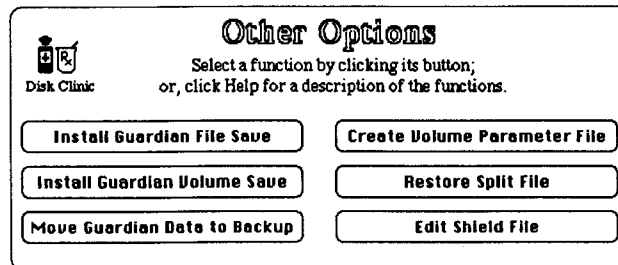
*From here wonders will spring forth.*

The major improvement in hard drive recovery technology has come from the added brute power in what was known as *MacZap*. The most important change is the addition of a new application called *Guardian*, and its little friend the *Shield INIT*, with these two you can recover almost any hard drive that has crashed or been accidentally trashed.

What these two can do borders on amazing (at least for the Mac world). You can now easily recover deleted files from your hard drive (floppies as well if you are willing to give up the space) or (and now for the amazing part) recover your hard drive if your dearest and bestest friend accidentally initializes your disk. Yes, that's what I said, "erased, trashed, gone, poofed" disks and drives can now be resurrected almost as good as new (well... at least in most cases).

Let's see how this marvel is accomplished. First you will need to spend around a hundred bucks or so to get *SUM*.

This is the first window that you will see after you click on the disk clinic icon. From here you can go to just about any of the other utilities. Click the cleverly named button "Other Options." It will take to the *Guardian* installation window.

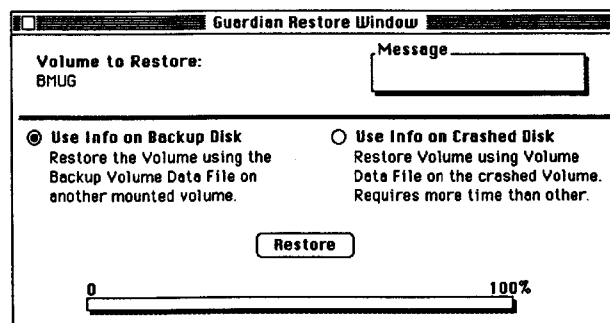


*Menu to install Guardian*

This window will be the most important before your hard drive crashes. It will, *believe me it will!* Install both the *Guardian* File and *Volume Save*. They allow recovery of your hard drive after it has crashed or undelete files that have been trashed.

What happens when your hard drive crashes? That depends whether you've installed the *Guardian* and the *Shield INIT*. If you have it's fast and easy.

It really is this easy. When you click on the restore button you get a mirror image of your crashed drive in about two to three minutes. There is the chance your hard drive is damaged beyond the ability of *Guardian*, but, there's still hope.







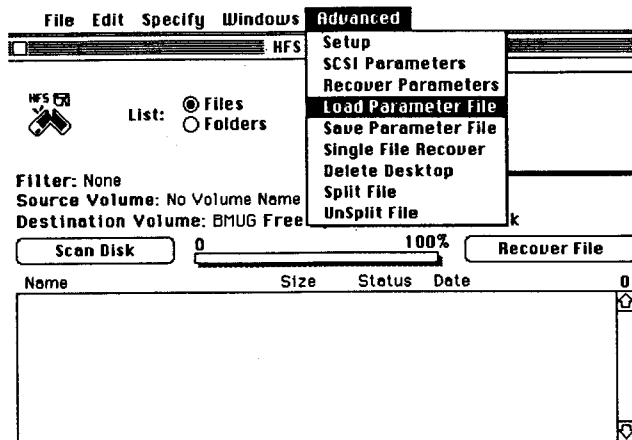
## SUM's QRW IS THE QUICK RECOVERY WINDOW

A subset of the more powerful *HFS Recover* that is hidden in the program. Most of the time this part of *SUM* will be all that's needed. When the QRW can't recover your hard drive, it means that some of the directory information it uses to recover files is too damaged to use. Now while Quick Recovery can deal with this as well, I recommend you leave the QRW and go into it's advanced mode to get more control.

Yes, this looks just like the older *HFS Recovery* application from *MacZap*. It's a little different, but it can still recover almost any corrupted drive. The menu selection used is only needed when your drive is too severely damaged to recover any other way. This window will examine the various settings that are too damaged for *SUM* to read. Once you click on the Scan Disk it will do it's best to find and recover your files.

Now, from past experiences most people won't get a program like *SUM* until after their drive crashes or they need a file that they've thrown away. As far as I know, *SUM* is the only set of utilities that allow you to recover files **without** the installation of another program before you've trashed them. Scanner, which comes with *SUM* will undelete programs with resource forks (which most applications have). However, it won't do very well with documents or spreadsheets, so the author added a new way of undeleting a selected group of files.

To undelete a file you need information regarding the particular type of file. You need to know where the file starts and how it's distributed on the drive. All files on the Mac have a header describing what type of file it is.



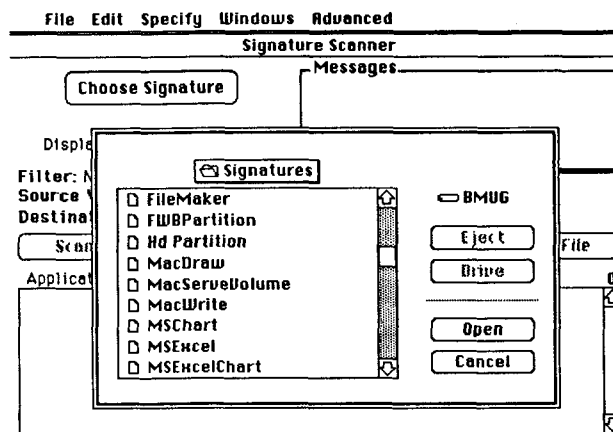
*Signature Scanner* has small files that you load into it containing the necessary information for it to go out and undelete all the files that have that particular signature. Scanner has about twenty signatures of the more common applications out there. This method of recovering files can take hours for Scanner to go through your drive.

The Quick Recovery Window will likely be the only tool you will need to recover your hard disk if you haven't installed the Guardian.

You will need to be patient after you load the Paramater File. It could take several hours for your hard disk to be recovered.

## FLOPPY DISK RECOVERY

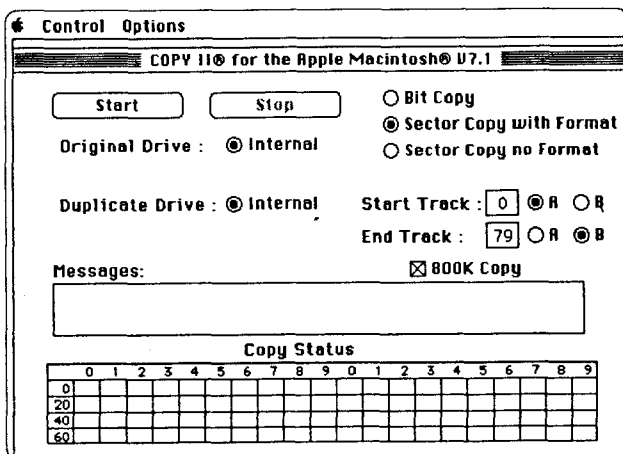
So far I've concentrated on hard disk drives and SUM. But there are other file recovery tools out there and we'll see what *Copy II Mac*, SUM's only real competitor, can do. I only use it for floppies as it is somewhat cumbersome to use on a hard drive. However, it does have some great features when working with individual files.



There is a window similar to the Quick Recovery Window for Signature Scanner. This is an interesting window to show what's going on.

What do you do if your floppy disk tells you: "This disk is unreadable?"

First and most important is making a sector copy of the disk with *Copy II Mac*. This will repair the disk about 30% of the time; well enough to *Finder* copy the files off the floppy disk.



*Copy II Mac set up to copy a damaged disk.*

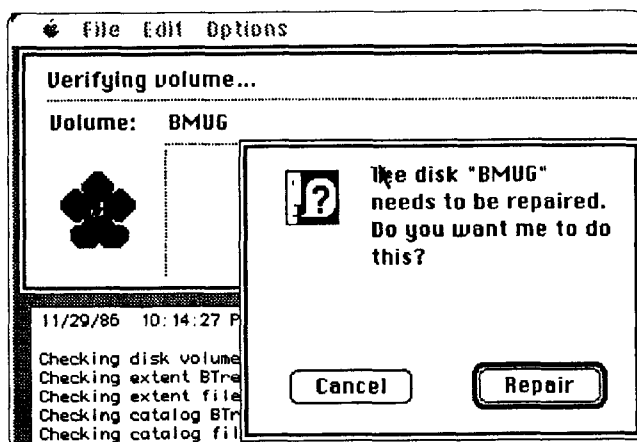
from Apple) as you might expect looks nothing like SUM. After you make a copy of your disk you need to run the *1st Aid* diagnostics on your disk. It will remind you that

If your disk still tells you that it is damaged, see if the *Disk First Aid* program that came with your Mac will repair the disk. This works every now and then.

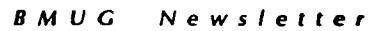
For the times this doesn't repair anything, you will need to use SUM or *1st Aid* to recover the files from your disk.

*1st Aid* (not to be confused with *Disk First Aid* when it's finished it will give you its diagnosis. From here you recover files from your floppy. It does have some faults, such as not putting your recovered files in a folder (which can make a difference if you have files on the disk you recover to with the same name).

Be sure to make a *Sector Copy* of your disk instead of a *Bit* copy. *Bit* copies copy the disk exactly, errors and all! A *Sector copy* will try to correctly write the sectors on your disk that may seem to be damaged.



Click on the Repair Button. When it says it can repair a disk, it never fails. To get the extra window do a "Control-S." The disk directories that *Disk First Aid* is checking are then displayed.



**\$140/\$90**

save your text to disk or simply allow you to view it on the screen.

Now there are several public domain and shareware programs out there that can do some of what *SUM* and *1" Aid* do. Particularly in extracting text from MacWrite files, *ReadMacWrite* is one of the best of them. It will

There are a great many things that can cause programs and hard disks to crash. With programs, the most common cause of crashes is bad programming. (Such as a program

*This part of 1<sup>st</sup> Aid will tell you what you need to do next.*

famous "This disk is unreadable: Do you want to initialize?" type of message are corrupted directories. The amount of damage in the directory determines how much can be recovered from the floppy disk. Many things cause directory damage, and cause you to get this message. Sometimes just a program crash will do it. A small percent-

*1<sup>st</sup> Aid extracting text from an unlikely source.*



**Free**

### *ReadMacWrite extracting the text from a damaged MacWrite file*

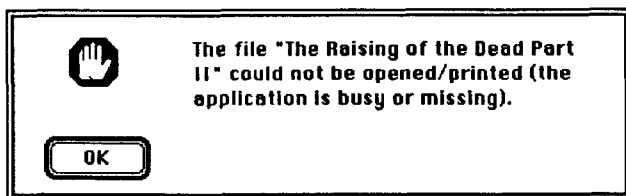


kind of problem, replace your floppy as soon as possible. Once a floppy drive starts going bad it will corrupt most of the disks or data files that it writes to. (Gee that sounds like some kind of juvenile delinquency.)

## PROBLEMS IN THE DESKTOP



Hard disks suffer from the same problems as floppy disks, but on a bigger scale. And hence they suffer from a certain kind of problem related to having a large amount of files on them. I'm sure almost everyone has gotten this message when they've tried to load a document. On a floppy disk when you get this message it generally means that you don't have the application needed for that document. On a hard disk drive it usually



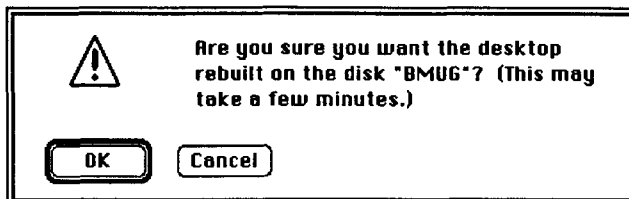
*One of the more cryptic error messages.*

means that your "Desktop" file is corrupted. The "Desktop" files are invisible files that keep track of the "Get Info" information and keeps a record of all the icons on the hard disk. Other signs that your Desktop is having problems include generic document

icons on your drive, or having a folder that takes a long time to open. Occasionally your cursor or mouse will freeze.

Of course, with Desktop problems being so common, Apple in it's wisdom (Ha, Ha) made it easy to deal with. Actually they really did. Really. Though it only took them 3 years to do it correctly.

There are two ways to rebuild your Desktop file. The first and easiest way anyone can do. Hold down the Option and Command keys on your keyboard when you 1) exit a program, 2) insert a disk or 3) when you mount your hard drive. You will need to keep these keys down until you see this dialog box.



*Click OK when you see this.*

The second, and slightly more difficult way is by deleting the Desktop file itself with a file editor program or desk accessory like DiskTop, or DiskTools II™. Desktop files cannot be deleted from the Finder. After you delete the Desktop file, it will be a bit of a wait before the you see the friendly desktop of the Finder.

## ID Error Codes

When you do crash you usually get some enigmatic error code. A litany of error codes. If you know what they mean it can help understanding what has gone wrong. I'll explain what the more common ID errors mean.

**ID-01** = I've never seen this error on anything but three Mac II's. On paper it's a kind of odd ball memory error. It's as if your computer tried to access more memory than it had. But due to how the Mac accesses RAM, even if it tried to use more memory it would just go back to the first byte of RAM and wouldn't crash with a ID—01, but would crash with a ID-25.

*Prior to System 5.0 (System 4.2 and Finder 6.0), when you rebuilt the Desktop you lost all the information in your "Get Info" boxes. Now you don't.*

**ID Errors Codes**

- 01 --Bus Error
- 02 --Address Error
- 03 --Illegal Instruction
- 04 --Zero Divide
- 05 --Range Check Error
- 06 --Overfloe Error
- 07 --Privilege Violation
- 08 --Trace Mode Error
- 09 --Trap Error
- 10 --Trap Error
- 11 --H a r d w a r e  
Exception Error
- 12 Unimplemented Core  
Routine
- 13 --U n i n s t a l l e d  
Interrupt
- 14 --I/O Core Error
- 15 --Segment Loader  
Error
- 16 --Floating Point Error
- 17 --PACK 0 not Present
- 18 --PACK 1 not Present
- 19 --PACK 2 not Present
- 20 --PACK 3 not Present
- 21 --PACK 4 not Present
- 22 --PACK 5 not Present
- 23 --PACK 6 not Present
- 24 --PACK 7 not Present
- 25 --Memory Full
- 26 --B a d P r o g r a m  
Launch
- 27 --File Map Trashed
- 28 --Stack ran Into Heap

- ID-02** = This is the most common error message that people get. And as one might expect it can be a sign of buggy programming. The CPU in the Macintosh can only access RAM in 1 byte blocks, one word blocks or one long word blocks. The 68000 needs 1 byte blocks of code at an odd or even memory RAM location. A word or long word must access information at an even memory address. Your Mac will crash if CPU tries to read a long or short word at a odd memory location. LaBomba!
- ID-03** = Again this usually means sloppy programming. If the program that you are in asks the Mac to do something that isn't in it's vocabulary of instructions it will return this error ID.
- ID-04** = You probably learned this in the third grade. If the Mac tried to divide by zero it will crash. A good program would never let this happen.
- ID-05** = More sloppy programming. This is an arrange error. If the Mac checks to see if a number in the code is within a certain range and and it isn't , you see this error. Usually it's some kind of debugging error.
- ID-06** = All stored numbers are allotted a certain amount of RAM. The bigger the number the more RAM allotted to that number. If the number grows, and it's allotted RAM doesn't, you crash with ID-06 when the 68000 checks for this condition.
- ID-07** = The Mac can run in two different modes; user or supervisor mode. As a rule, the Mac is in the supervisor mode due to the fact that some 68000 instructions can only performed in supervisor. But at times the Mac can be in user mode. If it is in the user mode and tries to do one of the commands that need the supervisor mode, the Mac will crash.
- ID-08** = This is a debugger error. When the 68000 goes into the runtime debugger mode and there isn't a debugger installed in your program, it results in this error code. Not a common error code and when it does happen it's the programmer's fault for being sloppy.
- ID-09** = Similar to ID-03 in that it's related to sloppy programming. The Mac's ROMs have lots of commands that programmers access that aren't in the 68000. When a program needs these non- 68000 instructions, the CPU looks them up in an instruction table that shows the location of the instruction in the ROM. If the 68000 finds the routine in the instruction table and goes to the ROM to find it and it doesn't match, an ID-09 occurs.
- ID-10** = More or less the same as ID-09.
- ID-11** = This is generally a hardware error of some type.
- ID-12** = Another sloppy programming error. If you get this error send back the program. A good programming technique is to set breakpoints in various parts of the program being developed. If these breakpoints are not taken out and one occurs without a debugger installed, you are left with this error code. Also could be software written for a SE running on a Mac Plus. Wrong system with the wrong ROMs.
- ID-13** = A hardware error. If part of the Macintosh, such as the keyboard or monitor, needed CPU time (i.e. a screen refresh) the 68000 would stop what it was doing (only for a very short period of time) and refresh the screen. The 68000 must have the screen refresh routine at hand to do this ... if not, then boom. Not a very common error anymore.



- ID-14** = You should never get this error with a Macintosh.
- ID-15** = Most applications on the Mac are divided into segments. It makes large applications usable on machines with limited amounts of RAM. Only one segment at a time need be in RAM. That's why 128K Macs always had to access their floppy disk drives when they were in an application. When the Mac needs a segment of the application it goes to the segment loader which tries to load it into RAM. If it fails to load you get this crash.
- ID-16** = The floating point bit halt was set. An uncommon error, generally a damaged system.
- ID-17 to 24** = The system has several resources that are called packages (PACK 0-7). These are small pieces of code that do such things as initialize a disk or set the Mac for international dates. Generally means a damaged system. This can also happen if you are running a older system on new Mac ROMs.
- ID-25** = If you get this error it means that you've run out of RAM.
- ID-26** = The Mac attempted to launch a damaged application or you have a corrupted system.
- ID-27** = This error almost is never found any more since it is a MFS kind of error. A bad sector was located in the Volume Directory Allocation Map (HFS disks use a Volume Bit Map).
- ID-28** = The system or the program that was currently running stack ran into the heap. Sort of an out of RAM error.
- ID-29** = Empty
- ID-30** = Disk insertion error. Another sloppy programming error which you should never see.

Each new System version will probably have a different number of PACK resources. A good case for always using the latest System and Finder that your machine can use.

These are about the only ID error codes that you should ever see.

## Sad Mac Error Codes



There are several other types of error codes that will show up from time to time. These include Sad Mac error code as well as ROM error codes.

Sad Mac codes only happen when you turn on your Macintosh and it performs some kind of diagnostic test. If the Mac fails any part of this test a Sad Macintosh will then appear.

The characters below the unhappy Mac tells you what code has gone wrong. The first two indicates whether it is a software or hardware failure. OF means some kind of software error and any other two characters means a hardware failure. 01 is a ROM failure while 02 to 05 are RAM errors. The last four digits show you which RAM chip is bad. The SE and Mac II have a slightly different Sad Mac error codes which I don't quite have a handle on yet. I have included a guide on what Apple tells developers. The third kind of error code are ROM error codes (Result Errors). Generally they won't crash the program that you are in. You just get a negative number display from which you can continue.

OF0001 - Bus Error	OF0004 - Divide by Zero	OF0006 - Overflow Error
OF0002 - Address Error	OF0005 - Range Check Error	OF0007 - Privileged Violation
OF0003 - Illegal Instruction		



OF0008 - Trace Mode Error	OF000D - Interrupt Error	OF0019 - Out of Memory
OF0009 - Trap Error	OF000E - I/O Error	OF001A - Launch Error
OF000A - Trap Error	OF000F - Segment Loader Error	OF001C - Stack Heap Crash
OF000B - Exception Error	OF0010 - Floating Error	OF0064 - Damaged System
OF000C - Core Routine Error	OF0011 to OF0018 - PACK Error	OF0065 - Damaged Finder

### ROM Error Codes

- 3 Core routine out of range. Somewhat like ID-12.
- 25 Tried to delete a desk accessory.
- 33 File directory full.
- 34 No more allocation blocks on your disk.(Your disk is full)
- 35 Disk asked for doesn't exist.
- 37 Bad file name. File has a illegal character in it name.(Don't put a colon in your file names.
- 38 A file that wasn't open was accessed.
- 39 End of file. A program tried to read more information than that the file had.
- 41 Memory full. The Mac ran out memory when it tried to open a file.
- 42 To many files open.
- 43 File not found.
- 44 The disk was locked when it tried to write to it.
- 45 File is locked
- 46 Disk is locked by a software setting
- 47 File is busy.
- 48 Duplicate file name already exists.
- 55 Tried to mount a disk that already was mounted.
- 56 Tried to mount a disk that din't exist.
- 57 Not a Mac disk, maybe a crashed disk.
- 59 A erro occur when a disk was renamed.
- 60 The disk is damaged. Some kind of directory damaged.
- 61 Tried to write to a read only file.
- 64 A requested drive wasn't mounted.
- 68 Information read from a drive doesn't mactch what was written.



## SAD MAC ERROR CODES FOR THE MACINTOSH SE

Decoding Sad Mac error codes for the SE is not always straightforward. The following information is intended as a guide to help isolate faults.

For Macintosh SE only



XXXXXXXX X = D7 = 32 bits  
YYYYYYYY Y = D6 = 32 bits

D7 indicates the class of failure and D6 indicates the failed bits (where applicable)

D7 possibilities

00000001 = ROM checksum test

00000002 = RAM first chunk (SIMM 1 or SIMM 2)

00000003 = RAM bank A (SIMM 1 or SIMM 2)

00000004 = RAM bank B (SIMM 3 or SIMM 4)

00000005 = RAM addressing (frequently SIMM 3 or SIMM 4)

00000006 = VIA 1

00000007 = VIA 2 (Mac II)

00000008 = FDB (ADB) access

00000009 = MMU failure (Mac II)

0000000A = NUBUS access (Mac II)

0000000B = SCSI access

0000000C = IWM access

0000000D = SCC access

0000000E = data bus test (frequently SIMM 1 or SIMM 2)

For RAM failures, the following is generally true:

D7 = 00000002 or 00000003 or 0000000E  
= failed SIMM 1 or 2 with D6 indicating the failed bits

D7 = 00000004 or 00000005 = failed SIMM 3 or 4 with D6 indicating the failed bits

Examples:

if D7 = 00000002 or 00000003 or 0000000E and

D6 = 00000001 = bit 0, SIMM 1 bad

D6 = 00000002 = bit 1, SIMM 1 bad

D6 = 00000004 = bit 2, SIMM 1 bad

D6 = 00000008 = bit 3, SIMM 1 bad

D6 = 00000010 = bit 4, SIMM 1 bad

D6 = 00000020 = bit 5, SIMM 1 bad

D6 = 00000040 = bit 6, SIMM 1 bad

D6 = 00000080 = bit 7, SIMM 1 bad

D6 = 00000100 = bit 0, SIMM 2 bad

D6 = 00000200 = bit 1, SIMM 2 bad

D6 = 00000400 = bit 2, SIMM 2 bad

D6 = 00000800 = bit 3, SIMM 2 bad

D6 = 00001000 = bit 4, SIMM 2 bad

D6 = 00002000 = bit 5, SIMM 2 bad

D6 = 00004000 = bit 6, SIMM 2 bad

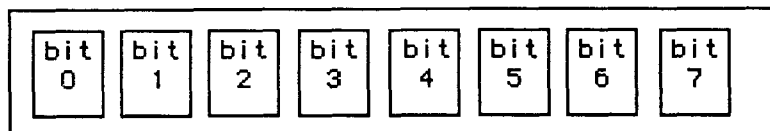
D6 = 00008000 = bit 7, SIMM 2 bad

multiple bit failure examples:

D6 = 00000003 = bit 0, bit 1, SIMM 1 bad

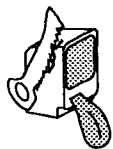
D6 = 00000050 = bit 4, bit 6, SIMM 1 bad

D6 = 00006000 = bit 5, bit 6, SIMM 2 bad

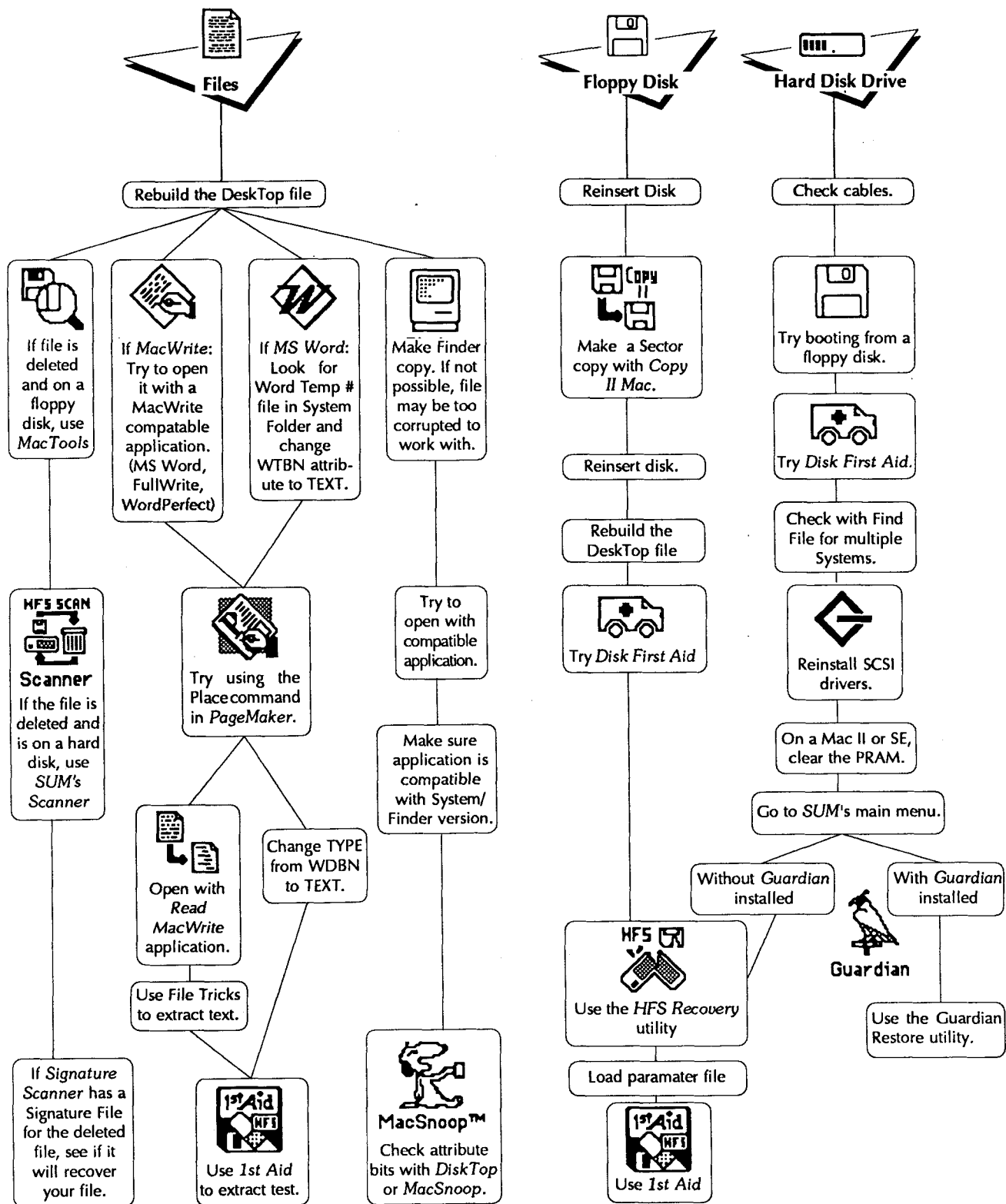


SIMM





## Small Solutions





 Jasmine Technologies, Inc. 1740 Army Street, San Francisco CA 94124 415-282-1111

Drive Safely.