

OPTIMA

U S E R ' S M A N U A L



This manual and the software described in it are copyrighted with all rights reserved. Under the copyright laws, neither this manual nor the software may be copied in whole or in part without written consent of Connectix Corporation, except as set forth in the License Agreement found on the envelope containing the software diskette. The same proprietary and copyright notices must be affixed to any permitted copies as were affixed to the original.

No part of this publication may be reproduced, stored in a retrieval system, or transmitted, in any form or by any means, electronic, magnetic, photocopying, recording, or otherwise, without prior written permission of Connectix Corporation.

Copyright © 1991
Connectix Corporation
First Edition: January, 1991.
125 Constitution Drive
Menlo Park, CA 94025

All Rights Reserved.

Printed in U.S.A.

TABLE OF CONTENTS

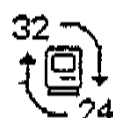
INTRODUCTION

What OPTIMA Does	1
Summary Description	1

GETTING STARTED

Installation	2
Quick Tips	2
OPTIMA's cdev	3

MEMORY ADDRESSING MODES

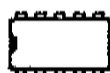


How to Change Memory Addressing Modes	4
Choosing Between 24-Bit and 32-Bit Modes	4
Working With MAXIMA	5
The Difference Between OPTIMA 32 and OPTIMA 128	5

WORKING 32-BIT CLEAN

What Are 24- and 32-Bit Addressing Modes?	6
All Software Running Must Be 32-Bit Clean	6
Which Applications Are 32-Bit Clean?	7
Dividing Memory Between Applications, Cache and RAM disk	7

RAM DISK



Using the RAM Disk Controls	9
The Remember Function	9
Details on the Operation of the Remember Function	10
Using the RAM Disk as an AppleShare Volume	11

DISK CACHE CONTROL



Using the Disk Cache Controls	12
Recommended Disk Cache Settings	12

HOW OPTIMA WORKS

24-Bit Addressing and the Dawn of Time	13
The Concept Behind OPTIMA	13
What Makes a Program 32-Bit Clean?	14

REFERENCE

Glossary	15
Startup Messages	16
kons	16
Alerts	16
Special Keys	17

INTRODUCTION

What OPTIMA™ Does

Extends Application Memory

- Creates a 32-bit clean environment under systems 6.0.4 to 6.0.7 on Macintosh IIci, IIx, IIsi and IILC[†] computers.
- Allows 32-bit clean applications to run under Finder™. OPTIMA 32 allows the use of up to 32 Megabytes of contiguous application memory while OPTIMA 128 allows the use of up to 128 Megabytes.
- Compatible with 4 and 16 Megabyte SIMMs.

Creates a RAM Disk

- Works on all machines.
- Adjustable RAM disk size.
- Avoids the need to manually load information from your hard disk onto the RAM disk at startup by Remembering previous RAM disk configurations.
- Can be made into be an AppleShare server.

Summary Description

OPTIMA is a utility for a special class of "power-users" who need to be able to use large amounts of memory for their work. It is especially useful for photo-processing (e.g. PhotoShop™), desktop publishing (e.g. Quark™ 3.0 and PageMaker™ 4.0), and animation packages, as well as for developers who need a 32-bit clean environment for testing software.

It works by allowing the use of full time 32-bit addressing mode, which allows direct access to all the SIMM RAM modules you can put in your machine. This normally would not be possible before the introduction of a 32-bit clean operating system, but by overcoming the restrictions of Apple's existing System 6.0.x software, OPTIMA provides future functionality today.

An important limitation of OPTIMA is that not all applications and INITs are written such that they are "32-bit clean." Such incompatible software will almost always immediately cause a machine crash if it is run in 32-bit mode. For memory extension with these programs, use MAXIMA™ which extends memory up to 14 Megabytes without resorting to 32-bit addressing, and so is compatible with almost all applications.

OPTIMA comes in two versions: OPTIMA 32 allows the use of up to 32 Megabytes of memory (a machine fully loaded with 4 Megabyte SIMMs) while OPTIMA 128 allows the use of up to 128 Megabytes (a machine fully loaded with 16 Megabyte SIMMs).

[†] Significant limitations exist with RAM utilization on the Macintosh IILC. See the bottom of page 4 for details.

GETTING STARTED

Installation

OPTIMA is simple to install. Just drag a copy of the OPTIMA file from the distribution disk to your System Folder. You can then immediately use the Control Panel to configure OPTIMA, and enable 32-bit mode for the next restart. If you are using an INIT chooser utility, you may have to make sure that OPTIMA is enabled by that utility if you wish to use the RAM disk features. Please remember that when you are running in 32-bit mode, *all* of the INITs, cdevs, and application software you use must be 32-bit clean.

Quick Tips

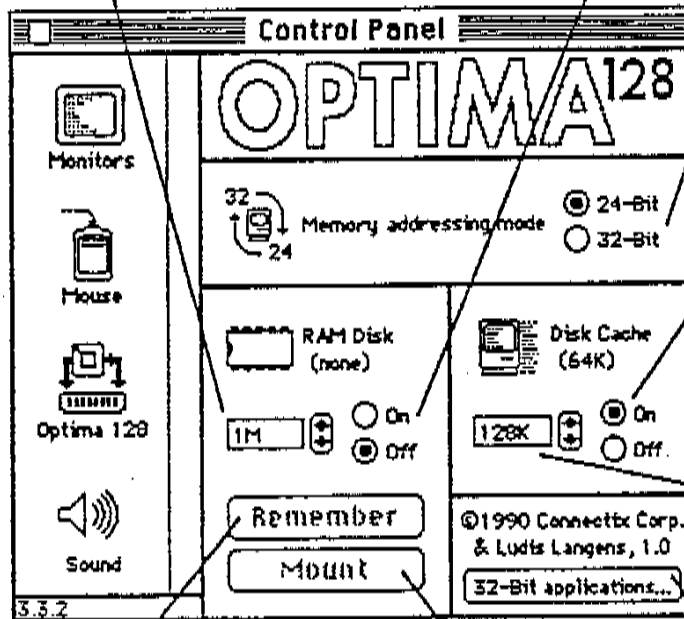
- Be sure to install MAXIMA and reboot *before* installing OPTIMA. MAXIMA can then automatically extend memory whenever you are running in 24-bit addressing mode.
- When you initially install OPTIMA, remove all the Startup, Control Panel, and Chooser documents (INITs, cdevs and rdevs) that you are not *sure* are 32-bit Clean and restart once before installing OPTIMA. You can then go back and add ones in question one by one to check if they are 32-bit clean.
- OPTIMA only works with Finder, so you should set your machine to Finder using the Set Startup command under the Special menu in the Finder.
- If you wish to disable OPTIMA, holding down the ESCape key (the upper left key on your keyboard) during boot will allow you to switch back to 24-bit mode.
- Even if you are an experienced RAM disk user, be sure to back up your RAM disk frequently, as power outages and system crashes can cause you to lose valuable data if it has not been saved to a non-volatile device.
- OPTIMA will work only on Macintoshes with 32-bit clean ROMs (IILC, IIsi, IIfx, or IIfx).

OPTIMA's cdev

Set RAM Disk Size: Using the arrows to the right of the RAM Disk Size display, you can set the amount of RAM allotted to the RAM Disk. After changing the size of the RAM Disk, you must restart your machine for the changes to take effect.

Enable/Disable RAM Disk: Use these buttons to turn the RAM disk which OPTIMA creates on and off. You must restart your machine for the change in these settings to take effect.

Memory Addressing Mode: Use the radio buttons marked 24-Bit and 32-Bit to set the Macintosh to start in the appropriate mode. You must restart for any mode change to take effect. (MAXIMA users note: If MAXIMA is active in your system and its Memory Extension feature is enabled, when you change the setting from 32-Bit to 24-Bit and restart, MAXIMA will automatically load. Conversely, if MAXIMA is present and active and you change from 24-Bit to 32-Bit, when you restart, MAXIMA will be automatically disabled.)



Enable/Disable Disk Cache: Use these buttons to turn the System's Disk Cache on and off. This provides an alternate means to enable and adjust the same control which is in the General cdev, with fewer size limitations on machines with more than 8 Megabytes of memory.

Set System Disk Cache Size: Using the arrows to the right of the Disk Cache Size display you can set the amount of RAM allotted to the System's Disk Cache. The number in parenthesis shows the setting currently in use. Moderately sized caches will usually maximize overall performance.

© 1990 Connectix Corporation

Pushing the Remember button memorizes all of the files currently on your RAM disk which came from your startup hard disk, and will then automatically reload those files onto the RAM disk each time you restart your machine.

In the screen shot on the top of this page, OPTIMA's control panel device is shown. To the right is the information screen that can be seen by clicking on the "32-Bit Applications..." button in OPTIMA's control panel device.

The screen shot above is of OPTIMA 128, the functionality of OPTIMA 32's control panel device is the same with the exception that it is only capable of addressing up to 32 Megabytes of RAM.

Mount: If your RAM disk becomes unmounted (thrown in the trash), clicking the "Mount" button will remount the disk and bring it back to the desktop.

Optima creates a 32-bit clean environment on Macintosh systems running under system 6.0.x. Many applications and INITs are NOT currently 32-bit clean. Below is a list of applications that are believed to be capable of running in 32-bit mode:

AppleLink 6.0, ColorStudio, Electric Image Animation System, Film Maker, FullWrite 1.5, HyperCard 2.0, Microsoft Excel, Oasis, PageMaker 4.0, Photoshop, PixelPaint Professional, SoftPC, Studio/32 v1.1, Strive! 3D, TypeStyler 1.02, WingZ, WordPerfect 1.0.3 and Quark XPress 3.0.

For sales/technical support call Newer Technology: (800) 678-3726.

©1990 Connectix Corporation & Ludis Langens
125 Constitution Dr. Menlo Park, CA 94025
(800) 950-5980 • International (415) 324-0727

OK

CONNECTIX
CORPORATION

MEMORY ADDRESSING MODES

How to Change Memory Addressing Modes

Once you have installed OPTIMA in your System Folder, you can change addressing modes by using the radio buttons in the Memory Addressing Mode area of OPTIMA's cdev (shown below). After changing the memory addressing mode you must restart your machine in order for the mode change to take effect.



When you are running OPTIMA in 32-bit mode you cannot run MultiFinder™, so you must set your machine to start up in Finder. This can be done under the Special menu using the Set Start-up command.

If the 32-bit mode setting on your machine is "greyed out" then your machine does not have 32-bit clean ROMs. You will not be able to run OPTIMA (or Apple's 32-bit mode in System 7) without upgrading your system.

Choosing Between 24-Bit and 32-Bit Modes

24-bit addressing has the advantage of being compatible with the full range of Macintosh software, unlike 32-bit mode. The primary limitation of 24-bit mode under both System 6 and System 7 is that it normally allows you to access only 8 Megabytes of application memory. MAXIMA extends this limit up to 14 Megabytes of application memory. Generally, if 14 Megabytes of application memory is sufficient for your needs, you should select 24-bit mode and use MAXIMA.

32-bit mode provides the benefit of allowing you to access up to one Gigabyte (1,024 Megabytes) of RAM. However 32-bit mode has three important limitations. First, you can run *only* 32-bit clean applications and INITs in this mode (see page 6). Second, under System 6, you can only use Finder (not MultiFinder) and so can run only one program at a time. Lastly, in either System 6 or System 7 you can only enter 32-bit mode if your machine has 32-bit clean ROMs (not currently available for the II, IIfx, IIfx, SE/30 or any 68000 based machine).

The Macintosh IIfx is something of an exception to the statements above. The standard IIfx normally runs in 24-bit mode. However, without a processor-replacement accelerator card, the IIfx's hardware appears to ignore the top 8 address bits even when the machine is switched into 32-bit addressing mode. So even though the IIfx ROMs allow 32-bit addressing, the hardware (at least, unassisted) does not. Even so, OPTIMA can yield a benefit on these machines for memory hungry applications. Running OPTIMA will extend the addressable memory from 8 Megabytes up to 10, and the entire application address space will be contiguous.

Working With MAXIMA

Because some applications are not currently 32-bit clean and also because some users of large amounts of RAM need to use MultiFinder, OPTIMA is designed to work closely with MAXIMA. An easy way to switch between 32-bit mode under OPTIMA and 24-bit mode under MAXIMA is by just using OPTIMA's control panel mode switch. To set this up, install MAXIMA first, with its Memory Extension feature enabled. Then restart and install OPTIMA. Once OPTIMA is installed, when you switch into 32-bit mode and restart, MAXIMA will automatically be disabled. Conversely, when you switch back to 24-bit mode using OPTIMA's control panel switch and restart, MAXIMA will take over and provide memory extension.

When working with MAXIMA it is important to remember that the RAM disks in OPTIMA and MAXIMA are different in operation and that they do not retain each others information. Also, each RAM disk has a different way of keeping track of what information to load. (It is possible to make their operation very similar — please see the section on using the RAM disk.)

The Difference Between OPTIMA 32 and OPTIMA 128

The functionality of OPTIMA 32 and OPTIMA 128 are very similar. All the user controls are identical between the two programs. However, OPTIMA 32 is capable of addressing only up to 32 Megabytes while OPTIMA 128 can address up to 128 Megabytes of memory.

WORKING 32-BIT CLEAN

What Are 24- and 32-Bit Addressing Modes?

There is a lot of confusion about what 32-bit addressing really means. This has probably been increased by the somewhat recent advent of 32-bit Color QuickDraw and 24-bit color video monitors, neither one of which has anything to do with memory addressing modes. The central issue is that, although the hardware is and has been 32-bit capable for some time, the operating system (ROMs and system software) is not. (For more details, please see page 13).

Quite simply, 32-bit addressing mode is when all 32 bits of each address generated by the processor are interpreted by the Macintosh to be part of the address. Currently Apple's system software ignores the top 8 bits of any address, using only the lower 24 bits. With the advent of System 7.0, Apple will be releasing a fully 32-bit clean operating system, but this mode will be included as an option. Since not all software is 32-bit clean, 24-bit "compatibility mode" will still be the default.

All available memory in 32-bit mode is contiguous; in other words there exists a continuous series of addresses available for use by application software. This contrasts with MAXIMA operating in 24-bit mode, which extends memory by adding additional, available memory blocks which are separated in address space from the other blocks.

Apple's current address map in 32-bit mode allows up to one Gigabyte (1024 Megabytes) of directly addressable RAM with another 3 Gigabytes available for slot card addresses. However, the motherboards of these machines are not wired to accept more than 128 Megabytes of RAM (using 16 Megabyte SIMMs).

All Software Running Must Be 32-Bit Clean

While OPTIMA overcomes non-32-bit cleanliness in Apple's System software (including the Desktop Manager), it cannot protect against nonstandard modifications which have been made to the operating system. INITs and some cdevs modify how the operating system works, and regrettably, not all of them are yet 32-bit clean. There are a huge number of INITs, and often multiple version numbers of each. In addition, developers are constantly trying to update their software to be compatible in a 32-bit environment. As a result, it would be impractical to print a permanent list of clean INITs here. Do, however, check the Read Me for the recent status of some of the more common INITs, packaged with this manual.

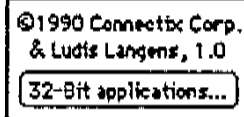
To find problems yourself, it is generally quicker to start with a fresh System Folder in a 32-bit environment and add Startup, Control Panel and Chooser documents a few at a time. Reboot and check the functionality of the software by exercising it a little, then move on to the next group.

Some NuBus™ cards also have code that gets executed when the machine starts. These problems will exist even with a clean System Folder while OPTIMA is set for 32-bit addressing mode. If you suspect that you have a NuBus card that has a 32-bit mode problem, try a different card that has the same functionality (*i.e.* another video card) as a temporary substitute to overcome the problem and confirm that this is truly the case.

Once any offending startup software has been found, an INIT selector can often be used to turn it off before entering 32-bit mode (the selector itself must of course be 32-bit clean). Alternatively, separate partitions or hard disks can be used to store distinct 24-bit and 32-bit clean System Folders. Note that when OPTIMA 32-bit mode addressing is engaged, OPTIMA will prepare the only system on the current boot volume for operations in 32-bit mode. Switching drives therefore requires two restarts: Once after a "startup device" switch to the 32-bit clean drive, and a second after the OPTIMA 32-bit addressing mode has been enabled.

Which Applications Are 32-Bit Clean?

One simple way to check to see if the application you wish to run is 32-bit clean is to see if it is on the application list displayed when you press the "32-Bit Applications..." button. This is a compilation of some of the 32-bit clean applications for which users have seemed to be most thankful of the ability to use large amounts of RAM for processing. Other applications on the list, while not needing huge amounts of RAM themselves, are useful as "support tools" while you are in 32-bit mode.



This list is by no means exhaustive. We have even found numerous old programs written for the original 128 K Mac which perform flawlessly under 32-bit addressing. In addition, new versions of existing applications are being released which are 32-bit clean. Even if such versions are not yet released, you may wish to contact the publishers of your favorite software which is not 32-bit clean. Most developers are working on compatible versions, and may appreciate help in testing from registered users of their software.

Finally, you can just try running an application to see if it does what you need it to do. Although a program which is not 32-bit clean will usually crash on launch or very quickly thereafter, there are also some programs which are "almost there," and only crash when you attempt a particular operation. If you can avoid these operations, the program may still have some utility while you are in 32-bit mode.

Dividing Memory Between Applications, Cache and RAM disk

With the ability to have 20, 32, 64 or even 128 Megabytes in your personal computer there is some confusion as to how best to allocate these huge RAM resources. Many applications which need massive amounts of storage have been written so they can page to the hard disk, and operate (albeit slowly) in reduced amounts of RAM. Should these be set to page to a RAM disk? Or should a very large disk cache just buffer hard disk accesses?

Usually, the best solution is to set the Disk Cache to 128 K, and turn the RAM disk off. This will be the most efficient configuration for about 4 out of 5 users. If you think your situation is a special case, however, please consider the following discussion before selecting alternate settings.

In general, whenever you are running very memory hungry applications, performance will be optimized if the application can directly address as much RAM as it will require to operate. The basic guideline here is to give your memory hungry application as much as it can effectively use. Programs which do their own paging almost always benefit from as much directly addressable memory as possible.

One way to use your RAM disk is to keep applications on it. Launching those applications will be significantly faster than starting them from your hard drive. However, you should use the RAM disk only if you know that the applications you are running will not need as much RAM as you have available. The RAM disk may tie up enough memory to force the application to start paging to the hard disk, which might slow operations. While it is possible to use the RAM disk as the paging volume for applications which swap out memory to a drive to gain more storage space, it is almost always preferable to use the memory for direct addressing by the application rather than let paging occur to a RAM disk. (In our unofficial, first-cut tests, directly addressing would seem to be about twice as fast as paging to a RAM disk.)

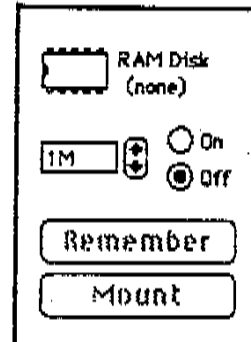
While the RAM disk is often best left turned off, the Disk Cache is generally best left turned on while set to a small value ($\approx$ 128 K or so). In practice, this usually lets the directory of your hard disk become RAM resident, so that when a disk access *does* become necessary, the disk heads do not have to move first to the directory, and then back to where the information actually resides. The speed increase which results is usually large as compared to the modest amount of RAM consumed. Larger caches not only consume more memory (leaving less for other operations), but also take longer to search through when finding a match (cache hit).

RAM DISK

Using the RAM Disk Controls

The RAM disk controls can be used to turn the RAM disk on and off, and to set the RAM disk size. You must restart for any changes to take effect. The currently active setting (the one as of the last restart) is shown in parenthesis. By holding the option key down when setting the size, you can adjust in finer increments.

Unlike MAXIMA, OPTIMA will use only the normally recognized RAM to make its RAM disk. With 32-bit mode, this is of course no problem, since all of the memory is recognized. But under 24-bit mode, it means that none of the memory in your machine beyond 8 Megabytes will be used (and the RAM disk will use memory up out of your first 8 Mb) so we recommend you use the MAXIMA RAM disk under these circumstances.



If the RAM disk becomes unmounted (thrown in the trash, for example) you can use the Mount button to bring it back onto the Desktop.

The Remember Function

The Remember button provides a unique means of re-filling your OPTIMA RAM disk with files from your hard disk each time you restart. Set-up is very easy — drag any file or set of files or folders over from your startup drive onto the RAM disk. Whenever you are satisfied that you have all the files you need, press the “Remember” button in the OPTIMA control panel. Essentially, this transparently makes a list of all the files on your RAM disk and where they came from on your hard disk. Whenever you restart, this list of files will be re-copied onto the RAM disk.

If you want to add files to the list, just drag the additional file or folders to the disk, and press the “Remember” button again. Similarly, if you want to eliminate some (or all) files, throw those files away off the RAM disk and press the Remember button.

Unlike the MAXIMA RAM disk, the OPTIMA RAM disk will not retain any changed information across crashes, restarts or shutdowns. You must copy any information which has been saved on the RAM disk back to your hard disk for it to be permanently saved. For this reason, we recommend storing only applications, tools and utilities on the OPTIMA RAM disk. Use it for fast access to files you already have stored on your hard disk, not for your personal files. It is also an excellent repository for temporary scratch or paging files when they are necessary.

It is possible to set up MAXIMA's RAM disk such that its behavior is very similar to the Remember feature of OPTIMA: Create a single folder on your hard disk which holds all of the files and folders you wish to have copied to the RAM disk at startup. Copy this folder to the RAM disk, and use the Remember button to memorize these files for use when running under OPTIMA. Setup MAXIMA by checking the “Copy files at Startup” feature while leaving the “Save files at Shutdown” feature unchecked, and set the folder

you created to be the Volume Folder (the contents of which will be copied to the RAM disk at startup). Following these instructions, the contents of the RAM disk will be the same whether you are in 32-bit mode under OPTIMA or in 24-bit mode running with MAXIMA.

Details on the Operation of the Remember Function

The details of exactly how the Remember button figures out where each file on the RAM disk came from will only very rarely be of use or interest, and are included here for the interested reader.

For each file on the RAM disk, we find a file on the startup hard disk which matches exactly the file's type (4 letter code), creator (4 letter code), and creation date. In addition to be called a match, at least two of the following three items must also exactly match (in descending order of priority): Location, file or folder name, and last modification date. If more than one match is found for all matching criterion, then the first file occurring in the directory index is used. The term Location in this context is defined as having a parent folder which is a match by the same rules above (this is a recursive match, and the root directory of a disk is always taken as a Location match). Invisible files will not be included in the list. If the entire contents of a folder is matched (including names and all subfolders), then each item in the folder will not be listed individually; instead the entire folder's contents will be copied (even if other files or folders later get added).

The reasons for these seemingly complicated rules are to allow some useful features you will find to be intuitive if you use the Remember function extensively: You can change a file on your hard disk, add to its length, and even change its name while not having to go back and copy it over to the RAM disk and press the "Remember" button. Files which are subsequently added to folders which you had copied over before in their entirety will also automatically be included. The changing of folder modification dates by the Finder occasionally overcomes these protocols, so you may be forced to refresh any missing files and press the Remember button again.

Using the RAM Disk as an AppleShare Volume

Although current versions of AppleShare are not 32-bit clean, there is a feature of OPTIMA's RAM disk which can be useful even on machines with 8 Megabytes or less of memory. Other RAM disk INITs can normally be set to use no more than one-half of the memory in a machine, while OPTIMA's RAM disk can use nearly all. This makes it ideal to use OPTIMA as a RAM disk AppleShare server. (The following technique could also be used to make a huge AppleShare RAM disk server under 32-bit mode, if and when AppleShare becomes 32-bit clean).

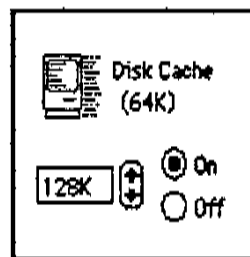
Start by preparing the server's Server Folder with AppleShare (and related needed items), Finder and Optima. Then restart and boot from a floppy disk. Temporarily drag the "AppleShare Srvr" out of the Server Folder, and restart the machine, letting it boot up into Finder off the hard disk. Configure the RAM disk size in OPTIMA, and restart once again. Now drag the "AppleShare Srvr" back into the Server Folder and launch "AppleShare Admin." Use AppleShare Admin to "Prepare" the RAM disk for AppleShare, and then Quit the Admin program. Drag the Server Folder which the Admin program will have just created on the RAM disk into the Server Folder on your hard drive (the folder holding OPTIMA). Do not open either folder at this time! Go into the Control Panel and click the "Remember" button in OPTIMA. When you restart the server, the RAM disk should be a server volume.

DISK CACHE CONTROL

Using the Disk Cache Controls

The Disk Cache control in the OPTIMA control panel represents precisely the same control that you already have on Apple's General control panel, but properly allows selection of larger cache sizes on all machines. This control adjusts the size of the memory which is given to caching (storing) frequently used disk information in RAM, so it is also convenient that it be placed here where you can divide up the memory in your machine between RAM disk and cache. Changes in this setting will become active at the same point they would if the General cdev were changed, that is, at the next application launch under Finder, or the next restart under MultiFinder.

The OPTIMA Disk Cache control also allows the selection of a finer increment by holding down the option key. This is not possible on Apple's General cdev Disk Cache control. The currently active setting is shown in parenthesis.



Recommended Disk Cache Settings

Usually cache sizes larger than about 128 K do little or nothing to improve disk performance, and can actually slow down many processes. Also, the cache Apple has implemented is not a write-through cache, so if a crash were to occur while you were working, a significant fraction of whatever you thought had been saved to the disk might not in fact have been flushed out if you were using a large cache setting. For this reason, we recommend fairly modest (≤ 128 K) cache size settings. Please note, however, that modestly sized settings can improve performance fairly dramatically as opposed to not having any cache at all.

There are, however, some special circumstances in which very large caches may be useful. Technically, if your "working set" of disk accesses can fit completely in the cache, access speed will be enhanced. However, this is subject to several exceptions, including the total number of files in use, as well as the combined size. Unless these implications are obvious to you, stick to modest cache sizes.

Please note: Apple's General cdev may incorrectly update the current Disk Cache setting each time General is opened on machines with more than 8 Megabytes of memory. As a result, you may have to go back and subsequently update the Disk Cache setting on the OPTIMA control panel to actually use large settings. Apple's Disk Cache control sees the amount of RAM in the machine modulo 8 Megabytes (the remainder when 8 Megabytes is divided into the machine's total RAM), while the OPTIMA control accurately recognizes the full amount of RAM.

HOW OPTIMA WORKS

24-Bit Addressing and the Dawn of Time

Apple's Macintosh system software was first developed on the Lisa and Mac 128 computers, both of which used the 68000 microprocessor. Although the internal architecture of the machine used 32-bit address and data paths, this microprocessor had only 24 address lines, and so no address higher than 2^{24} (≈ 16 million) was accessible. This didn't seem like a big limitation on a machine with only 128 K of RAM, and so, rather than let the top byte (eight bits) of each stored address go to waste, the software engineers took advantage of the fact by using these bits to signify different things. For example, setting the high-order bits of an address could help tag that memory as being locked or purgable. Thus the address \$80001234 represents the same memory location as \$00001234, but is just tagged differently. This convention was assumed throughout the operating system, and by the applications which were developed to run on the Mac.

With the introduction of the Mac II, the 68000 family hardware now became ready to make all 32-bits of each address significant. Now there was a problem however — since some of the high-order address bits had been set, if the hardware used all of them, the program would fetch information from an incorrect location each time those bit-tags were set; *i.e.* although the hardware was now 32-bit clean, the system and application software that has been developed for it were not!

Initially, Apple solved this conflict by setting up the hardware so it would still ignore the top 8 bits, but gave programmers a means by which they could (temporarily) slip into "32-bit mode." Only code which the developers had written themselves to be 32-bit clean could be run during these times (no calls to the ROMs or the System). Meanwhile, Apple immediately started to clean up their system software, and to try to impress upon third party developers the importance of following Apple guidelines, so that the software everyone wrote would work in a full-time 32-bit clean environment when it is ready.

By the time the Mac IIci rolled out, the ROMs were finally 32-bit clean. But the system software (like Finder) still wasn't ready for this mode.

The Concept Behind OPTIMA

OPTIMA overcomes the remaining incompatibilities in Apple's 6 system software, and makes it so the machine can run in full-time 32-bit mode. Well, not quite all of it: MultiFinder was too incompatible to be fixed, and so users will have to be content to give all of their memory to one application and run under Finder. Fortunately, this is just what truly memory-hungry applications most need! It is made even more fortuitous considering that the plain Finder environment is going to disappear entirely with the advent of System 7, and so OPTIMA under System 6 will continue to be the only means by which you can give all the memory in your machine over to just one application.

What Makes a Program 32-Bit Clean?

Even though OPTIMA makes the system software capable of 32-bit operation, application software must also refrain from using the high-order bits of addresses for alternate purposes. There are two common ways in which programs will fail 32-bit cleanliness, and both violate the guidelines that Apple established for developers. Some programs access the tags that were left by the system in the high-order bits directly, bypassing the system. Others use other high-order bits for their own purposes. In general, the developers who did this either had fairly good reasons for doing so (providing significant performance enhancements, for example) or perhaps didn't realize that although the code *they* wrote didn't play any tricks, the development tools (compilers and assemblers) they used to create their software *did* (again, usually for speed advantages). As 32-bit mode becomes the norm and compatible versions of software packages emerge, such incompatibilities will gradually fade away.

REFERENCE

Glossary

<i>24-bit addressing mode</i>	The mode in which the Macintosh was first developed, in which the top 8 bits (one byte) of address are ignored, and the lower 24 bits are used to direct memory accesses.
<i>32-bit addressing mode</i>	The hardware capability of newer Macintosh machines (ever since the Mac II), in which all 32 bits of each address are used to direct memory accesses.
<i>application memory</i>	Memory which is actually available for use either by an application or the operating system, and which will be recognized by standard operating system calls.
<i>boot</i>	The process of starting a computer by loading essential environment and operating system information into the computer's memory. Changes in many operating system parameters can only take effect at boot time. In this manual, it is also often used to refer to the restart process.
<i>contiguous</i>	When referring to RAM memory, an unbroken series of available addresses.
<i>fragmented</i>	Not contiguous; broken into logically or physically separate pieces.
<i>memory map</i>	Describes what information or devices may be found at any particular memory address.
<i>nonvolatile</i>	The ability to retain information without external power applied.
<i>RAM disk</i>	A logical structure made from semiconductor memory which emulates the functioning of a disk drive as closely as possible. Since most semiconductor memory (RAM) is volatile, most RAM disks are also volatile.
<i>Restart</i>	This usually refers to the selection in the Finder under the "Special" menu of the item which re-boots the computer without an intermediate interruption of power.
<i>Startup Disk</i>	The disk which appears as the topmost disk on the desktop. It contains the System and Finder which are currently in use.
<i>Shutdown</i>	Shutdown is used to refer to the orderly transition of your Mac to a powered-off state.

MESSAGES AND ALERTS

Startup Messages

The following message will appear in the "Welcome to Macintosh" window at startup. Note that if you are using a Startup Screen, this messages is suppressed.

Optima 32-bit addressing enabled.

Icons

The following INTT icons appear if the RAM disk feature of OPTIMA is enabled.



RAM Disk Loaded Icon



RAM Disk Not Loaded Icons

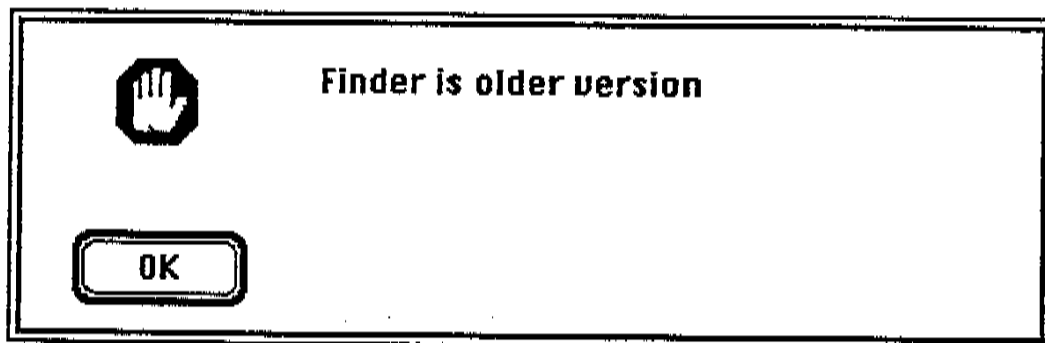


If the icon has a question mark over it, not all of the files which were "Remember"ed to be copied to the RAM disk made it onto the disk — either the RAM disk size, or the size of the files on the hard disk has probably changed.

If the icon has an "X" through it, the RAM disk could not be created. This is usually due to insufficient memory — for instance when the RAM disk size is appropriate for the memory under 32-bit mode, but is too large for the space under 24-bit mode. (Remember that there is a maximum of less than 8 Megabytes available to the RAM disk under 24-bit mode).

Alerts

If OPTIMA did not recognize the particular copy of the Finder on your machine, and if your version of Finder has not been replaced with a new 32-bit clean version, the following message will appear.



The simplest solution is to replace the Finder with an unmodified copy from one of Apple's original system disks, System version 6.0.4–6.0.7.

Special Keys



Holding down the escape key during the boot process disables all functions of OPTIMA, by totally bypassing loading. Use it to escape from 32-bit mode if you cannot get to the Control Panel (if an INIT causes you to crash before booting, for example). The ESC key must be depressed before the "Welcome to Macintosh" message is displayed and can be released when the following dialog appears:



This Macintosh is set for 32-bit addressing. You may switch to 24-bit addressing and use this disk or restart and use a newer startup disk. (System 6.0.7 does not work with 32-bit addressing.)

24-bit

Restart

Press the 24-bit button, and the machine will restart without OPTIMA, back in 24-bit "compatibility mode."