FWB® incorporated

CD-ROM ToolKit™

User Guides

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Credits

This manual was written by Stuart Saraquse, James Merkle, Robert Seretny, Alex Lau, Mike Michelletti, and Norman Fong.

Electronic publishing expertise was provided by Bruce Dundas.

The CD-ROM ToolKit program was written by James Merkle.

Contents

Section I — Introduction

Thank you for purchasing FWB's CD-ROM ToolKit! CD-ROM ToolKit consists of a high performance SCSI CD-ROM device driver, an integral caching utility for CD-ROM drives, and an application for playing audio CDs.

CD-ROM ToolKit's universal device driver allows most SCSI CD-ROM drives to communicate flawlessly with your Macintosh. The caching module works in the background to make CD-ROM drives access data faster. The CDT Remote application provides a convenient way to access audio CDs on your Mac.

Before You Begin

The Read Me First file on the CD-ROM ToolKit disk contains late-breaking information that was not available when this manual was written. Please open this file if you have any questions that are not addressed in this manual. This manual is divided into the following sections:

I. Introduction

This is a brief explanation of what CD-ROM ToolKit is and what it can do for you. It also outlines the minimum hardware and software configuration.

II.QuickStart

Quick overview of the main features and basic installation of CD-ROM ToolKit. This section is designed for advanced users who are familiar with Macintosh software.

III.Installation and Removal Specifics

Provides step-by-step instructions for installing or removing CD-ROM ToolKit on your system.

IV.Instruction Guide

Complete descriptions of each component of CD-ROM ToolKit, as well as detailed instructions for every function and option.

V.Troubleshooting

Identifies problems you may encounter while using CD-ROM ToolKit, and offers solutions. A list of error messages and appropriate responses are included.

VI.Technical Information and Tips

Important information and tips on devices, CDs, digital audio extraction, AIFF files and a variety of other topics of interest to CD-ROM ToolKit users.

VII.Glossary

Important and frequently used terms are explained.

VIII.Index

All relevant topics are cross-referenced for quick access.

What is CD-ROM?

CD-ROM stands for Compact Disc-Read Only Memory. It's based on the popular Compact Disc format, best known for storing digitally-recorded sound. In addition, compact discs are capable of storing up to 650 Megabytes of computer readable information equal to over 250,000 pages of text.

CD-ROMs can be written to only once, but can be read from many times. In some ways, this is a disadvantage when compared to other optical storage media. However, the fact that new data can not be added to a standard CD-ROM makes them ideally suited for distributing large amounts of unchanging information. Because they can be pressed in large volume at a low per unit cost, CD-ROMs represent one of the most cost effective storage mediums available.

Software and book publishers have found CD-ROMs to be perfect for distributing large amounts of data such as encyclopedias, dictionaries, games, collections of public domain software and clip-art. Use of CD-ROM has recently been expanded to include application software, documentation, training and support materials, periodicals, entertainment, and digital photographs.

CD-ROMs can now be recorded by anyone using relatively inexpensive CD Recorders. This recent technology also allows you to produce a music CD in much the same way that the pros do it.

CD-ROM drives can tell the difference between audio information and other data. They can play music through headphones or an amplifier and pass other data on to the computer for processing.

Why CD-ROM ToolKit?

Perhaps the most frequent complaint with CD-ROMs is that access times and data transfer rates are slower than other means of mass storage. In other words, it takes a long time to find information on a disc, and to get the information from the disc to the computer.

CD-ROM ToolKit helps alleviate this problem in two ways. First, CD-ROM ToolKit provides a highly efficient SCSI device driver that supports all popular CD-ROM drives and data formats. Second, CD-ROM ToolKit performs driver-based caching using your hard disk and RAM as a cache, which allows information on the CD-ROM to be accessed much faster.

CD-ROM ToolKit accomplishes this by caching important file and folder information from a CD-ROM onto your hard disk. Requests for data, such as those made when finding files and opening folders, can now take place ten to twenty times faster. CD-ROM ToolKit's unique read-ahead caching delivers improved transfer rates for most CD-ROM drives by intelligently anticipating what information is needed next and placing this data in a temporary buffer on the hard disk or RAM. When the

Macintosh requests this data, it is available instantly.

The CDT Remote program allows you to play audio tracks through headphones or an amplifier. It includes sophisticated features such as fast forward and shuffle play and allows digital audio extraction, which is explained later in this manual.

CDT Remote supports Compact Disc and Graphics (CD+G) media (also known as CD Karaoke titles). These special CDs usually offer lyrics and video to accompany music.

In addition, the device driver included in CD-ROM ToolKit allows you to access all the most popular CD formats, including Kodak Photo CD, Macintosh HFS, ISO 9660, High Sierra, and ProDOS discs.

CD-ROM ToolKit includes custom support for most SCSI CD-ROM drives. CD-ROM ToolKit is compatible with most of the newest CD-ROM drives and improves performance even on these faster devices.

Many of these newer drives now include the ability to read "multisession" discs (such as Kodak's Photo CDs). These multisession discs are unique because they can be written to more than once. The "secondary" writes are essentially written after the first. To read these secondary writes requires special CD-ROM drives that are multisession compatible. CD-ROM ToolKit supports most multisession hardware available. Please consult the list of supported devices in the "Supported Devices" file on the original CD-ROM ToolKit program disk.

Registration

Please take a moment to complete the registration card and mail it to FWB, Inc. so we can inform you of changes or updates to CD-ROM ToolKit.

Hardware and Software Requirements

- Macintosh Plus or better
- System 6.0.4 or better (System 7.x recommended)
- Four megabytes of RAM or greater (more is helpful)
- A supported SCSI CD-ROM drive
- Disk caching requires 1 to 3 MB of free contiguous hard disk space (more is helpful)

If you are unsure whether your CD-ROM drive is supported by CD-ROM ToolKit, please consult the "Supported Devices" file on the original program disk. If you have a drive that is not supported, please contact FWB to let us know what model it is, so that we can add support for it in the future.

Before using CD-ROM ToolKit, you should already be comfortable using the Macintosh environment.

If you need to familiarize yourself with the terminology and operations common to all Macintosh programs, please consult the manuals and other materials that were supplied with your computer.

Removing Old Driver Software

CD-ROM ToolKit contains special software that enables your CD-ROM drive to communicate with your Macintosh. This software is referred to as a device driver and must be installed on your Macintosh to use CD-ROM ToolKit.

If you already own a CD-ROM drive and have used it before on your Macintosh, then you already have driver software installed on your computer. That software will conflict with CD-ROM ToolKit, preventing it from loading. It is necessary to remove or replace any existing CD-ROM device driver on your Macintosh in order to use CD-ROM ToolKit's high performance device driver.

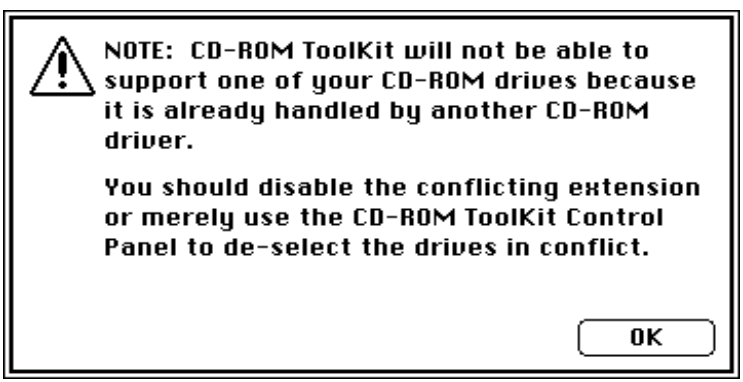

Figure 2: *Extension Conflict Message*

If you are using a new CD-ROM drive with your Macintosh for the first time or CD-ROM ToolKit was included with your CD-ROM drive, you may skip to the QuickStart section.

If you have an Apple or another third party CD-ROM driver already installed on your computer, it should be disabled by removing it from your System Folder. The driver will be replaced by the one in CD-ROM ToolKit. System 7.x users will usually find the CD-ROM device driver in either the Extensions Folder or Control Panels Folder inside the System Folder. System 6 users will find the device driver in the System Folder itself. See the list (Figure 2) of common device driver names to help you locate the file. Please note, this list is for information only and is not meant to be exhaustive. If you have problems locating your CD-ROM driver software, check with the manufacturer of the CD-ROM drive you have.

Manufacturer	File Name
Apple	Apple CD-ROM; PowerCD Extension
CD Technology	CDTECH 1.x.x
Casa Blanca Works	Drive7Rem; DriveCD
Charismac	CD-ROM Extension; AutoCache Extension; TurboCD™-ROM Init; Anubis™ CD-ROM
Chinon	CDINIT (Mac Plus); CDINIT (Mac II)
Corel	~CorelSCSI!
Insignia	RapidCD
MetroCD	MetroCD INIT 1.x.x
NEC	NecCDDrvr
OAC	Spirit™CD
PLI	PLICDDrvr
Pioneer	CLD Access
Trantor	TSLCDDrvr
Toshiba	Toshiba CD-ROM Driver 1.x.x

Figure 3: *Common device drivers, by manufacturer*

After locating the file, disable it by dragging it out of your System Folder or dragging it to the Trash. It is unlikely you will need this file again, but it is recommended that you maintain a back up copy just in case.

In addition, the latest version of Apple's Foreign File Access software is included as a courtesy to you. It is used by the Macintosh to mount Audio, ISO, and Photo CD discs. If you are not using the most current version, remove the old files and replace them with the included files.

Section II — QuickStart

If you are already familiar with operating a CD-ROM drive and your Macintosh, you may find the following instructions sufficient to use most of CD-ROM ToolKit's features.

Basic Installation

If you have been using your CD-ROM drive with your Macintosh prior to installing the CD-ROM ToolKit, you must disable any previously installed driver software before installing the ToolKit's device driver.

To disable Apple's or any third-party device driver, simply drag the file out of the System folder and restart your Macintosh. Please refer to Installation and Removal Specifics for additional information on this procedure.

NOTE: Before proceeding with the installation, restart your computer with all extensions off, making sure to disable any virus protection software.

Begin the installation by inserting the original CD-ROM ToolKit diskette in your floppy drive. Now simply double click on the "CD-ROM ToolKit™ Installer" file located on the CD-ROM ToolKit disk.

You will be presented with the CD-ROM ToolKit™ Installer window. Click the Continue button. You will have the option of choosing Standard installation, Custom installation, or quitting the Installer.

Figure 4: *Installer screen*

Figure 5: *Standard Installation Dialog*

Figure 6: *Custom Installation Dialog*

The **Standard** installation will place CD-ROM ToolKit directly into the Control Panels folder, CDT Remote into the Apple Menu Items folder, and Audio CD Access, Foreign File Access, High Sierra File Access, ISO 9660 File Access into the Extensions folder inside your System Folder.

The **Custom** installation will allow you to choose which components you wish to install.

We recommend the Standard installation, as it will properly install all of the components necessary to properly run CD-ROM ToolKit:

- Audio CD Access, Foreign File Access, High Sierra File Access, and ISO 9660 File Access will be placed into your Extensions folder

- CD-ROM ToolKit™ will be placed into your Control Panels folder
- CDT Remote™ will be placed into your Apple Menu Items folder
- Read Me files will be placed into the installer-created folder labeled "CD-ROM ToolKit Extras"

NOTE: If you are using System 6.0x, all system files will be placed into your System Folder, and CDT Remote and the Read Me First files will be placed into a newly-created folder called "CD-ROM ToolKit Extras".

When the installation has completed, click OK in the completion dialog (Figure 6). Eject the original CD-ROM ToolKit disk. Store the original program diskette in a safe place.

Figure 7: *Installation Completion Message*

After restarting your computer, the CD-ROM ToolKit icon should appear briefly at the bottom of your screen while the “Welcome to Macintosh” banner is displayed.

Open the Control Panels folder from the Apple Menu. Locate and double click on the CD-ROM Tool-Kit icon to launch the Control Panel and personalize CD-ROM ToolKit.

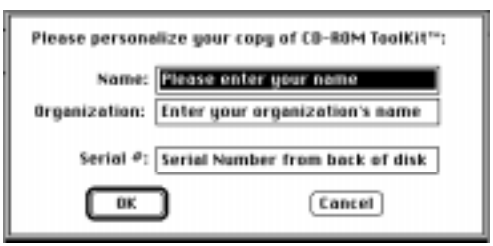

Figure 8: *Personalization Dialog*

Personalizing CD-ROM ToolKit

The first time you run it, the Control Panel will ask you to enter your name and the program’s serial number in the Personalization dialog (Figure 7). The serial number can usually be found on the back of

the CD-ROM ToolKit program disk. The Control Panel will not run until a valid serial number has been entered.

If you receive an “invalid serial number” message, make sure that the number has been entered correctly. The format of the serial number will appear as follows: ZZXXXXXXXX, or ZXXXXXXXX, where Zs are letters and the Xs are numerals. Do not enter any spaces. Make sure that you have installed the Control Panel before attempting to enter the serial number.

If you receive the message: “Unable to change settings because your System Folder is locked”, CD-ROM ToolKit will not load because your System volume is write-protected. You must turn off write protection of your System Folder so the serial number can be recorded to CD-ROM ToolKit. Changing CD-ROM ToolKit’s default settings also requires that write protection is disabled.

After the serial number has been entered, the Control Panel will appear on your screen. The top section displays a list of devices attached to your computer. The lower portion of the Control Panel allows you to customize the default settings for acceleration.

After installing the software, CD-ROM ToolKit will automatically load into memory every time you start your computer.

Congratulations!

You have completed the CD-ROM ToolKit installation. While it is not absolutely necessary to
read the rest of this manual, we suggest that you refer to "Section IV - Instruction Guide"
to get full enjoyment from CD-ROM ToolKit.

Section III — Installation and Removal Specifics

Installing CD-ROM ToolKit

CD-ROM ToolKit is shipped on a single floppy disk. The disk contains the CD-ROM ToolKit Installer, Read Me First and Supported Devices files. The Read Me First and Supported Devices files are text files which may be viewed or printed by running TeachText, which is provided for this purpose.

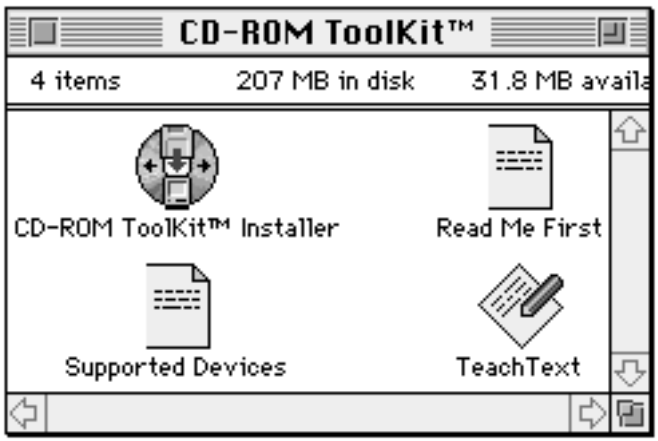

Figure 9: *Contents of CD-ROM ToolKit Disk*

NOTE: Before proceeding with the installation, restart your computer with all Extensions off, making sure to disable any virus protection software.

Begin the installation by inserting the original CD-ROM ToolKit diskette into the floppy drive. Double click on the "CD-ROM ToolKit™ Installer" file located on the CD-ROM ToolKit disk.

You will be presented with the CD-ROM ToolKit™ Installer dialog. You will have the option of choosing Standard installation, Custom installation, or quitting the Installer.

The **Standard** installation will place CD-ROM ToolKit directly into the Control Panels folder, CDT Remote into the Apple Menu Items folder, and Audio CD Access, Foreign File Access, High Sierra Files Access, ISO 9660 File Access into the Extension folder inside your System Folder. The Installer will also create a CD-ROM ToolKit Extras folder containing the Read Me files. System 6 users will find the CDT Remote application in the CD-ROM ToolKit Extras folder.

The **Custom** installation will allow you to choose which components you wish to install.

We recommend the Standard installation, as it will properly install all of the components necessary to properly run CD-ROM ToolKit.

Once the installation has completed, drag the original CD-ROM ToolKit disk icon to the trash to eject the disk. Store the original program diskette in a safe place.

CD-ROM ToolKit is installed and working properly if the icon appears briefly at the bottom of your screen (Figure 9) while the “Welcome to Macintosh” banner is displayed.

Figure 10: *Normal Startup Icon*

If the CD-ROM ToolKit icon briefly appears with an X through it after restarting (Figure 10), then a startup error has occurred and CD-ROM ToolKit did not load properly.

Figure 11: *Problem Startup Icon*

If you have this problem, try disabling other System Extensions by removing them from your System Folder or by using an Extension management program, and restarting your Macintosh. After isolating which Extension is causing the conflict, you may find that renaming the Control Panel, or putting a space before it’s name, will solve the problem. This will change the loading order because Extensions and Control Panels load in alphabetical order.

CD-ROM ToolKit will display a question mark over its icon (see Figure 11) upon startup if it has not been configured to support any CD-ROM drives, or if your CD-ROM drive is not recognized by CD-ROM ToolKit (check the Supported Devices list). This would typically occur if you have a newer drive that is not yet supported by CD-ROM ToolKit, or perhaps if you have an older, discontinued drive. Please contact FWB to let us know what model it is so we may support it in the future.

Figure 12: *Missing Device Startup Icon*

The most common causes for this error are not having your CD-ROM device powered on startup, a conflict with another Control Panel or Extension, or failure to remove old CD-ROM driver software. Another possible cause could be that there is not enough memory to load CD-ROM ToolKit.

If you add one or more CD-ROM drives to your computer after installing CD-ROM ToolKit, you must open the CD-ROM ToolKit Control Panel and check the boxes next to the drive ID of the new CD-ROM drive to tell it to support those devices.

Likewise, if you change the SCSI ID of your CD-ROM drive after having installed CD-ROM ToolKit, or if you start up without the CD-ROM drive powered up, you must open the CD-ROM ToolKit Control Panel and check the boxes next to the desired new SCSI ID to enable them to be used.

You have now finished installing CD-ROM ToolKit. If you are an experienced user, you may consult the QuickStart section for basic information needed to configure CD-ROM ToolKit. Otherwise, please consult the Instruction Guide for detailed information on each module.

The first time you open the CD-ROM ToolKit Control Panel, it will ask you to enter your name and the program's serial number. Please refer to Personalizing CD-ROM ToolKit in the QuickStart section for personalization information.

If you encounter any of the problems described above, please refer to the Troubleshooting section for additional instructions.

Removing CD-ROM ToolKit

CD-ROM ToolKit's driver may be deactivated by using the Control Panel to turn off the driver. Please see the section on the CD-ROM ToolKit Control Panel in the Instruction Guidefor additional information on this option.

CD-ROM ToolKit can be removed from your computer by dragging all the files installed completely out of the System Folder or into the Trash. Additionally, drag the CDT Remote application from the Apple Menu Items folder completely out of the System Folder or into the Trash. You will also want to remove the FWB CD-ROM Cache File xx, FWB CD-ROM ToolKit Prefs, and FWB CDT Remote

Player Prefs from the Preferences folder in the System Folder to be complete. The next time you restart your Macintosh, CD-ROM ToolKit will not load into memory.

To remove the product, begin by opening the System Folder on your start-up drive. Locate all the CD-ROM ToolKit's file icons listed below. System 7.x users will find some of the CD-ROM ToolKit icons in the Extensions folder and one in the Control Panels folder. System 6 users will find all necessary CD-ROM ToolKit files in the System Folder.

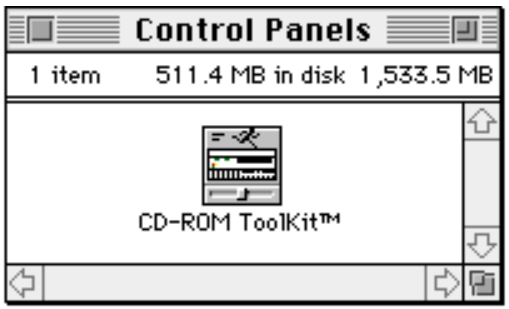

Figure 13: *File Installed by CD-ROM ToolKit into Control Panels Folder*

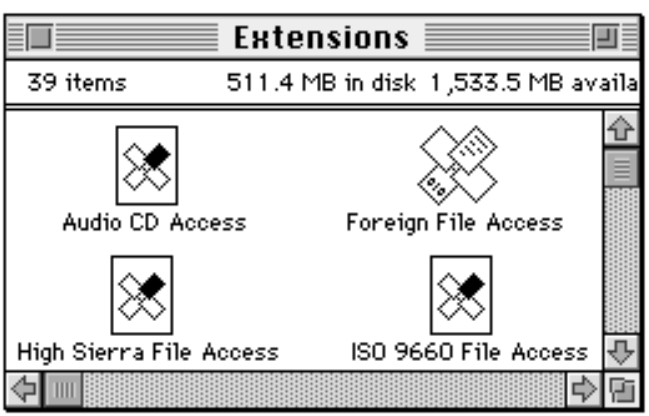

Figure 14: *Files Installed by CD-ROM ToolKit into Extensions Folder*

Section IV — Instruction Guide

Now that you have successfully installed CD-ROM ToolKit, you can immediately begin to enjoy the added performance and compatibility offered by this powerful utility.

This section of the manual includes detailed information on:

- The CD-ROM ToolKit Control Panel
- Reading Different CD-ROM Formats
- Prescanning CDs for Acceleration.
- Playing Audio CDs with CDT Remote

The CD-ROM ToolKit Control Panel

Most users will find acceleration to be a fast and effective way to improve all aspects of CD-ROM performance. CD-ROM ToolKit includes a convenient Control Panel that allows users to automatically accelerate and configure all discs for optimum performance.

Accessing the Control Panel

1. Select Control Panel from the Apple Menu.
2. Scroll the Control Panels list until you see the CD-ROM ToolKit icon.
3. Double click on the CD-ROM ToolKit icon to open the Control Panel. (System 6 users should click only once.)

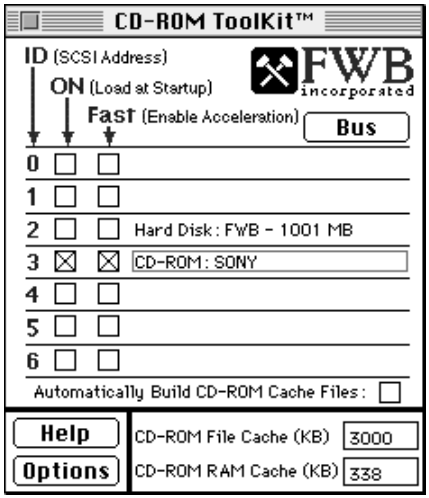

Figure 15: *CD-ROM ToolKit Control Panel*

The top section of the Control Panel displays a list of devices attached to your computer. The lower portion allows users to customize the default settings for acceleration.

After opening the Control Panel, CD-ROM ToolKit will automatically scan the SCSI bus and identify the device at each SCSI address in the right column. Devices displayed within boxes are CD-ROM drives. Other SCSI peripherals attached to your system are identified for your information only. This can be helpful when diagnosing SCSI ID conflicts.

> **NOTE:** If your CD-ROM drive does not appear in the Control Panel window, it is likely that it is not turned on, not connected correctly to your computer, or conflicting with another device. Please consult your CD-ROM drive's operation manual for information on connecting the drive to your computer and resolving conflicts.

CD-ROM ToolKit must be reconfigured if you add CD-ROM drives, change their SCSI IDs after having installed it, you must open the Control Panel and check the boxes next to the SCSI IDs of the newly added devices to enable support.

The column titled ON allows you to designate whether you want CD-ROM ToolKit's device driver to load at startup. Most users will use the default ON setting to automatically load CD-ROM ToolKit's driver into memory at startup so that CDs will mount.

This feature provides users with an easy way to turn off CD-ROM ToolKit's driver should they wish to run a third party driver, such as Apple's, instead. To turn-off CD-ROM ToolKit's driver for a specific CD-ROM drive, simply click on the ON check box to toggle to the off position.

The column titled Fast allows you to turn acceleration on or off for individual SCSI IDs. By checking ON, acceleration for the chosen device is enabled.

Unchecking the ON box for individual CD-ROM drives provides an easy way to defeat all acceleration features. This also allows you to use all of CD-ROM ToolKit's audio and driver software without any of the caching features (in case you suspect the caching features to be causing problems).

The **Bus** button allows you to view devices on any active SCSI Manager 4.3 compatible bus on your Macintosh, such as the FWB SCSI JackHammer bus, if installed. Simply click on the Bus button to view any CD-ROM drives on other busses for driver loading and acceleration. The Bus button will not appear unless more than one SCSI bus is present.

CD-ROM ToolKit is fully compatible with Apple's SCSI Manager 4.3. CD-ROM ToolKit's drivers allow you to exploit the capabilities of Apple's SCSI Manager 4.3 on Macintosh AV, Power Macintosh, Power PC Upgraded Macintosh computers, and any Macintosh equipped with the SCSI JackHammer. The SCSI Manager 4.3 System Extension is installed on Centris and Quadra machines running System 7.5. The benefits of FWB's latest driver coupled with SCSI Manager 4.3 are: support for devices on multiple buses, DMA support, reduced SCSI I/O processing overhead, asynchronous SCSI I/O, high-speed synchronous data transfers, and maximized SCSI bus utilization which translates to higher overall data throughput.

The lower portion of the Control Panel offers several settings that allow you to further customize the program.

The **Automatically Build CD-ROM Cache Files** option starts the acceleration of CD-ROM discs without asking for user confirmation. By checking this option, CD-ROM ToolKit will begin caching file and directory information to the hard disk automatically when you insert a CD-ROM disc.

Most users will prefer to turn this option ON. This will allow you to bypass the dialog that prompts you to accelerate each disc. Writing the cache files takes place entirely in the background, is fairly quick, and uses 1 to 10 megabytes or more of hard disk space you have allocated in the Control Panel. When CD-ROM ToolKit builds the cache file, it will always overwrite any existing cache file to prevent consuming additional hard disk space. Reboot after checking the ON checkbox for acceleration to take effect.

At the bottom of the Control Panel are two text boxes that allow you to edit the amount of memory allocated to the cache. The upper box titled “CD-ROM File Cache”, refers to the maximum amount of hard disk space you wish to assign to the cache (per drive). 3000KB is the default which equals approximately 3 megabytes of disk space and is generally an optimal setting for most uses of your CD-ROM drive. This number can be changed by clicking in the box and typing in a new number. The cache can utilize from 1500 to 10000KB of hard disk space. Users with large amounts of available disk space will benefit by allocating the maximum 10000KB to the cache. Some CD-ROMs that contain very large collections of files (greater than 16,000) require at least 3000KB for maximum acceleration effect. We recommend a minimum of 3000KB of available disk space for CD-ROM ToolKit. If you increase this number, you should slightly increase RAM cache as well to retain the same performance.

If your startup hard disk volume is heavily fragmented or nearly full, preventing the creation of the standard 3000 KB cache file, CD-ROM ToolKit will attempt to allocate less disk space to the disk based cache file.

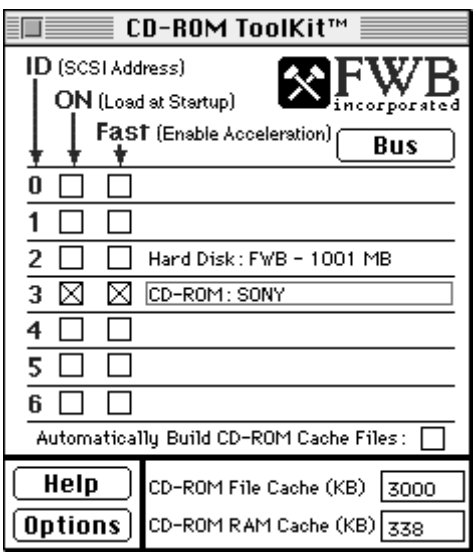

Figure 16: *CD-ROM ToolKit Control Panel*

Caching settings

The text box at the very bottom of the Control Panel titled “CD-ROM RAM Cache” refers to the maximum amount of Random Access Memory you wish to assign to the cache. The default of 335K is

generally an optimal setting for most uses. This number can be changed by clicking the in the editable area and typing in a new number. The RAM cache can utilize from 65K to 10000K of memory. Because RAM is more precious and more expensive than hard disk space, allocating RAM to the CD-ROM caching scheme is optional. Users with excess available RAM will see performance gains from allocating small amounts of RAM to the cache. Most users will designate between 335KB and 1000KB of RAM to the cache, depending on the amount of memory available.

Dynamic vs. Static Cache

CD-ROM ToolKit provides both a dynamic and static cache to maximize the performance of CD-ROMs. A lot can be said about the fundamental differences between dynamic caching and static caching, however we will try to summarize this complex topic as simply as possible. Cache should be thought of as data that is meant to be read often which is stored in alternate locations for future faster accesses. Some information has a much higher probability of being used frequently and is conveniently stored in a "static" cache instead of the more volatile and ever-changing "dynamic" cache. A "dynamic" cache stores information in a reusable pool replacing older data that was not recently referenced. A static cache never deletes data stored in it until another CD-ROM insertion. The static cache is usually filled with information prescanned (or pre-cached) immediately after CD-ROM insertions and includes megabytes of Finder related information such as icons, file names, and folder information. The static cache is mostly stored in a large file CD-ROM ToolKit maintains. The size of this file is totally configurable in CD-ROM ToolKit's Control Panel. Dynamic caching should not have to be a function of a storage device driver using a modern operating system, yet CD-ROM ToolKit offers this feature to gain every speed improvement possible. Dynamic cache is helpful because it is exceptionally fast and even helps speed up data normally accessed first from the static cache.

Stunningly fast performance can be seen with our new dynamic RAM cache capability. Dynamic caching is on by default, and uses 128k of the default RAM cache of 335k. Suggested values for optimal dynamic caching include: 335k, 467k, 725k, 1241k, 2273k, 4337k, and 8465k. These values maximize caching structure efficiency. The maximum amount is determined by how much memory your computer has and how many System Extensions are being loaded. Although 10000K is the maximum supported, most Macintoshes cannot support it unless they have an abundance of memory. To eliminate any slowdown from overhead of static disk cache and static RAM cache technologies, you may deselect all four of the prescanning options in the CD-ROM ToolKit Control Panel. If done, only Dynamic cache is performed, though Static Cache prescanning benefits will be sorely missed and most people will not choose to deselect the Prescanning options.

Changes made to the Control Panel will only take effect after restarting your computer.

Customization Options

At the very bottom of the CD-ROM ToolKit Control Panel is an Options button that provides access to specific caching features. Click on the Options button to open the Customization Options dialog.

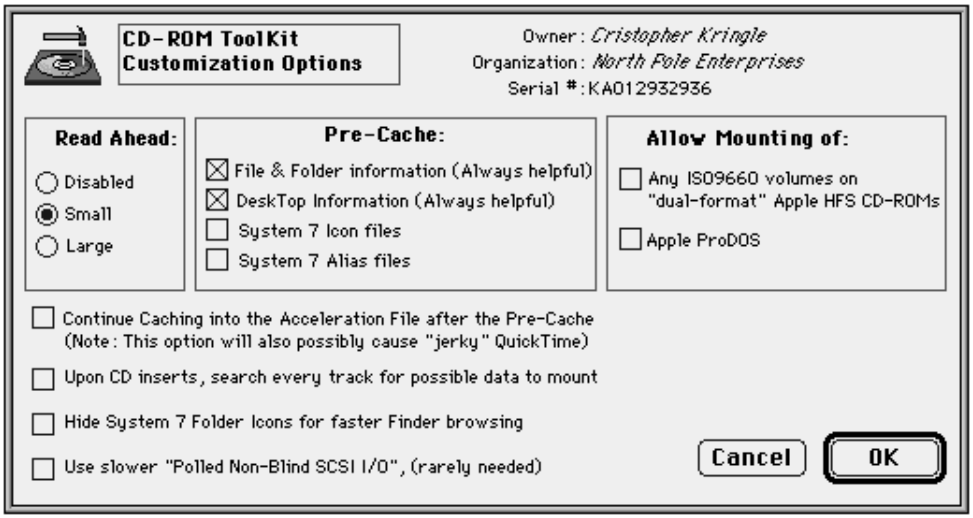

Figure 17: *Configuration Options Dialog Box*

These options are automatically configured to the optimum settings for most users. Some users may choose to change these defaults to experiment with potential performance differences, or to minimize system overhead required by caching.

NOTE: Changes made to the customization options will only take effect after restarting your computer.

Read Ahead Options

Read ahead caching (often referred to as prefetching) is designed to anticipate the next request for data from the CD-ROM by reading information physically adjacent to the previous request. It functions in both forward and reverse directions. Read ahead caching improves performance particularly for applications that are inefficient in how they handle requests for data.

Disabled - Selecting this option will turn off all read ahead caching. Disabling all read ahead caching may slow down file transfers when the requesting program is inefficient in how it handles requests for data.

Small - Selecting this option will turn on read ahead caching using 2K data blocks. By prefetching data in small 2K increments, users may enjoy the performance gains associated with read-ahead cach-

ing while using fewer CPU cycles to refresh the cache.

Large - Selecting this option will turn on read ahead caching using 32K data blocks. By prefetching data in larger 32K increments, users may enjoy insreased performance gains associated with larger cache files by dedicating additional resources to the cache. The disadvantage to the this option, is that QuickTime users may find video to be “jerky” due to fluctuating data transfer rates. Heavy QuickTime users should choose the Read Ahead Small option, or disable it altogether. This option functions better on 2x or faster drives, and on faster Macintoshes.

Pre-Caching Options

Pre-caching is designed to copy repeatedly used information to a “buffer” on your hard drive. This process off-loads basic information requests to the faster storage device and is the primary acceleration technique used by the CD-ROM ToolKit.

File & Folder information - Selecting this option copies basic file information to the hard drive, significantly improving your ability to find files and folders on the disc. This caching option represents the best opportunity to improve overall performance of CD-ROM drives and therefore should be left on. This information consumes the largest portion of the cache file on the hard disk.

Desktop Information - Selecting this option copies icons and other file specific information to the hard drive which improves the speed of window refresh and Get Info operations. This information will utilize a smaller portion of the cache file on the hard disk.

System 7 Icon files - Selecting this option will copy custom icon information to a buffer on the hard drive and improves Finder operations and icon drawing speed. Enabling Pre-scanning System 7 Alias files and System 7 folder icon files options in the CDT Control Panel can easily result in exhausting all caching buffers. Many CDs that contain color icons have hundreds of them that occupy a lot of cache space and require lots of pre-scanning time, especially public domain and clip art collections. By default, these two caching options are not enabled. Be aware that enabling these options may result in extremely long pre-scanning times for titles with lots of icons.

System 7 Alias files - Selecting this option copies small alias records to a buffer on the hard drive and improves Finder access to these files. “Caching Aliased files” consumes a small amount additional hard disk space.

Continue Caching into Acceleration file after Pre-Cache - If this option is enabled, the computer will continue to store the most accessed CD-ROM information into the static cache file and static RAM cache, even after prescanning has concluded. The prescanned information is stored first, but because extra space is usually left over, you may want to continue storing CD-ROM data until it is filled up. This may cause slower QuickTime performance, but is best used if a single title is repeatedly accessed.

Upon CD inserts, search every track for possible data to mount - If this option is enabled, the program will be able to mount multi-volume multisession CD-ROMs. This does not refer to normal multisession Photo CDs, but rather Desktop CD recorded media with data written in many tracks, or in tracks following an audio track. These CD-ROMs usually are golden instead of silver colored. If this option is used, mounting some Photo CDs, 'flawed' disks that no other driver can mount, or other CDs with large numbers of sessions will take longer to mount than if the option is off. You should also turn off this option if the “Table of Contents” area of the CD is meant to be ignored when mounting for speed, or when using “Active Audio™” audio CDs. “Active Audio™” technology allows Macintosh and MS Windows accessible information to be stored on audio CDs in a way very similar to CD-ROMs. Contact BMG Australia LTD at Internet addresses of Chris@PAMS.com.au, or advmedia@singnet.com.sg for information on new audio CDs containing “Active Audio™”. Leave this option off if you are not sure if you need to use multisession multi-volume CDs.

Hide System 7 Folder Icons for faster Finder browsing - If this option is enabled, CD-ROMs that have System 7 Color Icons placed over the folders will have them hidden when mounted. This speeds up browsing CD-ROMs that overuse these folder icons because large icon files are not read from the CD-ROM. The speedup is very significant but, as a consequence, folder icons are suppressed. Selection of this option is merely a matter of preference.

Use slower "Polled Non-Blind SCSI I/O", (rarely needed) - This option should not be used unless you are trying to determine if a problem is eliminated when fast blind SCSI I/O is avoided. Some CPU acceleration boards cannot reliably use blind SCSI I/O on all devices. Devices that cannot use Blind SCSI I/O on all normal Macintoshes operate no differently when this option is used because the software is written to already use slower "Polled Non-Blind SCSI I/O" for these older devices. Leave this option off unless your CD-ROM drive manufacturer’s manual or technical support advises you to use it.

Allow Mounting Options

Many CD-ROM titles now include both Macintosh HFS partitions and ISO 9660 (or Apple II ProDOS) partitions on the same disc. Usually, these partitions are disabled and only the Macintosh HFS partitions will appear on the desktop. CD-ROM ToolKit has the unique ability to mount both Macintosh and non-Macintosh partitions.

> **NOTE:** In order to eject these multiply-mounted discs, you must drag the non-HFS partition to the trash first. Dragging the HFS partition, or all partitions at the same time, to the trash may cause errors to occur.

Any ISO 9660 volumes on "dual-format" Apple HFS CD-ROMs - Selecting this check box turns on the ability to mount ISO 9660 partitions on multiple-volume CD-ROMs. For instance, if you have a clip art CD-ROM that has popular Macintosh graphic file formats on the Macintosh HFS partition and popular PC graphic file formats on the ISO 9660 partition, you can select this check box and mount

both partitions.

NOTE: Application programs on PC-based partitions are not written to run on the Macintosh. You will need a PC emulator in order to run these programs.

Apple ProDOS - Selecting this check box turns on the ability to mount ProDOS partitions on multiple-volume CD-ROMs. The early Apple developer CD-ROMs came with Apple II-style ProDOS partitions in addition to the Macintosh partitions. In order to mount both the Macintosh and the ProDOS partitions, you must have the ProDOS File System Extension loaded and this box checked. The ProDOS File System Extension is available with the Apple IIe Card for LC software, and it is also downloadable from AppleLink.

Reading Different CD-ROM Formats

CD-ROM ToolKit includes all the special software to read non-Macintosh formats including Photo CD, ISO 9660, High Sierra, and audio discs.

CD-ROM ToolKit has unique support of dual format CD-ROM titles. It can simultaneously mount CD-ROMs that have both Macintosh HFS, ISO 9660, and ProDOS formats. Open the CD-ROM ToolKit Control Panel and enable this via the Options button. CD-ROM ToolKit requires that the ISO 9660 partition be unmounted BEFORE the Mac HFS partition is unmounted.

Early Apple Developer CD-ROMs (Volumes 1-7) contain both an Apple II ProDOS partition and a Macintosh HFS partition. To mount the ProDOS partition, you must have the ProDOS File System Extension in your System Folder, and the ProDOS mounting option enabled in CD-ROM ToolKit's Control Panel. This file is part of the Apple IIe card software for the Macintosh LC family. You can download this software from AppleLink from the following path:

Software Sampler
Apple SW Update
Macintosh; Peripherals
Apple IIe Card for LC
IIe Card for LC Startup 2.2

Most CD-ROMs designed for the Macintosh are HFS compatible and are exclusively for Macintosh computers. However, a growing number of titles are created in a format called ISO 9660 which can be used on PC compatible computers and other systems that recognize this international format.

The CD-ROM ToolKit program discs are shipped with several files that allow your Macintosh to recognize non-Macintosh discs. These files will be placed into the appropriate area of your System Folder during installation. With this software installed, you can use non-Macintosh discs without further

setup. If you have removed these files from your System Folder or have outdated versions, refer to the section on Installation in this manual for installing them.

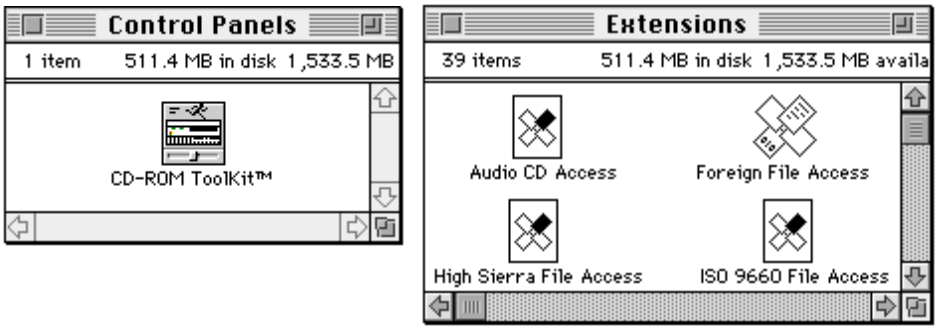

Figure 18: *Correct Location of Files in System Folder.*

Photo CD discs

Kodak's Photo CD discs allow you to open and view digital images created from photographs or developed from film and stored on a CD-ROM for use with your Macintosh.

For best use of Kodak's Photo CDs, we recommend using two Apple Extensions: QuickTime 1.5 or later and Apple Photo Access. QuickTime is available through resellers and on several online services and on AppleLink; the Apple Photo Access Extension is available on the Internet and on AppleLink. We recommend using QuickTime 2.0 or newer.

NOTE: QuickTime does not operate on "68000" computers such as the Macintosh Plus, SE, Classic, Portable, and Powerbook100.

To view images stored on Photo CDs, you can use any program that can view PICT files in conjunction with QuickTime, or you can use a specialized program such as Adobe's Photoshop to view and edit the images.

"Apple Photo Access" is a System Extension file that will allow the Finder to present nice looking icons and folder structures on Photo CD media. Macintosh systems without that Extension can use Photo CD, but its absence makes it impossible to select photos to load and use the Finder to browse photographs without additional software. This means you will need some type of Photo CD compatible graphics program, such as Adobe Photoshop, to view Photo CD pictures. This file is available directly from Apple or by downloading from information systems such as AppleLink. Users of Photo CD should obtain this file to make Photo CD access more Mac-like. You can download this software from AppleLink from the following path:

Software Sampler

Apple SW Update

Macintosh

Peripherals

Macintosh CD-ROM Setup 5.0

NOTE: CD-ROM ToolKit provides single session Photo CD capabilities to most drives. Multisession Photo CD discs require multisession compatible CD-ROM drives. Multisession compatibility is an advanced hardware feature, and only exists in certain devices introduced after October 1992. Please refer to your CD-ROM drive's owners manual or the Supported Devices file included with CD-ROM ToolKit to determine whether your drive is multisession compatible.

Prescanning CDs for Acceleration

Begin by inserting a CD-ROM into the drive. A dialog will appear asking if you would like to activate acceleration for the disc. (This can be suppressed by choosing the Automatically Build CD-ROM Cache Files option within CD-ROM ToolKit's Control Panel.)

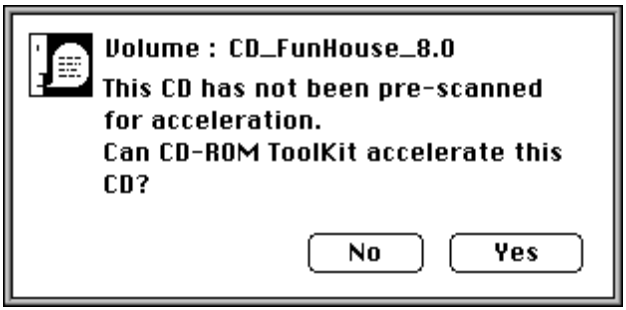

Figure 19: *CD-ROM ToolKit asks for permission to pre-scan your CD*

If you would like this disc accelerated, click on Yes or hit the Return key and CD-ROM ToolKit will do the rest. Once the CD-ROM mounts on the Desktop, CD-ROM ToolKit begins working entirely in the background caching information from the CD-ROM to your hard drive and RAM. You have control of the Macintosh during this process and can open folders, copy files, or launch applications as you normally would. CD-ROM ToolKit will complete the caching process within seconds, depending upon the number of files on the disc. You should notice significant improvements in your ability to quickly navigate around accelerated CD-ROM discs.

If you do not want acceleration, click on No, and the CD-ROM will not be accelerated; all requests for data from the CD-ROM will occur at the drive's normal access speed. Not enabling acceleration will not affect CD-ROM ToolKit's ability to play audio CDs, read Photo CDs, or otherwise access CD-ROMs.

NOTE: The use of the word "acceleration" in the preceding paragraphs refers exclusively to prescanning, and has nothing to do with dynamic or static caching or read-ahead. The other caching technologies are always engaged if enabled.

Playing Audio Discs with CDT Remote

If your CD-ROM drive is equipped with audio jacks or speakers it can play audio CDs, or data CDs that contain audio tracks, using the CDT Remote program. This program is designed to look like a standard remote control unit for a home stereo. You can use CDT Remote to start, stop, play, and otherwise control the disc.

The CDT Remote application is normally copied to your hard drive during installation. If CDT Remote cannot be found, please refer to the section on Installation in this manual for installation instructions.

Figure 20: *CDT Remote*

There are two types of CD that contain music: traditional audio discs, and multimedia CDs. Traditional audio discs appear on the Desktop when mounted with files named track 1, track 2, etc... (Figure 20). You can play these by simply double-clicking on individual tracks.

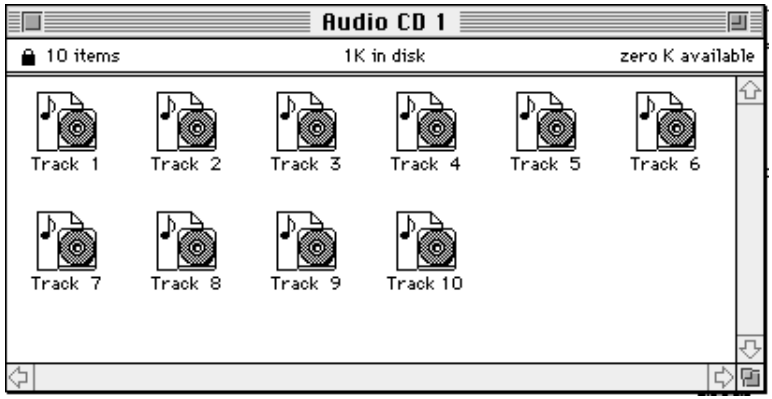

Figure 21: *Traditional Audio CD Icons*

Some multimedia discs contain audio tracks as well as other types of data. As they are encoded differently, you can not play audio tracks on these discs by opening or clicking on their icons. Use CDT Remote to play these audio tracks. They will always start after track "1" in audio player programs.

Using CDT Remote

NOTE: Using the CDT Remote program requires that a CD-ROM driver is available. If CDT Remote gives an error message, make sure that the CD-ROM drive was powered on at startup and that the CD-ROM ToolKit Control Panel has been configured correctly.

Insert a CD in the drive. Be sure that the disc contains audio information. CDT Remote will only play audio files. You will normally access CDT Remote from the Apple Menu.

Double Clicking (opening) an audio file icon of an inserted audio CD in the Finder will play that single track and automatically launch CDT Remote. If you have multiple CD ROM devices connected, remember that CDT Remote will display the first device on the SCSI bus. If it appears that CDT Remote is not playing the selected track, even though you are getting the correct output through your headphones or speakers, go to the Player pull down menu and choose the Select Device menu item to select the correct CD-ROM drives' SCSI ID to view and control the playback.

CDT Remote automatically scans the disc inserted in the drive and displays the first track in the Elapsed Time Window. The following section describes each of CDT Remotes' buttons.

Stop: Clicking this button stops play and resets to the start of the current track.

Play: Clicking this button starts playing the track displayed in the Elapsed Time Window.

Pause: Clicking this button stops play without losing your place on the disc. After pausing you can resume play exactly where you left off by clicking on the pause button a second time or clicking play.

Elapsed Time Window: This window displays status information about the current track (stop, play, pause,etc…). The time elapsed since the track began playing is shown on the right side of the display.

Track >>: Clicking this button will skip to the beginning of the next track.

Track <<: Clicking this button will skip to the beginning of the current track. Subsequent clicks will go to the previous track. Using the track buttons is much faster if the drive is stopped first.

Scan >>: Holding this button down while playing an audio track will repeatedly skip forward in the audio portion played through the headphones or amplifier. Smooth hardware-assisted fast forward audio scanning is not supported on all CD-ROM drives, yet is simulated on all others. Please see the Supported Devices file to see if your drive is supported.

Scan <<: Holding this button while playing an audio track will repeatedly skip backward in the audio portion played through the headphones or amplifier.

Shuffle: Clicking this button will enable playing the tracks on the inserted CDs in random order until each is played.

Audio Channels: Clicking this button will allow you to select different audio channels for play through your headphones or amplifier. It cycles through left only, right only, both channels left, both channels right, monophonic, and stereo.

NOTE: Not all CD-ROM drives can actually emit monophonic audio.

Volume: This slider bar will adjust the volume from the CD-ROM drive output to your headphones or amplifier. Dynamic software volume control is not supported by every CD-ROM drive; please see the Supported Devices file to see if your drive is supported. The bar can be moved to the right to increase volume and to the left to lower the volume. The default position of the slider is controlled by the specific device and its driver.

Eject: Clicking this button at any time will stop play and eject the disc from the drive. This can also be accomplished by dragging the CD icon to the Trash.

Time: Clicking this button toggles between displaying the elapsed time for the current track and the

time remaining for the current track.

The CDT Remote Menu

CDT Remote also includes a menu from which additional commands may be selected.

Figure 22: *CDT Remote Player Menu*

Select Device - If you have more than one CD-ROM drive with an audio disc inserted, CDT Remote automatically picks the drive with the lowest SCSI ID number. You can select another drive by choosing Select Device from the CDT Remote menu.

Show Fewer Controls - If you prefer to have CDT Remote take up less room on your screen, you can choose Show Fewer Controls and the CDT Remote window will shrink to less than half the size while still keeping the most important control buttons. Your selection will be saved, so the next time you run CDT Remote it will display the preferred size. This command will eventually take you to the CD+G window if your device supports this feature.

Transfer Digital Audio... CDT Remote allows flawless stereo digital audio extraction on some drives, if QuickTime 1.6 or newer is installed. Our driver supports over 19 different devices for digital extraction. See the Technical Information and Tips section for more information on digital audio extraction. This menu item will not be displayed if QuickTime is not present or if drive does not support it.

Play an AIFF file... Playback of AIFF files at 16 bit quality, when possible, is also supported. The playback will function in the background, while you work, and will give much better performance than tools such as Apple's MoviePlayer 2.0. This menu item will not be displayed if QuickTime or Sound Manager 3.0 is not present.

Figure 23: *Fewer Controls for CDT Remote*

Figure 24: *Even Fewer Controls for CDT Remote*

The first time you choose Show Fewer Controls, you will see the window displayed above left. The second time, you will see the window displayed above right. The third time, if supported by your CD- ROM device, you will see the window displayed below, displaying Compact Disc & Graphics (CD+G) media. These special CDs offer lyrics and video to accompany music. Please refer to the Read Me First file for a list of CD+G titles. If your CD-ROM does not support this feature, you will be returned to the default CDT Remote window.

Figure 25: *CDT Remote CD+G Window*

Play Only Chosen Track - This command will restrict CDT Remote to playing only the track that is currently displayed in the Elapsed Time Window.

Section V — Troubleshooting

This section will attempt to address items that may cause trouble and that are not covered elsewhere in the manual. If you are having problems using or installing CD-ROM ToolKit, please read through the relevant section in the manual first, then consult this section.

CD-ROM ToolKit Q & A

CD-ROM Disc Mounting Issues

Using my new CD-ROM drive I get "This is not a Macintosh Disk" when I insert my disc into the drive.

If you have an NEC drive such as the CDR-84, CDR-84-1, CDR-401, CDR-510, CDR-550, or CDR-900, the DIP switches on the rear of the unit may be set up to operate in the SCSI-1/CCS mode rather than the supported SCSI-2 command mode. All NEC drives were shipped from the factory set to the SCSI-2 mode. This must be changed back to the SCSI-2 setting for proper operation of your CD-ROM subsystem. *Do not inadvertently switch your SCSI ID number!*

Other possible problems include: dirty or damaged disc, dirty lens, marginal cabling or termination, or alien volume format. As there are over 15,000 circular spirals per inch, it follows that a CD does not require a great deal of damage to render it unusable.

Furthermore, there may be defects in the manufacture of the disc which are invisible to the naked eye. Even though there are several layers of error correction designed into the standard, damage to the Table of Contents located at the innermost tracks can render a disc completely inoperative. Also, the error correction strategies are more tolerant of radial scratches and abrasions (spoke-like, perpendicular to the direction of rotation) than tangential (circular) defects.

If there is dirt or smudges on the disc, using a soft tissue not impregnated with lanolin, carefully wipe the disc from inside to outside in a straight line. Never wipe the disc in a circular pattern. You may clean the drive's lens with a cleaning kit recommended by the manufacturer of your drive or with compressed air. Several of the high quality audio CD player cleaning kits work very well.

Another possible cause of this message for non-audio CDs is not having the proper Foreign File Access modules installed (and enabled by your Extensions/INIT Manager utility). These include Audio CD Access, ISO 9660 File Access, Foreign File Access, High Sierra File Access, and optionally the Apple Photo Access and ProDOS File System modules. These System Extensions allow your Macintosh to mount these foreign volume formats in the same way as standard (HFS) Macintosh volumes. These modules rely upon the Foreign File Access Extension, which must be present in the Extensions folder (or System Folder if you are running System 6.0.x).

Using a CPU accelerator, I get "This is not a Macintosh Disk" dialogs when I insert data discs, but

not for audio discs – they work just fine.

Some CPU accelerators, such as Daystar's Turbo 040 board, are incompatible with SCSI blind transfers. Open CD-ROM ToolKit. Turn off blind transfers by checking the Polled Non-Blind SCSI I/O option in the Options dialog.

Are there any problems with SCSI Probe 3.5 or DOS Mounter 3.0.1? When I have DOS Mounter 3.0.1 turned on, I cannot mount ISO/High-Sierra or Audio CDs.

The primary compatibility issue with SCSI Probe is its option to close the driver when the user unmounts removable volumes. This is very dangerous as there is no bootstrap-loadable driver present on CDs as there is with hard disks. You must not enable this option while using version 3.5 of SCSI Probe.

DOS Mounter 3.0.1 interferes with the normal process of mounting foreign volume formats, preventing non-HFS volumes from appearing on the desktop. Since it identifies the disc as "Not a Macintosh Disk" before the operating system can use Foreign File Access translation software to mount it, there is nothing CD-ROM ToolKit can do to work around this problem. We recommend avoiding DOS Mounter 3.0.1 if mounting non-HFS discs is a requirement for your system.

I am having problems with multi-volume multisession discs. Only the first session mounts on my Desktop.

First, verify your drive is capable of mounting all of the sessions on multiple-session discs from the Supported Devices list on the CD-ROM ToolKit program diskette. Most modern CD-ROM drives have multi-volume multiple-session mounting capability. Furthermore, insure that Upon CD inserts search every track for possible data to mount in the *Options* area of the Control Panel if you are experiencing problems mounting these discs.

Once you are certain your drive supports multiple session discs, ascertain what type of disc you are trying to mount. There are known mounting problems with discs mastered by Pinnacle drives with pre-IBBK firmware, as well as those mastered with certain options in the Pinnacle software. Furthermore, discs which have blown sessions or an improperly fixated table of contents may fail to mount at all. If your drive ejects the disc without your Macintosh giving you a "Not a Macintosh Disk" dialog, it is likely that the disc was not properly mastered.

There are problems with Apple's CD300 Plus (Matsushita Tray-Loader) drives which seem to prevent it from mounting non-Photo CD multiple-session discs.

When I mount a Photo CD, I do not get the Slide Show Viewer application or thumbnail icons of the pictures.

You must have the Apple Photo Access Extension installed in your System Folder for this functionality. Apple Photo Access can only be obtained from Apple Computer, Inc. Sources include AppleLink, Apple Dealers, or wherever Apple products are sold.

If Finder memory is low, discs such as the Apple System 7.5 CD and QuickTime CD will not display the thumbnail icons.

CD-ROM Hardware Setup & Configuration Issues

My drive does not show up on the list in the CD-ROM ToolKit Control Panel.

The CD-ROM device may not be: powered up, connected correctly to the Macintosh, or set to a unique SCSI ID. Please double-check each of these, making sure all cables are securely fastened and the proper termination is provided. Remember, every SCSI device connected to the Macintosh must be set to a unique ID number from 0 to 6. ID 7 is reserved for the Macintosh.

If your Macintosh has multiple SCSI buses and is running SCSI Manager 4.3 software from ROM, through our SCSI JackHammer, or with Apple's SCSI Manager 4.3 Extension for Quadras provided by System 7.5, try clicking on the Bus button in the upper right side of the main Control Panel screen. You may have connected your CD-ROM device to a different SCSI bus than you expected; unlike most other CD-ROM utilities, each SCSI bus is logically as well as electronically separate from each other. CD-ROM ToolKit fully exploits SCSI Manager 4.3 functionality, which allows you to control 7 devices per SCSI bus present in your computer.

NOTE: The Bus button will not appear unless you are running SCSI Manager 4.3 and have more than one SCSI bus available on the Macintosh.

During system startup, I get a CD-ROM ToolKit icon with a Question Mark through it and discs won't mount.

Open the CD-ROM ToolKit Control Panel, and verify that each connected CD-ROM device you wish to operate is enabled. If the drive is connected to a SCSI bus other than your normal internal Apple-supplied bus, you may need to click on the Bus button to find your drive. If you cannot find your drive, refer to the Installation and Removal Specifics section for more help.

I think my drive is on the list, but it has a slightly different name (or is equivalent to another drive made by the same manufacturer for an OEM customer).

In some cases subtle differences in the model number (or firmware revision levels) of a drive have little or no impact on CD-ROM ToolKit's ability to support it. There are instances where certain firmware revisions were insupportable or had major reductions in functionality, and so, no compatibility relationship among similarly (but not identically) labeled firmware labels can be reliably inferred. The best way to determine CD-ROM ToolKit's support for your drive is to connect and try to enable it with the Control Panel. If CD-ROM ToolKit does not support it, you will receive a message detailing the drive's firmware identification, which you can pass along to your drive supplier for an update.

When starting up my system, I receive a message that a CD-ROM driver has already been loaded preventing CD-ROM ToolKit from loading its driver for that device.

If you wish CD-ROM ToolKit to control all of your CD-ROM devices, search through your Extensions and Control Panels folders for other CD-ROM drivers. Some of them may not have the word CD in their names, please refer to the list on page 5 and make sure none of them are present in your System Folder.

If you must use other drivers in addition to CD-ROM ToolKit, whether because of certain drive compatibility or functionality issues or personal preference, CD-ROM ToolKit must load before the other CD-ROM driver(s) that do not have configuration dialogs. To accomplish this: 1) Make an alias of the CD-ROM Control Panel. Move the CDT Control Panel into the Extensions folder while leaving the CDT alias in the Control Panels folder. 2) Remove the auto-mount Extension for the removable drive from the Extensions folder. Please make certain you have removed the original CD-ROM Extension from the Control Panels folder.

CD-ROM ToolKit can be disabled on an ID-by-ID basis, and uses a loading mechanism which is guaranteed to never conflict with another driver. Disable CD-ROM ToolKit on the SCSI IDs which have devices you wish other drivers to control.

To further hedge your compatibility bets, set your CD-ROM ToolKit-controlled device's SCSI IDs lower than the IDs controlled by other drivers.

The sound from my internal Apple CD player is not working (I cannot hear it from my Macintosh).

For Sound Manager 3.0 users, open the Sound Control Panel, click on the *Alert Sounds* pop-up menu and select *Sound In*, make sure *Built-in* is selected. Click on the *Options* button, and then be sure the *Internal CD* is set to be the internal source, and that the Playthrough box is checked. Some AV programs, such as the demo FusionRecorder provided with the Quadra AVs, disable the Playthrough option when you exit.

If you are still unable to hear sound while the CD is playing audio, the electrical connection between your internal CD-ROM device and your computer may be broken or disconnected. If you've recently had your Macintosh serviced or taken apart (to install additional RAM or VRAM for example), the audio connector may have come undone.

> **NOTE:** For best quality CD-Audio playback on Quadra AV & PowerMac models, be sure Stereo, 16-bit, and 44.1 KHz sampling rate options are selected. All Quadras except for the 605, 610, 630, and 650 models have 16-bit stereo Digital/Analog Converters.

Why can't I hear my external drive's audio from my Macintosh speaker?

To hear sound from your Macintosh speaker requires your CD-ROM drive's audio outputs to be connected to an audio input port located on the Macintosh motherboard itself. On post-900 model Quadras, there is a capability to mix the Internal CD audio with the normal Macintosh sound. In theory, specialized software along with audio extracting CD-ROM drives, could play through the Macintosh

speaker, but it is yet to appear commercially.

Application Compatibility & Performance Issues

What are the best settings for the cache?

The default settings of 335 KB for RAM cache, and 3000 KB for File Cache are optimal for most discs and applications. Increasing either cache setting should improve performance providing you have sufficient resources to do so.

For optimal QuickTime playback, it is usually best to disable caching. QuickTime needs the most consistent data rate from the drive, and almost never re-reads the same data, hence will nearly always encounter cache misses, and so caching would generally be a hindrance. Small Read Ahead generally benefits QuickTime playback by caching remnants of a physical disc block not requested by QuickTime.

> **NOTE:** If you are running with Virtual Memory enabled, avoid the temptation to set your RAM cache very large. It will reduce the amount of Physical RAM available to your system and impair overall performance. For best performance do not use Virtual Memory.

QuickTime or Multimedia playback is very jerky. Audio does not synchronize properly with video. Will allocating additional caching memory help?

There could be several causes for these problems: heavy network service activity, numerous background processing or periodic tasks, Virtual Memory, RAM Doubler, or very slow CD-ROM drives. Most multimedia playback programs prefer 6-8 MB of real (not-Virtual) RAM for optimal performance. Also, most QuickTime movies (compressed with the Apple Video compressor) playback best on screens set to 16 bit (thousands) color mode.

Additional caching memory will not significantly improve QuickTime playback, although avoiding static cache may help somewhat. To do so, turn off the Continue Caching option.

I am getting a message from Apple's Foreign File Access about multiple ISO 9660 files, etc. (And I use System 7 or newer).

You have multiple copies of the Foreign File Access translator modules installed in either your System or Extensions folders. This can happen to long-time CD-ROM users who have had the Foreign File Access software installed in their System Folder, and then manually upgraded to newer versions which the Finder places in the Extensions folder, failing to replace the older files in the System Folder. System 7.x users will find the duplicate files in the Extensions Folder, Control Panels, or the System Folder itself. Performing a Find File will assist you in locating them.

Using Rebel Assault from LucasArts, I get an error which states the application cannot locate certain files on the disc.

LucasArts has released a patch to upgrade the application to version 1.01 which completely fixes the problem.

When I attempt to launch CDT Remote, I get an obscure message from the Finder about not being able to find QuickTimeLib, aborting the launch.

On Power Macintosh models, the QuickTime PowerPlug supplied with your System Software must be installed in your Extensions folder along with QuickTime, or QuickTime will not function when used.

Some applications and games crash while running them. (Some crash when I run them from the CD).

Most multimedia applications prefer to be copied to your hard disk, and launched from there. Furthermore, the applications may run better with additional memory allocated to them (use the Get Info menu command from the Finder and increase the Preferred Size field of the application once you have copied it to your hard disk). Increase the memory by 1000k or more. Remember that increasing the memory and taking all the available RAM can adversely affect the Macintosh operating system.

Try disabling the acceleration options, although the chances of this working are negligible.

If you have an another CD-ROM driver, such as Apple's, you may also try using it to verify that specific CD-ROM drivers are not related to the problem.

> **NOTE:** Many applications designed before the release of the Quadra AVs are incompatible with the Sound Manager 3.0 built into them. If your titles crash while running on a 660AV or 840AV, but not on other Quadras (without Sound Manager 3.0), then ask your CD-ROM vendor for an update.

When I double-click on a document icon on a disc, no application can be found to open it.

This is a common problem with non-HFS CDs, such as ISO 9660 volumes. ISO 9660 discs can show icons within the Finder, but only if the applications (and their respective icons) responsible for opening those documents are present on your hard drive. The manual included with your CD-ROM title will help you determine how to access files on that disc.

When I try to eject or unmount the disc from my drive, the Finder displays "Unable to eject (Volume Name) because it is currently in use."

Before the Macintosh will allow you to unmount volumes, all open files and applications residing on the disc must be closed or exited. Due to a long-standing File Sharing problem, even if Sharing is not enabled for the volume you are trying to unmount, the operating system will not unmount the disc until you deactivate File Sharing on your Macintosh. It is also necessary to wait for CD-ROM ToolKit to finish building the cache file before ejecting the CD-ROM disc.

"Unable to speed up this CD-ROM because you do not have sufficient contiguous disk space to create the cache."

Whatever value you enter for File Cache size will need to be one contiguous allocation of space available on your startup volume (where CD-ROM ToolKit resides) for speed improvement. Under System 7.x, cache files are created within the Preferences folder. If there are more cache files present than there are CD-ROM drives connected to your computer, remove them and reboot. Also, you may try using a third-party defragmentation program to optimize the free space on your startup volume.

Using CD-ROM drives equipped with CD-ROM ToolKit, what types of typical usage should we see substantial improvements? What technologies achieve this?

FWB's CD-ROM ToolKit provides a multitude of performance enhancements for CD-ROM drives, including background pre-scanning of volume oriented directory data, read-ahead/behind caching, fast dynamic cache, static cache stored in RAM and/or hard disk, scatter-gather block prefetch for 2,048-byte-per-block devices, streaming optimizations for multimedia playback applications such as QuickTime and Macromind Director.

Pre-Scanning

CD-ROM ToolKit is unique in providing background pre-scanning of directory and icon database information. In addition, no other product provides pre-scanning for ALL CD data volume formats: HFS, Apple ProDOS, ISO 9660, etc. All other products monopolize your computer for extended periods during pre-scanning; because of this deficiency, many pre-scanning drivers use up inordinate amounts of space on the user's startup volume creating different cache files for each volume inserted into the drive. CD-ROM ToolKit's fast and unobtrusive pre-scanning algorithm permits the use of a single cache file per CD-ROM device.

Pre-scanning provides hard-disk browsing speeds for the user, enabling rapid and effortless location of files and information. We have found most users are annoyed when forced to wait for the drive to update Finder windows while browsing through Compact Disc volumes. The Finder can locate a particular file on a volume with over 16,500 files in under two seconds. Without pre-scanning the directory information, finding a file would require over forty seconds on some drives. We consider pre-scanning to be the most important part of a performance enhancement strategy from the user's perception.

Read-ahead/behind Caching

Read-ahead and its companion read-behind caching refer to anticipating further data requests when three or more contiguous requests are issued to the driver. This technology primarily assists older devices which lack intelligent cache logic. Until CD-ROM ToolKit, this technology was primarily used during the pre-scanning stage; now it has been extended to improve all aspects of drive use.

Fast Dynamic Cache

CD-ROM ToolKit also introduces dynamic caching to RAM, providing rapid access to repetitively requested data and speeding most types of device access by users. Few products even offer true

dynamic caching, and fewer still permit you to disable it. There are streaming applications which are actually hampered by dynamic caching, as the percentage of cache misses become high. Another reason few products offer dynamic caching is because caching is best accomplished outside of the driver at the highest level of the File System Manager.

The result of months of intense development effort, CD-ROM ToolKit provides unparalleled dynamic cache performance. Throughput as high as 32 MB/sec has been recorded (on a Power-Mac 7100/66 without cache card) when the File System requests blocks resident in the RAM cache of our driver. Even a Quadra 610 achieves 15.6 MB/sec on the same test. In a dynamic cache implementation, it is crucial to keep cache "miss" and cache "hit" overhead to a minimum. FWB has tested many drivers and configurations and discovered many implementations do not optimize cache hits at all.

Under what rare circumstances could a caching CD-ROM driver cause a drive's performance to remain flat or slower, relative to a non-caching driver?

To completely answer this question, it is important to consider what caching is and how it works. Caching introduces extra layers & steps into the driver execution path in order to fetch some data from a faster storage medium than the hardware for which the driver was written. In order for caching to be considered beneficial, it needs to have a sufficiently high hit rate. If one had 100% cache misses, the overall performance would be significantly lower than if the driver performed no caching at all. In some ways, it's a gamble: you want a sufficiently high percentage of cache hits to offset the overhead of the caching layers.

Caching technology must be intelligently designed and implemented to a) increase the statistical hit rate and b) impose the smallest overhead on cache misses. One way CD-ROM ToolKit increases the chances of cache hits is to anticipate sequential data requests made of the driver, and to read larger hunks of data than requested. This way, if an additional request is made from locations contiguously beyond the prior I/O operation, the driver can immediately return data which was previously fetched into the read-ahead cache buffer. It is critical that proper thresholds and limits be placed on this operation, otherwise this read-ahead burdens every I/O operation with additional overhead with little (or negative) overall benefit.

Drivers which cache volume information to hard disk, such as FWB's CD-ROM ToolKit, can also suffer when the target hard drive is slow. Since there is overhead in re-vectoring CD-ROM requests to the hard disk, a slow hard disk would reduce the overall performance improvement. For example, an old 80 MB internal hard drive which lacks a deferred write capability will be dramatically slower for static cache technologies, as the computer is held up until the write operation completes.

The cache file resident on the startup disk is made contiguous for performance. Furthermore, most large CD-ROM volumes require a 3 MB disk cache to fully capture the volume information. If the disk cache setting is insufficient to copy the volume and desktop information, there will be significant

chances for cache misses, thereby impeding overall performance.

Note that CD-ROM ToolKit disk cache ships with a default of 3 MB and very conservative RAM cache settings (335 KB, which is enough for basic cache structures to manage the disk based caching of a 16,500 file disk). If additional performance is desired, increasing the RAM cache to 1 MB or more would have dramatic improvements in CD-ROM ToolKit. Some other CD-ROM products work well only when their settings are set to “maximum,” and even then with mixed results; some large requests are efficiently handled but small cache misses are laden with high overhead. CD-ROM ToolKit’s RAM cache algorithms are exceptionally light-weight, and impose nearly no perceptible overhead on I/O operations.

It’s been said that “Cache + Cache = Trash,” which reflects the common wisdom regarding the dangers of introducing caching at too many levels of the I/O path. There is little benefit in caching at every layer, as what invariably happens is simply buffer copying from cache to cache. Buffer copying is slow, and is nothing but overhead. Studies have shown caching is best performed at the highest (File Manager) layer. CD-ROM ToolKit’s default configuration avoids overusing RAM resources.

Apple’s System 7.5 introduces new caching technologies which enhance the performance of all devices. Its new caching algorithms will obviate the need to design a cache into most device drivers for optimal performance. System 7.5 still does not address write collection of blocks to be posted to disk as well as some other cache issues, however it should be regarded as an intermediate step in the evolutionary path towards maximum performance. Pre-scanning will always be an important enhancement regardless of what cache technologies are employed in the future.

No driver could be written to improve the speed of a CD-ROM application which reads large amounts of data only once, and issues large requests to the driver with no delays between requests. Such an application is merely exercising the physical medium transfer rate of the drive. Fortunately, few applications are such "worst-case" clients of CD-ROMs.

What type of testing is made to measure performance enhancement when using CD-ROM ToolKit?

We test with all popular titles and optimize speed for the real world. There are some facts to consider when assessing the performance improvements of caching CD-ROM devices. Even the quickest quad-speed drive has a maximum media transfer rate of 600 KB/sec, which is much slower than the Macintosh SCSI bus transfer rate limits for all except the older 68000-based products. Data resident in the drive controller cache can be transferred at its controller’s limit, which is usually 2 MB/sec. Since all but the oldest Macintosh models are capable of that data rate, all CD-ROM device drivers will perform actual SCSI transfers at the same rate.

Therefore, fundamental differences in performance are solely due to different algorithms and implementation overhead – how well the caching system works from a statistical analysis, how small the overhead of cache misses, and the throughput of cache hits all figure into the overall performance of

the caching driver.

In our tests, we have attempted to measure the overhead of the cache layers in both hit and miss scenarios. Each caching driver exhibits differing levels of throughput for cache hits. The methodology we used was to patch the Random seed to return 0, so multiple tests could run with identical test data. Note that cache hits mean the driver returned data from the machine's RAM and represents the maximum theoretical transfer rate of the driver.

CD-ROM ToolKit provides lightning speed access to files and folders while browsing in the Finder, which is something everyone does with their CD-ROMs. And it does so without tying up their computer every time they insert a CD, or gobbling indeterminate amounts of storage space on their startup device. Users can complete a standard System 7.x Finder file find within four seconds on any data CD, rather than just HFS discs; they do not experience annoying pauses while browsing through their volumes.

Can CD-ROM ToolKit improve the performance of low throughput drives (single spin) more, or less than it would benefit higher-throughput (double, triple, quad spin) drives?

Most multi-speed devices provide larger cache buffers in addition to increasing the spindle speed, thereby increasing more than just raw throughput and complicating the answer to this question. In addition, there are cost-conscious consumer multi-speed CD-ROM devices which offer small caches and have inferior performance to identically spun units with larger caches under many conditions.

Multiple-speed drives often have two (or more) advantages over their single-speed counterparts: larger cache memory, lighter optical assemblies (fast average access), lower rotational latencies, and improved cache algorithms. This makes it difficult to assess what the direct ramifications of merely increasing the spindle speed has on performance. Furthermore, multiple-speed drives are of modern design and optimized for streaming read-ahead, which permits them to continue reading data between requests from the host.

Since the cache hit rate, cache throughput, and SCSI hardware are unchanged variables, it follows that the improvement ratio will be smaller for higher throughput drives when compared with single-speed units. However, overall system throughput will be significantly improved because the "floor," or cache miss level, of performance has been raised. The "ceiling" performance is fixed by the limitations of the driver, machine, cache settings, etc. But unless the floor and the ceiling are similar, there will always be an improvement by using caching technology. So long as CD-ROM devices have huge access times (greater than 100 ms), there will always be a vast benefit by caching data to a 12 ms access time device, let alone to RAM.

If a device has poor hardware caching, does CD-ROM ToolKit improve its performance more or less than it benefits drives with better hardware caches?

If it is the sole variable between two drives, poor controller cache algorithms may actually impede per-

formance, affecting throughput only when the driver cannot fulfill a request from its own cache buffers. Drives which employ poor caching have a lower floor performance than drives with good caching algorithms, which section the cache buffers into stream-ahead and most-recently-used pages. Just as with slower (single-speed) devices, CD-ROM ToolKit sports a higher improvement ratio for devices with poor hardware caching.

What factors are more important than mere performance?

With all of this discussion about performance, there is a risk of focusing on minute numerical differences to judge a product. In reality, performance differences amongst modern CD-ROM drivers are usually quite small. More important is the driver's functionality, compatibility, degree of device support, and robust design. Important questions which need asking:

Does the driver fully implement all of Apple's CD-ROM driver calls?

Apple's CD-ROM driver specification details over 100 commands (including the 36 audio playback methods) which comprises their multimedia specification. Since many CD-ROM titles have no audio tracks and do not require the use of Apple's CD-ROM driver calls, many driver designers do not properly implement the audio commands. However, all CD-ROM application designers work from this standard and expect any CD-ROM driver they use to fully implement its functionality.

The sad truth is that few drivers even attempt to implement all of the calls, and fewer still implement them properly and completely. In fact, only Apple's CD-ROM driver and our CD-ROM ToolKit provide complete conformance to their CD-ROM Multimedia specification.

While the idea of mixing audio and data tracks within a CD-ROM multimedia application was exciting a few years ago (refer to Interplay's Battle Chess for a good example), perhaps the endless sea of incomplete and defective CD-ROM drivers discouraged the active development of such exciting titles. After all, if the user could not hear the audio properly no matter what audio calls were issued, why bother at all?

Does the driver offer a superset of Apple's CD-ROM driver functionality?

Apple's CD-ROM driver contains an impressive array of capabilities such as CD+G subcode streaming during playback, digital audio extraction, undocumented audio playlist commands, and asynchronous I/O capabilities. Not only is CD-ROM ToolKit unique in supporting all of these wonderful technologies, our product goes several steps beyond. Our CDT Remote™ audio playback application provides enjoyable CD+G playback as an option for those CDs which contain graphics subcodes.

CD-ROM ToolKit versions 1.09 and later support Apple's new AppleCD Audio Player 2.0 on every supported device – few other third party drivers support it.

Since November 1993 with version 1.05, CD-ROM ToolKit has supported all of the digital audio extraction commands. QuickTime as well as forthcoming audio editors can take advantage of this pow-

erful technology, which provides key resources for multimedia developers.

Additionally, CD-ROM ToolKit permits the user to access ISO volumes on discs mastered with both HFS and ISO 9660 sections, Apple ProDOS partitions for Apple II users, as well as mounting multiple session/multiple volume discs mastered by some CD Recorders such as the FWB Hammer CDW 4x. We are not aware of any other products which provide this support.

Does the driver fully exploit all features present in supported devices?

FWB's CD-ROM ToolKit provides complete audio sourcing control (e.g., left, right, stereo, mono), hardware-assisted fast-forward/reverse audio scanning, and software controlled volume control on all devices which support these controls. On devices which lack hardware audio scanning, it is simulated in software for all other CD-ROM devices. Many drivers support neither proper audio sourcing control nor hardware-assisted audio scanning commands on Apple hardware!

Does the driver fully support all available CD-ROM devices?

Only FWB's CD-ROM ToolKit provides full and complete support for 69 CD-ROM devices as of October 27,1994. Unlike most driver designers, FWB doesn't simply install a driver for a device it does not recognize. In our experience, it is not sufficient to assume a driver written towards the ANSI X3T9.2-1992 (SCSI 2) specification will correctly operate every CD-ROM device in existence. It is grossly irresponsible to install a driver for an unvalidated drive. We've gone as far as adding Photo CD support to drives which were otherwise thought to be incompatible with Photo CD media, such as the Panasonic 501, Apple CD SC, and NEC CDR-80 and several others. Every CD-ROM drive we support is at least Photo CD single session compliant, except for four devices.

Is the driver fully compatible with all Macintoshes which have SCSI ports?

CD-ROM ToolKit provides full functionality on all versions of Apple System Software (6.0.4 or better), from the Macintosh Plus to the most advanced PowerMac 8100/80AV equipped with several SCSI JackHammer cards. CD-ROM ToolKit 1.5 exploits SCSI Manager 4.3 and supports multiple SCSI buses. FWB has every Macintosh model ever sold in-house, some of the most advanced audio/video hardware available, and most of the popular CD titles. CD-ROM ToolKit undergoes a battery of sophisticated systematic tests and validations to ensure there is absolutely no data corruption or system integrity compromises. For example, all of our data access test suites involve huge keylength CRC checks to ensure data integrity.

It is not enough to simply ensure the product doesn't crash, it must never return corrupt or invalid data to the user. It is not enough to merely provide Apple's level of functionality, we must recognize where improvement is needed and blaze our own trail. And it is not enough to stand by and judge our product by comparison with Apple's or anyone else's and be complacent if we just do more, better, and faster than they do: when users entrust their data to our products, nothing less than perfect will do.

Section VI — Technical Information and Tips

Care of Manual Ejecting CD-ROM Drives

It is vital to remember that a few CD-ROM drives require special attention when removing media. The Macintosh was not designed to have an application's resources improperly removed, at any arbitrary time while the computer is running. To prevent this, and speed up performance, storage devices are instructed to prevent the manual eject button from functioning when files are open on the disk. A few CD-ROM devices will not prevent media removal when instructed. These drives are usually the lower-cost portable drives that have fliptops or have manual eject buttons. Because they are manually ejected, they must NEVER have their cartridges ejected, or media removed, unless all the mounted CD volumes are first unmounted (dragged to the trash) and only then after at least one second of time elapses. CD-ROM ToolKit will not accommodate incorrect removal of discs. Always remember to unmount CD volumes before removing the CDs!

Manual eject drives include:

- Apple PowerCD (Philips CDF080).
- Chinon CDU-525
- LMS/Philips CM-2xx Series
- Media Vision Reno
- NEC CDR-25
- NEC CDR-36
- NEC CDR-37
- NEC CDR-38
- Texel DM-5024 (DM-3024)
- Toshiba XM-4100A
- and other flip-top CD ROM drives.

NOTE: Some fliptop CD-ROM drives require that the hinged access cover be open at boot time if there is a CD in it. Starting up the Macintosh with a CD inserted in this type of CD-ROM drive with the access door closed may cause bootup problems. Please consult the instructions provided with your CD-ROM drive.

CD Recorders

This past year has seen the aggressive marketing and deployment of Compact Disc recorders, with end-user prices falling below $3,000. Bringing the reality of Desktop CD Mastering to fruition, these drives, along with specialized mastering software, allow users to make standard audio discs for consumer audio CD players, mixed-mode CD-ROMs with CD audio and data, or even multiple session

archival discs capable of retaining an entire company's data on very inexpensive and reliable media.

CD-ROM ToolKit offers special support for multiple-session discs mastered by these recorders. Since each session requires a new track to be laid down, these sessions create new origin points, delineated by the track boundaries. Using the "Search All Data Tracks…" option invokes special logic to look for mountable volumes on each data track boundary. This will allow your multiple-session compliant hardware to mount multisession discs properly mastered by CD recorders.

NOTE: Some recorder systems make discs which do not adhere to proper Orange Book standards, and hence will not and CAN NOT mount in any CD-ROM drive, other than the drive which mastered the disc. Furthermore, if the mastering process failed in either the I/O or FIXATION phases, the disc is ruined. There is strong hope for a technology which will recover these ruined discs, at least permitting the unused space to be mastered in subsequent sessions.

All About Multisession Multi-Volume CD-ROMs

FWB's CD-ROM ToolKit has supported the mounting of multisession multi-volume CD-ROMs since November 1993 when CD-ROM ToolKit was released. These are rare CD-ROMs and do not exist as mass-produced items but as inter-corporate media distribution and archives.

All previous versions supported mounting multiple volumes, such as multiple Mac HFS volumes and multiple Apple ProDOS volumes as well as any ISO 9660 partitions if present. The previous versions all support multisession Photo CD ISO 9660 volumes also. Due to the anticipated popularity of Desktop CD Recorders, very special capabilities were added to CD-ROM ToolKit to allow more exotic types of CD-ROMs to be supported. For example when a CD is inserted the program scans the Table of Contents, and all other possible key locations for potential volumes to mount. This thorough search allows CD-ROMs to be supported that contain more than one data track, and have complete volumes, or portions of volumes (Photo CD), on those data tracks. These data tracks may be either recorded in the first and only session of a CD-ROM, or recorded in multiple sessions at different times. Additionally, CD-ROM ToolKit can properly accommodate audio tracks intermixed on the CD-ROM, including the rare situation where an audio track is the first track on the CD-ROM and data tracks follow it. The FWB CD-ROM ToolKit driver is the only Mac product that performs any of these capabilities.

If the CD-ROM, including all of its tracks and multiple volumes, is recorded in one session, the CD-ROM can be mounted on any CD-ROM drive in existence with a driver such as CD-ROM ToolKit. Only one "session" is created if the recording is performed in one sitting and using proper software that allows multiple tracks and volumes to be recorded in one session, otherwise it may be a multisession recording.

Desktop CD Recorders are all different and they are further limited by the mastering programs that command them. The existing common CD Recorder manufacturers are:

- JVC

- Kodak
- Philips
- Pinnacle
- Sony
- Yamaha

Many newer CD Recorders will become available soon, including devices that will be affordable to all.

All these CD Recorders support the international standards for multisession CD-ROM creation, referred to as the Orange Book specification. Media created under the Orange Book specification is documented PHYSICALLY with great detail but the Orange Book does not mandate LOGICAL treatment and conventions. Therefore multiple volume or multi-version ISO 9660 is not part of Orange Book, nor Kodak Photo CD, and certainly not even multi-version or multi-volume Mac HFS, or anything of the sort. The ISO 9660 standard does not document what to do with multisession. It was finished before Orange Book was proposed. ISO 9660 is used as a subset of a Kodak Photo CD and those CDs have some limited Extension capabilities dependent on driver-level block remapping so that newly recorded photographs can magically appear inside the folders as extra photographs.

Because these standards do not exist, and because multisession CD-ROMs can only contain 24 sessions maximum and 99 tracks in total, few people have advanced the discussion of how to handle the multisession multi-track multi-volume technologies that this document has been discussing.

Nevertheless, CD-ROM ToolKit offers support today. The method we use is very direct and very simple. When a CD-ROM is inserted, all the efforts expended while examining the first CD track for mountable volumes is extended to all the tracks on all the sessions on a CD-ROM, and Photo CD sessions and audio tracks are accounted for as normal.

Two problems can be commonly encountered when using the CD Recorders: Blown Sessions, and old firmware or software.

Blown Sessions

The most common way to create a "Blown Session" is data underrun when mastering. Data underrun is a condition where a device that is busy recording a single long spiraling CD-Track consumes all the data in its buffer and has to terminate the session as a blown session. The way to prevent it is to either provide more data to the recorder at a faster and consistent rate, or to operate the recorder at a slower recording rate. The slowest recording rate is normally called "Single Speed" and is 75 blocks per second where each block is 2352 bytes of data per block (the recording technology actually uses 7,203 bytes per block within the recorder). If a CD Recorder is rotating at 75 blocks per second the Macintosh must provide about 173K/sec. If the device has a large buffer (enough to hold a few seconds) then the recording software and technology can be lax in feeding the recorder. Some CD Recorders however

uses a rather small 64K buffer that exhausts almost three times per second. This means that the Macintosh must always provide data to the recorder without fail without ever delaying for a third of a second. If a whole CD is recorded this must be maintained for an hour without fail. If not... Kaboom, the session is blown and you will need to try recording again in a new session.

In addition, any CD created with the some CD Recorders' software containing even a single Blown Session is referred to as a "Frisbee" because it has no value except on the CD Recorder that created it, or as a psychedelic flying discus. The root cause is that the Blown Sessions are marked bad using a technique in the software. It marks the Table of Content entry as MISSING for that track entry. Normal CD-ROMs may not contain missing references to tracks, though the CD Recorder that created it does not mind reading them. Not all CD recording software uses this questionable technique.

Thermal recalibrating hard drives, and busy network tasks can cause problems, so it is recommended that the recording computer be unencumbered while performing the recording, and that the thermal recalibration be disabled. Thermal recalibration is an annoying but necessary function of high-temperature fast rotating hard disks that periodically evaluate the horizontal expansion of platters so that future head positioning can be performed accurately at maximum speed. This recalibration should not be performed if the SCSI device or bus appears very active but the devices do not include such useful logic and abruptly seize up every now and then to perform thermal recalibration. FWB's HammerTime™ Extension and FWB drivers can temporarily disable thermal recalibration on key FWB products when capturing QuickTime video, but HammerTime does not help in this instance. Luckily, owner's of FWB's Hard Disk ToolKit can use the "World Control" program on Seagate Drives and DEC drives if they are skilled power-users and comfortable manipulating vendor-unique SCSI MODE SELECT PAGES. Note that using World Control is only a temporary 15 minute reprieve from future thermal recalibration delays.

To avoid Blown Sessions with a CD Recorder: use a fast computer with non-thermal recalibrating hard drives, and only record complete IMAGES of volumes on a spare or scratch hard drive instead of HFS multiple file selection recording (HFS on-the-fly).

Old Firmware

Get the latest firmware for your CD Recorder to utilize special optimization to locate the final session of a CD. The mounting optimization scans for the last session FROM THE OUTSIDE EDGE INWARD instead of the normal direction starting at the inside hub and chaining outward.

Summary

What this means is, uncorrupted CDs with no blown sessions can reliably be mounted on all drives we support, including multiple session multiple volume CD-ROMs. Corruption is very common on some CD Recorders because of the small buffer in conjunction with either HFS On-the-fly recording or when thermal recalibrating hard disks are present. If both are avoided and no sessions are blown that CD can be mounted and all sessions can be seen on any CD-ROM drive, so long as recent firmware

was present in the recorder. The sole exception is the newer AppleCD 300+ drives (Matsushita CR-8004), though all other CD-ROM drives we have access to seem to work with these "perfect" CD-ROMs.

The number one reason some CD Recorder created multisession multi-volume CD does not stay inserted or mount is the disk contains a blown corrupted session and is illegally missing track information in its TOC. This occurs because of a method some CD Recorders use to "Mark" a bad track by striking it from the TOC.

There is a side note, some multisession drives can handle some types of blown sessions, if the blown session was the final session. We do mount this type of disk despite the defect, though sometimes not all sessions appear.

All about Digital Audio Extraction

Digital audio extraction is a process whereby standard audio track information is transferred from a CD-ROM drive to a computer system through the SCSI cable, rather than through an analog interconnect wire. Digital audio extraction is capable of producing an almost exact copy of the digital information contained on the CD media. Audio CDs consist of sound samples recorded at 44.1 KHz in stereo with each channel using 16 bits of amplitude, providing for very high quality audio. Currently, there are few commercial software applications which use digital audio extraction with computers, but the preliminary steps of transferring the audio into a computer file are now possible. It is a fun and powerful new tool which will become increasingly common over the next few years.

Few CD-ROM drives are actually capable of supporting digital audio extraction. One reason may have been the music publishing industry's fears and legal concerns about uncontrolled duplication. Just as the home VCR helped triple the size of motion picture industry, digital audio extraction may do the same for the music industry. FWB's CD-ROM ToolKit for the Macintosh supports digital audio extraction on all known drives capable of extracting audio. Version 1.0.5, released November 1993 supported over 10 devices for audio extraction and several more have been added in recent versions.

Drives which support digital audio extraction include:

- Apple 300, 300i, (Sony CDU-8003, CDU-8003A)
- Apple 300+, (Matsushita CR-8004)
- Chinon CDS-535, (needs v2.0 firmware "Q20" or "R20")
- Compaq CR-503BCQ, (OEM is Matsushita)
- Compaq CDU-561, (OEM is Sony)
- Hitachi CDR-6750,
- NEC CDR 400, (MultiSpin 3xp portable)

- NEC CDR 500, CDR 510, CDR 600, (MultiSpin 3x series)
- NEC CDR 501, (MultiSpin 4xe quadruple speed)
- NEC CDR 900, (MultiSpin 4x Pro quadruple speed)
- Sony CDU-55S, (needs firmware 1.0f or newer)
- Sony CDU-561
- Sony CDU-561SUNCD, (Sun)
- Plextor PX-43CH (45CH), (aka 4Plex caddy high-end)
- Plextor PX-43S (45S), (aka 4Plex sliding tray midrange)
- Toshiba XM 3301TE, (Silicon Graphics version)
- Toshiba XM 3401TA, XM 3401B, (found in FWB's HammerCD)
- Toshiba XM 3401TE, (Silicon Graphics, and Sun versions)
- Toshiba XM 3501B,
- Toshiba XM 4100A,
- Toshiba XM 4101TA, XM 4101B
- See the "Supported Devices" file for updated information.

Any Macintosh programmer can easily utilize digital audio extraction because Apple standardized its use in technical documentation for CD-ROM drives in 1993. Few commercial software packages take advantage of extraction yet, despite Apple selling over a million CD-ROM drives capable of extraction. To remedy this Apple provided digital audio extraction through the services of QuickTime 1.6 and newer and added a conversion button to the dialog used for selecting a QuickTime file. Any QuickTime program can allow you to extract a track of CD audio.

In addition to capable hardware and driver software fully compliant with Apple’s newest CD-ROM commands, you should also have QuickTime 1.6 or later installed. FWB’s CDT Remote player relies on QuickTime 1.6 or newer to permit digital audio extraction.

How to extract using CDT Remote

CDT Remote makes the task fun and simple. First, insert a standard audio disk, not a multimedia disk containing audio tracks, into your CD-ROM drive. If you have the right equipment, and QuickTime 1.6 or newer installed, and an audio disk is inserted, you will see a raised button in the lower right of CDT Remote:Pressing this button is equivalent to selecting "Command-T" in the menu bar for CDT Remote

as shown below:

Figure 26: *CDT Remote Ready for Digital Audio Extraction*

Figure 27: *CDT Remote Player Menu*

You will then be presented with a dialog asking you where to save the large file that will be created. Select a destination with lots of space, because it may be a gigantic file (40 megabytes or so) depending on the options you are about to select. You must select a fast storage device for best quality because

digital audio extraction must be done live without hesitation, because audio tracks stream data much the same way an old record player needle tracks a vinyl groove. Any hard disk should be fast enough but network drives with low sustained write speeds may cause portions of audio to be "garbled" during the transfer. After naming your "AIFF" export file, another dialog will appear. It is shown here:

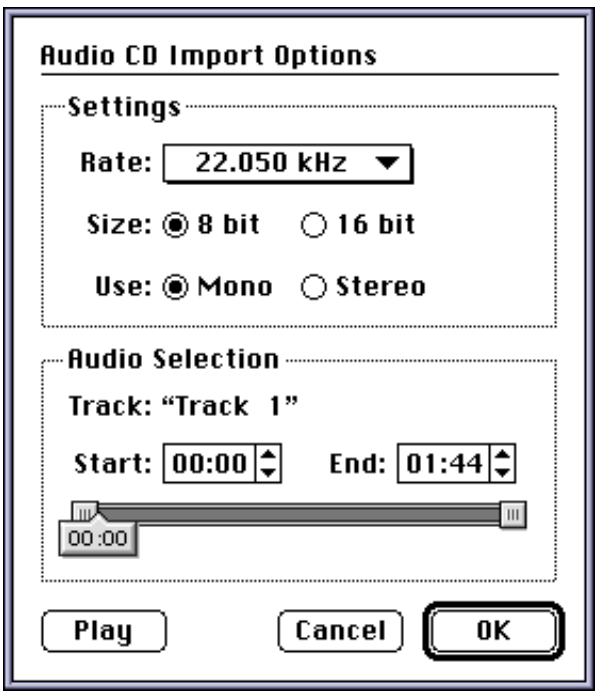

Figure 28: *Audio CD Import Options*

This dialog is somewhat interactive, which you may use to find the exact portions of the track you would like to extract. It offers several quality options which have trade-offs in terms of storage space requirements. The best quality (and largest) sample rate is 44.1 KHz, however you should select 22 KHz if you have normal Macintosh sound equipment as your files will be larger than you personally will be able to enjoy them. If you own a Quadra AV or PowerMac series machine you may use the 44.1 KHz sample rate. The 16 bit sound option will make your files twice as large as the "8 Bit" option and is also unneeded if your system does not have a third party sound card or is not a Quadra AV or Power-Mac series machine. Stereo is generally preferable, but is double the size of Mono files. Monophonic sound is ideal for non-musical samples, such as voice. If you are making a System Beep, most owners

do not use stereo speakers so stereo could be eliminated to save disk space.

In summary, the highest CD pure digital extraction setting is 44.1 KHz, 16 bit, Stereo and the each of those options makes the file twice as large as their lower quality counterparts. A 22 KHz 8 Bit Mono signal is 8 times smaller than a 44.1 KHz 16-bit Stereo signal, with audio quality nearly equivalent to an AM Radio broadcast.

There is a sliding start position marker and end position marker. Additionally the center marker can be positioned anywhere in the audio track and the Play button may be used to enable/verify digital audio extraction. Sound will come from your internal Mac sound source, not your CD output lines! This sampling technique may sound choppy and have hesitating gaps because it is not possible to perfectly stream digital audio to be played in this manner. This is not a problem because the extracted audio (recorded to the file) will be free of hesitating gaps and choppy sound. Clicking OK initiates the process.

At this point a dialog with a progress bar will appear. Digital Audio extraction takes a long time as most devices require the same amount of time as the duration of the audio clip you are copying. Some devices are much faster, however even if you've selected some low quality options all the data must be sent to the computer as if you selected the highest quality. When the dialogs disappear your AIFF file is ready for use.

What is an AIFF file?

AIFF stands for Audio Interchange File Format. It is a full featured audio file specification which allows many programs on multiple platforms to share standards for audio storage. It is primarily a digital music instrument specification however over the years it has been enhanced to provide compressed digital sound (AIFC). AIFF files have been used on IBM Clones, Amigas, Ataris, Macintoshes, Apple IIGS, Unix workstations, etc. Electronic Arts published the AIFF specification in 1985. Large AIFF files are especially well suited to the Macintosh because Apple provides developers with routines to play them without fully loading them into memory. Most professional digital sound editing programs will import and export AIFF files, which may also be used with CD and DAT audio mastering products.

CDT Remote version or later provides for playing a selected AIFF file as a background process allowing you to use other applications without the music stopping. The file is read from the disk in small hunks, and if your hard disk is fast enough, the audio should be as good as a CD player if the right output equipment is available. To use this feature you must have Sound Manager 3.0 or newer installed or inherently present in your system (System 7.5 and newer has it pre-installed). In fact, if Apple's Sound Manager 3.0 is not installed the menu command in CDT Remote titled "Play an AIFF File" will be absent. It will not even appear as grayed out. Sound Manager 3.0 is provided with Apple's Hardware Update disks and on many Electronic Network services. It consists of two files: an Extension and a

Control Panel shown below:

Figure 29: *Extension* ***Figure 30:*** *Control Panel*

These files are very helpful for all but the oldest of Macintoshes, and should be installed by everyone. Their primary purpose is to provide sophisticated sound input and sound output capabilities, but they enhance all Macintoshes' sound capabilities even if no specialized sound equipment is present. CDT Remote requires these files to play AIFF files. If you own a third party sound card such as MediaVision's ProAudio Spectrum 16, or Digidesign's AudioMedia II you are probably already familiar with these two files. They are vital to allow any Mac program to emit 16 bit stereo audio output at 44.1 KHz sample rate. The Apple Quadra 660AV, 840AV, and PowerMac series do not need a third party sound card to output high quality sound.

Common Problems

Digital audio extraction with CDT Remote only works on Audio CDs, not multimedia CDs containing audio tracks. Other third party extraction programs may not have that limitation.

Digital audio extraction with CDT Remote requires QuickTime version 1.6 or newer. But other third party extraction programs may not have that limitation. Properly written digital audio sound extraction programs use Apple's official digital audio extraction commands and therefore will work with FWB's CD-ROM ToolKit driver even without QuickTime 1.6.

Digital audio may be played back in the background from CDT Remote only if Sound Manager 3.0 or its equivalent is present in your system. Please make certain the QuickTime Extension loads before the Sound Manager Extension as it normally should under Apples default environment.

AIFF file playback is broken up with periodic gaps of silence when CDT Remote's menu command is used if your hard disk is slow, your computer is slow, or if your hard disk does not read ahead when data is being streamed from it in small frequent requests. Use a professional audio program to playback 16 bit high frequency AIFF files instead of the CDT Remote desk accessory if this happens to you, or avoid 16 bit sound and try 8 bit.

Digital Audio will sound hissy if you do not own 16 bit audio sound output equipment, because the Mac uses 8 bit digital sound hardware.

Digital audio will also sound hissy on 8 bit hardware when pre-hearing audio selections in the digital audio extraction dialog because it is monitoring using 8 bit audio rather than 16 bit.

Digital audio will sound less than 16 bit quality in most Macintosh programs written prior to 1994. This is because Sound Manager 3.0 is needed to officially use 16 bit output. Luckily, CD Remote has a 16 bit audio file playback option in the menu. It can play huge files as a background task even with the mouse held down in a menu for extended periods of time (no other programs at this time are known to do this).

AIFF files do not play when double clicked in the finder. An AIFF file can be converted into a system beep or system sound file with sound editing programs such as Sound Edit Pro v1.0.5.

Some CD-ROM drive models do a better job of extracting audio than others. There is little we can do to remedy this, though new devices with improved extraction capabilities continue to appear. The HammerCD 4X, Chinon 535, Sony CDU-55S and Toshiba XM 4101TA extract digital audio perfectly. In fact, the HammerCD 4X can extract at nearly quadruple speed and the Sony CDU-55S at double speed.

QuickTime versions 1.6 and 1.6.1 swap audio channels between left and right sources when extracting; third party programs which do not employ QuickTime might avoid this problem. QuickTime 2.0 fixes all known extraction problems related to QuickTime, though still requires lots of spare memory within the application to convert to AIFF files.

Some extraction imperfections often occur due to the design characteristics of audio CDs. Audio CD blocks are located along a spiral track: devices do not have precise ways of locating a particular block without estimation. Digital markers indicating the position along the spiral are not present at every location for audio tracks. A symptom of flawed extraction is choppy low frequency pops in the sequence, caused when data could not be taken from the device at sufficiently frequent intervals.

Another culprit is older versions of QuickTime such as QuickTime 1.6.2, which asks the device to reread audio data that was sent in the previous request. Such an action requires the CD head to move out of track, thus interrupting the stream of digital audio. Third party professional extraction programs which avoid older versions of QuickTime entirely while adhering to Apple's CD driver commands for digital extraction will probably yield the best results. We know of no such extraction tools yet. It appears that QuickTime 2.0 should be good enough for most drives.

Some extraction defects are caused by debris, scratches or pressing defects. Audio CDs are allowed approximately 200 pressing defects per disc according to industry standards. You will not hear such defects because they result in a minor audio fidelity loss averaged over a block, and all CD-ROM

drives will transfer the extrapolated and corrected audio for you as a favor.

High quality 16 bit stereo 44.1 KHz CD sound is not necessary for average use. This format demands a great deal of space, which is why CD-ROMs can hold so much information. An audio disk can reliably hold a maximum of 4,400 seconds of sound, however because the data is pressed as a spiral track, there is no exact finite limit. That amounts to 740 megabytes of digital sound. You should expect an average four minute song to require 40 megabytes if fully extracted at the highest quality settings.

To many people such high quality audio is unnecessary and consumes excessive disk space. People involved in music production, multimedia arts, QuickTime creation and editing demand such quality, while common everyday SysBeep sounds gain little from it. You be the judge. FWB is just providing the best tools to allow you to experience what was merely a dream in 1992.

Playing Audio Tracks on Multimedia disks

Our player (and others) will not allow you to play the first track on most multimedia disks because that first track is not an audio track. It is a computer data track. There is no problem regarding this except for the confusion it may create. Renumbering the tracks to hide the first data track is not an honest solution, but would have eliminated the problem. Some multimedia CDs containing audio tracks include: "Battle Chess" and "Just Grandma & Me".

Using True Multimedia Titles (CDs with both Audio and Data tracks)

If a CD-ROM's installation manual instructs you to run a copy of the program from your hard disk, be sure to do so. True multimedia titles use digital audio tracks as well as data stored in computer format. There are few of these titles in existence. One reason is that the user must setup audio output from the CD-ROM drive, usually to headphones or an amplifier. The other reason is that most of these titles suffer small audio quirks on non-Apple drives without a flawless CD-ROM driver such as FWB's CD-ROM ToolKit. There is a third reason that they are rare. Audio output can sometimes be inadvertently stopped due to requests for file information. Any request for information from a file must immediately cancel whatever audio was playing because the CD drive must fetch it. The best solution is to move the application and its key files from the CD to the hard disk before starting. An example of a multimedia title that could be affected includes "So You Want to be a Rock and Roll Star?"

Avoid Virtual Memory

Virtual memory adversely affects many titles that play sequences of images or sound from a CD-ROM in a sustained manner. The reason is that many applications assume that large amounts of RAM exist without realizing that this memory is "virtual" and actually stored primarily on a storage device. The symptom is choppy audio, reduced video frame rates, or video jerkiness. You will want to avoid starting the computer with virtual memory enabled when running many QuickTime based CD-ROMs if the applications suffer from jerkiness on your system. This is common to all CD-ROM driver products, including CD-ROM ToolKit.

Helpful Hint for Interactive Titles

There is a way to get additional performance. Many interactive CD games are built using Macromedia's "Director" program. It has been observed that many of these titles prefer to have as much memory as possible allotted to them. Most title publishers pre-configure their titles to run with as little memory as possible, maximizing the target audience. Copy the main application to the hard disk and set the amount of RAM allotted to the application to a much larger value, but not all the memory. Your performance should increase, though not dramatically.

Section VII — Glossary

Access Time: The time period from issuance of a command to access a single sector to the time when the disk drive's head reaches the sector. Access time equals latency plus seek time plus command overhead.

Adaptive Delta Pulse Coded Modulation: This audio compression algorithm outlined and employed by the White Book Standard, provides for a user-configurable reduction in audio bandwidth required by stereo digital audio. Standard digital audio requires 176,400 bytes per second, while ADPCM can reduce this by a factor of four or more, permitting other data to be interleaved with audio. Of course, the greater the reduction in bandwidth, the lower the resulting quality of the audio stream.

Address: The ID number of a device on the SCSI bus, or of a block of data in storage.

ANSI, or the American National Standards Institute: ANSI is a private, nonprofit membership organization that performs two functions: It coordinates the United States' voluntary consensus standards system, and; it approves American National Standards. ANSI ensures that a single set of nonconflicting American National Standards are developed by ANSI-accredited standards-developers, and that all interests concerned have the opportunity to participate in the development process. These requirements for due process have resulted in a high level of confidence and credibility, and thus broad acceptance, for American National Standards. It is important to remember that ANSI does not develop standards. Rather, it provides the means for determining the need for standards, ensures that qualified organizations develop those standards, and coordinates standards approval. If you wish to contact ANSI, write or call: ANSI, 1430 Broadway, New York, NY 10018; (212) 354-3300.

Average Seek Time: The time in milliseconds to do all possible seeks on the drive divided by the number of seeks possible.

Bit: Bit is a contraction formed of 'binary' and 'digit'; all computer information is represented as a unique combination of the binary digits 0 and 1, which are also called 'offs' and 'ons.'

Block: The smallest "chunk" of memory accessed or transferred by the disk drive. Usually 512 bytes in size, it can be larger in multiples of 512. The number of bytes in a block is the same as block size.

Buffer: A temporary storage area for data being transferred from one place in the computer system to another. When accessing a single sector, the controller may read the entire track and store it in a buffer.

Byte: A group of eight bits. The basic unit of information.

Cache: Similar to buffer but more configurable. Cache can reside in RAM or on the drive's controller. It is used to store and quickly transfer recently used data.

CD ROM (Compact Disk, Read-Only Memory): Data is stored as pits on the platter surface, which are read by a laser in the CD ROM drive. The data can only be read; data cannot be erased; new data cannot be added.

CD-ROM/XA: Acronym for CD-ROM Extended Architecture - an Extension of the original CD-ROM standard which adds the capability for interleaving data to enhance real time playback of time based data. One notable substandard of the CD-ROM/XA specification is the ADPCM audio compression definition. CD-ROM/XA multimedia discs are not commonly found because superior technologies for motion video, such as QuickTime and ISO Whitebook have superceded it.

CD-I: An acronym for compact disc interactive - a compact disc technology similar to CD-ROM but intended for the consumer of electronics market. CD-I discs require special CD-ROM drives to operate.

CD-W (CD Recorder): Bringing the reality of Desktop CD Mastering to fruition, these drives, along with specialized mastering software, allow users to make discs themselves.

Central Processing unit, or CPU: The brains or 'central switching station' of any computer.

Controller, or Controller Board: Circuitry, usually built into a drive, that interprets signals between the host and the peripheral; it acts upon these commands, thus providing the device with 'intelligence.'

Data Error: Any discrepancy between recorded data and recovered data.

Data Transfer Rate: A measure of how quickly data is supplied to the computer from the CD-ROM drive.

Device-Independent: operating at the systems level and not requiring specific customization to run.

Drive, Hard Disk: A data storage device that employs one or more rigid disks as the medium.

Drive, or Disk Drive: The physical components necessary to transfer data to and from the recording medium.

Driver, or Device Driver: The software program that translates commands between the Macintosh's operating system and the Macintosh's SCSI Manager.

Firmware: An often-used microprogram or instruction stored in ROM. Usually refers to the ROM-based software that controls a drive.

Fragmentation: With use over time, the sectors of a file are written in different areas across the platter's surface. This slows access time.

Green Book (CD-I): This is a proprietary superset of the White Book building upon the logical organization of audio/video discs. It goes on to specify an operating system (a special version of OS/9, a complete Application Programmatic Interface), and playback hardware specifications. Currently, only Philips (N.V.) markets this technology. Special hardware or sophisticated emulators are needed to use these.

Gigabyte (GB): 1024 Megabytes or 1,073,741,824 bytes.

HFS: Hierarchical File System

ID, SCSI: A device's unique address on the SCSI bus is referred to as its ID, or identification.

Input/Output (I/O): The communication flow between the Mac and its peripherals.

Intelligent: Refers to a device capable of processing commands on its own.

Interface: The go-between that provides a common basis for communication between two otherwise incompatible devices.

ISO 9660: ISO is an acronym for the International Standards Organization and ISO 9660 is an established international standard file structure for CD-ROM discs adopted by ISO.

Kb/s: Kilobits per second.

KB/s: Kilobytes per second.

Kilobyte: One thousand bytes (actually 1024).

Latency: The time, in milliseconds, it takes for the spinning platter to bring around the desired sector to where the read/write head can access it. Does not include head positioning time. Contributes to access time. (See Interleaving.)

Mb/s: Megabits per second, equal to 1,048,576 bits per second, or 131,072 bytes per second.

MB/s: Megabytes per second, equal to 1,048,576 bytes per second, or 131,072 bytes per second.

Media: Another term for the disk platter, but more specifically the magnetic coating that covers the platter. The surface of the platter that holds the data.

Megabyte: 1,048,576 bytes.

Motion Picture Experts Group: This compression algorithm, like its audio counterpart (q.v.

ADPCM), provides configurable compression for video data, employing complex Discrete Cosine Transformation and frame differencing algorithms. Simply put, it allows the Author to control the amount of data required by the video portion of his media, sacrificing quality for greater compression. As the degree of compression increases, picture detail and color range decreases; video footage with a great deal of full-screen changes do not compress nearly as compactly because of this algorithm's assumptions about most video footage remaining largely static from frame to frame.

Mount: To appear on the Desktop; that is, to show an icon on-screen.

Multisession: An ISO standard CD-ROM format often referred to as "Orange book" that allows additional information to be added to a CD-ROM disc that has already been written to once. Multisession discs are most commonly associated with Kodak's proprietary digital photograph format called Photo CD. Multisession Photo CDs use special CD-ROM production equipment and allow digital photographs to be written to a CD-ROM disc more than once through "data interleaving". Reading the "secondary" writes on these multisession discs requires special CD-ROM hardware that is multisession compatible.

Optical Drive: A method of storing data by encoding information data on a disk with a laser.

Orange Book Standard (CD-WO System Description): Another Sony/Philips collaboration which details physical and optical characteristics of Compact Disc Write Once media, and hybrid ROM/WO discs which have read-only and write once areas on the same disc. As of this writing (1994 Oct), this technology is rapidly becoming more cost effective. Within a year, CD recorders may cost in the $1000 range, with media costs currently at $14 per disc. New generation recorders offer high speed (4 or 6x standard CD rate) writing as well as reading. Discs for recording use gold as a substrate metal instead of the aluminum employed by mass-market stamped discs, but may employ both.

Overhead: The incidental command processing time that is necessary to complete a task.

Partition: A portion of a storage area allocated to a particular use or user.

Peripheral: A device that is attached to the computer, either directly or via the bus.

Platter: The rigid disk that is used for storing data on hard disk drives.

Prefetch: Similar to buffering, except prefetching can read ahead to the next track. These larger reads get more data ready for the CPU's next request, thus speeding up access time.

Proprietary: Vendor-unique technology or devices that are incompatible with other products in the industry.

QuickTime: An Extension of the Macintosh system software that provides facilities for managing

time based data.

RAM, or Random Access Memory: Temporary memory usually found on single in-line memory modules (SIMMs) on the motherboard of the computer. RAM is lost when power is turned off.

Red Book: Refers to the specifications for the compact audio disc format developed by Philips and Sony and is the standard format of commercial audio CDs.

Red Book Standard (Compact Disc Digital Audio System Description): In 1983 a consortium of Philips (N.V.) and Sony drafted a comprehensive document to thoroughly define the Compact Disc Digital Audio standard. This document, eponymous for the color of its cover, describes the physical dimensions, optical characteristics, and logical organization, including the table of contents, track, and audio stream formats. This is the seminal Compact Disc document, from which all subsequent standards are derived.

ROM, or Read-Only Memory: Permanently stored data in the computer memory. Also refers to storage media that may only be read (not erased or written to).

SCSI Manager: The SCSI Manager is part of the Macintosh Operating System that provides the interface between a program such as a driver or formatter and the actual hardware SCSI port.

SCSI: Small Computer Systems Interface. A standard interface by which computers and their peripherals communicate with each other.

Sectors: Sectors are the smallest subdivisions of tracks, and usually contain exactly 512 bytes of data.

Seek Time: The time it takes the read/write head to move back and forth in search of the appropriate track; does not include latency or command overhead. (See Access Time.)

Single-session: Refers to standard CD-ROM discs where multisession format is not present.

Time Based Data: Data that can be stored as samples taken over time, such as audio, video, and animations.

Tracks: On a CD-ROM, tracks are logical divisions of the total data capacity. A CD may contain up to 99 tracks in it's Table of Contents. Tracks on hard drives are invisible magnetic "grooves," in the form of concentric circles that store data on a platter. Each track is a single line of magnetic domains.

Volume: Also known as a partition. Represented by an icon on the Desktop and used to store files and folders of information.

White Book Standard (Video CD System Description): JVC, Matsushita, Sony, and Philips co-

authored this specification, also known as the “Video CD Standard.” MPEG compression plays a major role in this standard. This remains a nascent technology, waiting for CD-ROM technology and the right marketing approach.

NOTE: MPEG is neither designed nor controlled by any of the co-authors of this standard.

Yellow Book Standard (CD-ROM System Description): A subsequent standards document which builds upon the Red Book Standard, allowing for the presence of data tracks on a Compact Disc. The Yellow Book standard specifies that CD-ROM must encode the first track as data. In addition to the two layers of error correction outlined in the Red Book (modulation-based & CIRC), standard 2048 bytes-per-block data is further protected by a third layer of error detection & correction for added security (known as ECC).

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