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Using this Manual

TECHTOOL® PRO

Version 3

User's Guide and Reference Manual

www.micromat.com

Copyright Information

Printed in the USA.

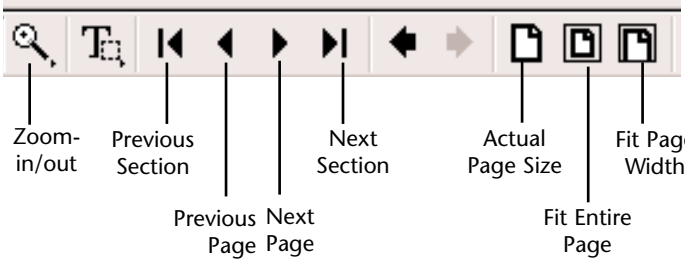
Part number: MM00777

Using This Manual

This manual was prepared in the Adobe® Acrobat® PDF format for viewing on screen. You may also print out selected pages or the entire manual on your local printer.

Using the Manual **on screen**

Use the scroll bar at the right of this screen to scroll through the entire manual. You may also click on Contents, Prev or Next buttons in the upper right to view the Table of Contents or move to the Previous or Next page. Clicking the items in the Contents will jump to that page. The standard tools on the Acrobat Reader toolbar shown below may also be used to navigate this document.



Printing portions of the Manual

You may print pages at any time by selecting **Print** from the **File** menu. Follow the on screen instructions that appear for your specific printer.

The page sizes for this manual are 4.75 inches wide by 7 inches tall. If your printer software has the ability to print 2 pages side-by-side, you may select this option in your Print Options prior to printing. Refer to the instructions provided with your printer for additional information.

Installation and System Requirements

Introduction

Thank you for purchasing *TechTool Pro!* We have worked hard to make *TechTool Pro* the most powerful and easy-to-use problem-solving utility available for the Macintosh. With *TechTool Pro* you will be able to:

- Diagnose and repair problems with your drives.
- Scan for and eradicate computer viruses.
- Check for software conflicts.
- Recover lost data.
- Test critical computer components and subsystems.
- Do routine maintenance on your computer.
- Reveal the culprits which cause your Macintosh to crash.
- Verify system configurations.
- Check critical software like the system and enablers.
- Test new equipment.
- Make sure that your computer is running as fast as it should.

Most importantly, *TechTool Pro* allows you to test your computer like a professional without the need of years of experience or a computer degree. *TechTool Pro* allows you to check the intricate components of your Macintosh with a simple click of your mouse. When *TechTool Pro* finds a problem with your computer, it will either fix it for you or it will suggest steps you can take to correct the situation.

Consider *TechTool Pro* your personal Macintosh technician—always ready to help, and only a mouse click away.

Registration

Please take a moment to register the program. Your serial number is your proof of ownership of *TechTool Pro*. Keep it in a safe place since you may need it when you make future updates, upgrades, or need technical support. By regisitering, you also give us a means to help you determine your serial number in case it is lost. Most importantly, registration is required to receive technical support for *TechTool Pro*.

The easiest way to register is to do so online. Simply visit Micromat's web site at www.micromat.com and click **Register**. Fill out and submit the online form and you are finished. If you do not have Internet access, then you should fill out the registration card and mail it directly to Micromat.

System Requirements

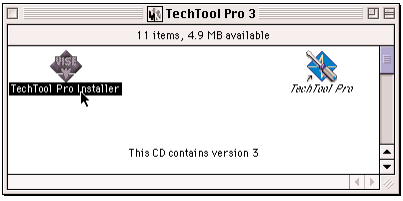
- Color-capable Macintosh computer with minimum 640x480 display.
- System software version 7.5.5 or later.
- Drive capable of reading CD-ROMs.
- Minimum 5 megabytes of RAM above that required by the OS.
- Hard disk drive.

Note that these requirements may change with future updates. Please refer to the ReadMe file on the CD for additional changes.

Installing TechTool Pro

TechTool Pro utilizes an automated installer to correctly place the *TechTool Pro* application and all ancillary files in their proper locations. The installer offers several installation options and these are explained in detail on the *TechTool Pro* installation screen. To install:

- Insert the **TechTool Pro CD**.
- Double-click the **TechTool® Pro Installer** icon.

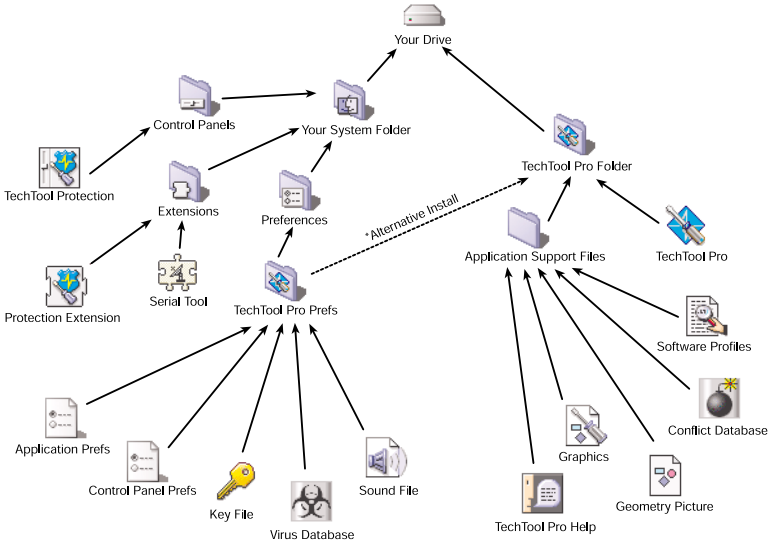


- Read the explanatory text on the installer screen and then follow the prompts.

What's Installed

The *TechTool Pro* installer will install the following components as indicated below:

Note that this installation may vary in future updates.



TechTool Pro Parts

Following is a brief description of the files and folders that are installed by *TechTool Pro*. Full details on the functions of these items are provided throughout this manual.

TechTool Pro Folder

This folder contains the *TechTool Pro* program and its necessary support files.

TechTool Pro Prefs Folder

The *TechTool Pro Prefs* folder contains the various preference files used by both the *TechTool Pro* main application and the *TechTool* Protection control panel set. The *TechTool* Protection control panel requires that a copy of this folder resides in the System Folder's Preferences folder. However, a copy can also be kept in the *TechTool Pro* Folder. This makes it easy to use the program on another drive/volume where you would like the *TechTool Pro* application, but don't require a system folder and the *TechTool* Protection control panel set. Just copy the entire *TechTool Pro* Folder (with the *TechTool Pro* Prefs Folder included) to the second volume, and you will have everything necessary to run the program from the second volume.

Application Support Files

This folder contains various data files required for the operation of *TechTool Pro*.

TechTool Pro

Resides in the *TechTool Pro Folder*. This is the main application and the item that you double click to launch the program.

Application Prefs

Resides in the *TechTool Pro Prefs* folder. It contains the preferences for the *TechTool Pro* application itself. If the *TechTool Pro Prefs* folder resides both in the System Folder's *Preferences* folder and the *TechTool Pro Folder,* the application preferences in *the TechTool Pro Folder* will take precedence over those in the *Preferences* folder.

Control Panel Prefs

Resides in the *TechTool Pro Prefs* folder. It contains the preferences for the TechTool Protection control panel.

Virus Database

Resides in the *TechTool Pro Prefs* folder. This file contains the information required for the virus checking tests of *TechTool Pro*.

Key File

Resides in the *TechTool Pro Prefs* folder. This file contains the serial number and personalization information for *TechTool Pro*.

Software Profiles

Resides in the *Application Support Files* folder. It contains a database of software information used by *TechTool Pro*. This information is necessary to perform the File Tests. It checks the Finder, System, Enablers, Updates, MacOS ROM, and System Resource files.

Conflict Database

Resides in the *Application Support Files* folder. This file contains the database of known software conflicts used by *TechTool Pro*.

Sound File

Resides in the *TechTool Pro Prefs* folder. This file contains the various warning and control sounds heard while using *TechTool Pro*. This file may be alternately installed in the *Application Support Files* folder.

Graphics

Resides in the *Application Support Files* folder. This file contains graphic elements used by the *TechTool Pro* application.

Geometry Picture

Resides in the *Application Support Files* folder. This pict file holds the Custom Picture used in the Video Geometry test. To use your own image in the test, replace this file with a pict image of your choice named **Geometry Picture**.

TechTool Pro Help

Resides in the *Application Support Files* folder. This file contains help and advice information.

TechTool Protection

Resides in the *Control Panels* folder. This control panel works together with the Protection Extension to provide automatic security for your computer. This includes an automatic check of your directory structure, regular backup of your disk's directory, maintenance of the Trash Cache (which allows you to easily "unerase" deleted files), and virus checking routines.

Protection Extension

Resides in the *Extensions* folder. The Protection Extension implements the automatic routines controlled by the TechTool Protection control panel (see above).

Serial Tool

Resides in the *Extensions* folder. This file is an Apple Communications Toolbox item. It is used in the Serial Ports tests, and in the Modem tests to allow *TechTool Pro* to test all available ports.

Contacting Technical Support

Micromat provides technical support to its customers by telephone, email and U.S. Mail. For a current listing of our telephone numbers and other contact information, please refer to the back cover of this manual or visit our website at www.micromat.com. Technical support is available Monday through Fridays (excluding public holidays), from 8:30 AM to 5:00 PM PST

If you wish to contact technical support, you will need to have your TechTool Pro serial number and version number ready. Our automated phone attendant will require you to enter this information before connecting you to a technician. Please be near your computer when you phone, since our technicians will need to ask you questions about your system, and will attempt to guide you through solving any problems.

Please have the following information ready for the support technician, and be sure to include it in any email or U.S. postal mail you send to Micromat.

- A Brief description of your problem.
- Version number of your TechTool Pro software. (Example: TechTool Pro 3.01)
- Version of Macintosh System software you are running. (Example: Mac OS 8.6.1)
- Type of computer and configuration. (Example: Apple Macintosh 8600, 48MB of RAM, 4GB internal hard drive.)

- A list of peripheral devices and accessories attached, such as external hard drives, scanners, printers, recordable CD-ROM devices etc.
- If you are using a third party Video Card, please have the make and model number available.
- If you are connected to a network, including a cable modem or DSL modem that uses the network connection, mention the type of network and devices being used.
- Modem type and speed (Example: Apple Internal 56k).

Micromat News (for notification of updates and other information):
Micromat maintains a notification system called Micromat News. This allows us to inform our customers of updates and upgrades by email. If you wish to receive these notifications, please follow the instructions below:

1. Send an email message to listmanager@micromat.com. (You must send the message from the email account that you wish to subscribe.)
2. Message body should say ONLY the following:

   SUBSCRIBE MICROMATNEWS

   (note that "micromatnews" is one word)
3. You'll receive confirmation of your free subscription and you'll automatically be notified whenever a new update is released.

About Micromat Computer Systems Inc.

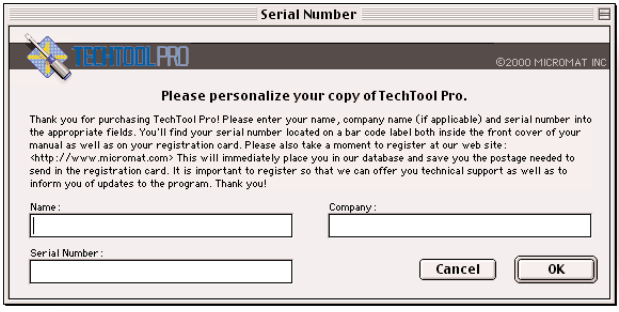
Micromat Inc. has been developing Macintosh diagnostic utilities since 1989. As the first company to offer diagnostic products for Macintosh, Micromat has pioneered many new technologies for helping Macintosh users bring their computers back to life, and to keep them running their absolute best. When NASA needed to conduct micro-gravity computer experiments in space, they chose our first product, MacEKG, for its ability to test the behavior of computer equipment outside the confines of the Earth's gravity. We were more than happy to help, because NASA not only put us miles above other utility software products, they gave us the honored distinction of being the first computer diagnostic ever to be used in space.

Getting Started

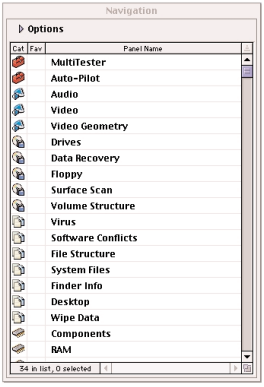
Launching TechTool Pro

After successfully installing *TechTool Pro*, locate the *TechTool Pro Folder*. Inside you'll find the *TechTool Pro* application. Double click the **TechTool Pro** icon to Launch the program.

The first time you launch *TechTool Pro*, you'll be presented with a dialog box with three fields for your name, company name, and product serial number. Your serial number is listed on the registration card included with the *TechTool Pro* package. Enter the appropriate information into the corresponding fields.

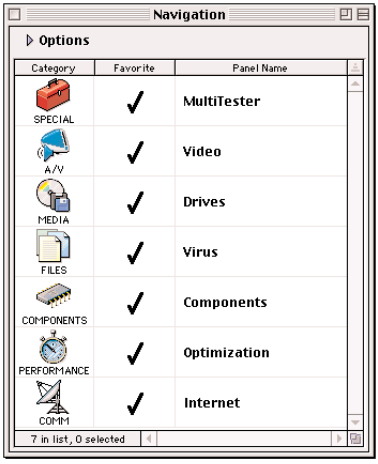


Sample Session



When you first launch *TechTool Pro* you will see the Navigation Window and the MultiTester panel open on the screen. The MultiTester contains a standard suite of tests that will do a thorough analysis of your computer's drives and components. To run these tests, all you need to do is click the **BEGIN** button on the MultiTester panel. If problems are found, you will be notified and offered the option to make repairs. When the tests are completed you will be presented with a report detailing any problems found and the results of any repairs. If repairs cannot be made, the *TechTool Pro* report will give you information on how to proceed. This is all that is required to do a comprehensive check of your computer system.

Navigation Window

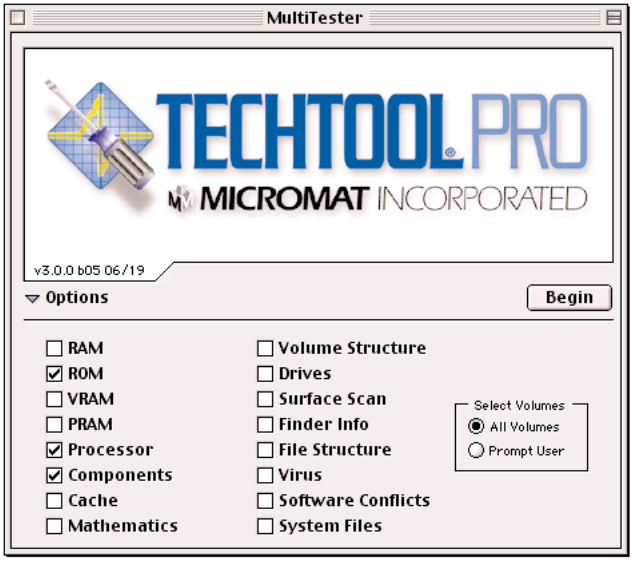


The Navigation Window can be thought of as TechTool's *Center of Operations*. It lists each test suite and utility available in the TechTool program so that you can work with it individually. When you double-click on a test, an individual test panel opens with the options for that test.

The Navigation Window has a number of options that make it easy to use. You can drag it to any spot on the screen and size it to your liking. If you wish, you can choose a large format display to make it easier to read. Each test displays an icon indicating its category, such as *Drives* or *Communications*. You are able to sort the list based on a variety of criteria. In addition, you can choose favorite tests and list only your favorites, or list only tests that contain a certain "string" of characters in their name.

MultiTester

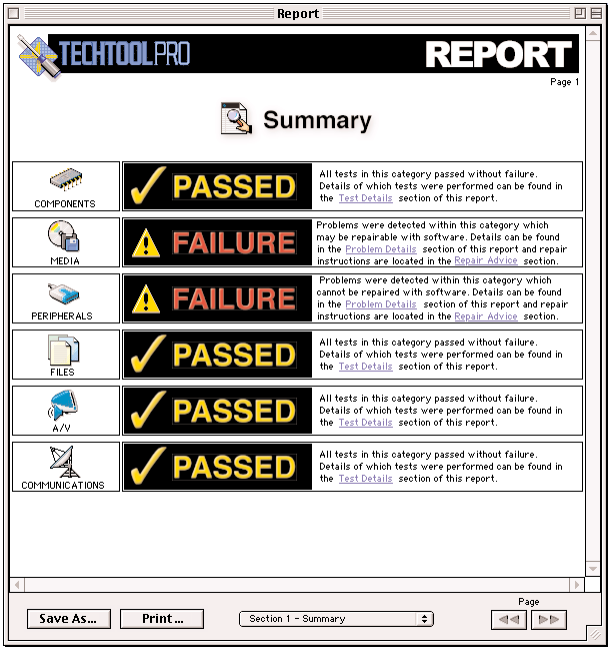
The MultiTester is one of the panels in the Navigation Window. It contains a variety of tests that you can run as a suite on your computer. To see what tests are available in the MultiTester, click on the **Options** disclosure triangle.



Each test may be selected individually by checking its box. The tests may be run on all the attached physical drives or on selected volumes. To run the tests on the selected drives/volumes just click the **BEGIN** button.

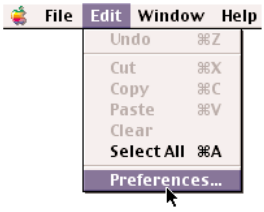
Reports

As tests are performed in *TechTool Pro*, the data for the final report is being generated. Upon completion of the tests this report is displayed. It lists which tests passed and failed, any action taken, and advice on how to proceed if further action is recommended. The report may be saved as a Simple Text document and printed for future reference.



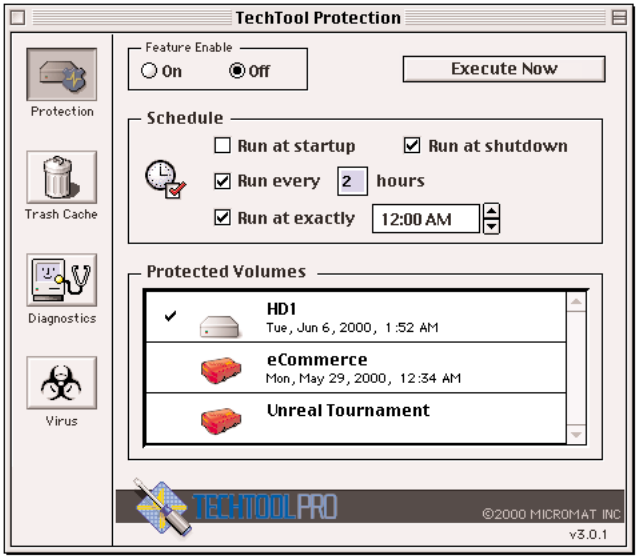
Preferences

TechTool Pro allows you to control and save certain program settings from the *Preferences* dialog. These are set by choosing the **Preferences…** option under the **Edit** menu.

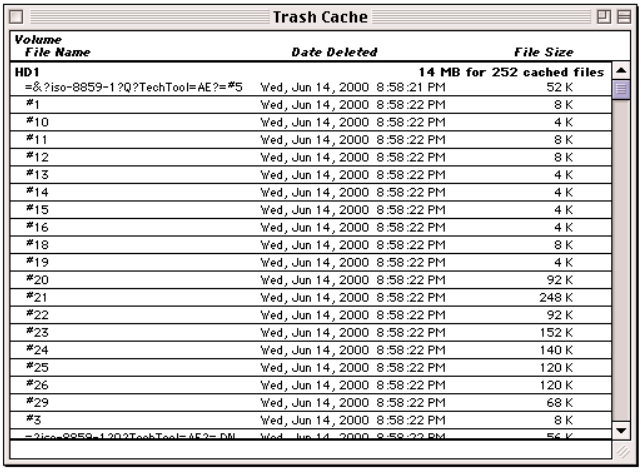


By adjusting preferences you can customize how *TechTool Pro* behaves—from whether it uses sound and speech, to how its window settings and dialogs are displayed.

TechTool Protection Control Panel



When you install *TechTool Pro*, the *TechTool Protection* control panel and the *Protection Extension* are placed in the active *System Folder*. These two items work in tandem to provide extra protection for your system. The TechTool Protection control panel allows you to configure the operation of the Protection Extension, and to change the default settings for it, if you wish. By default, TechTool Protection does a diagnostic scan of your volumes at startup to try to spot any directory corruption before it becomes serious. If problems are found, you will be warned so that you can take further action. In addition, a backup of your volume's directory is made at shutdown. This can often help with data recovery in the case of volume structure problems. TechTool Protection allows you to perform a scan of your drive(s) in order to detect the presence of any known Macintosh viruses. The extension also maintains a Trash Cache that allows you to retrieve deleted files within the currently set limits for the cache (configurable by you).



The Trash Cache is useful not only for “undeleting” items you have purposely trashed, but can often assist in recovering data from documents you were working on during a computer crash.

Troubleshooting Using TechTool Pro

Preventive Maintenance

One of the most valuable functions of *TechTool Pro* is its ability to assist you in finding and repairing problems with your computer before they get out of hand. For maximum protection, it is important that *TechTool Pro* is actually installed on your system. When you install *TechTool Pro* you install extensions which regularly check your volume(s) and backup your directories. In addition, it is a good idea to run the basic suite of tests in MultiTester on a regular basis (for example monthly) to more thoroughly check your system. This will help ensure that your computer is running at its full potential, and minimize the chance of crashes and data loss. It is important to keep valuable data backed up. A hard drive or volume will always fail at some point in time. While *TechTool Pro* should be able to bring your drive back to life, the insurance provided by a backup is important. A little time spent maintaining backups and checking your system regularly, may save you many hours of recovery and repair down the road.

Troubleshooting Hints

Computers are complex electronic devices that can sometimes be daunting to troubleshoot. Their proper operation depends on the reliable functioning of both sophisticated hardware and software. *TechTool Pro* was designed to do as much for you as possible in the event of a computer problem. It also has functions to help you extinguish small problems before they become big problems. But here are a few tips which can help ensure that you are back in business as soon as possible.

Backup Before Repairing

If you are experiencing problems be sure and immediately attempt to backup any important data that hasn't already been saved. Do this before trying to make any repairs. It may be impossible to retrieve your data later if the problems get progressively worse as the computer is used. Also, consider archival backups. This simply means that instead of having one backup, keep several backups made on different dates. That way, if you should discover a file was damaged, and was backed up damaged, you can refer to a prior backup.

Be Prepared

Keep your version of *TechTool Pro* up-to-date. Know where the *TechTool Pro* CD is located in case you need it. If you have updated your copy of *TechTool Pro* over the Internet and don't have the latest version of *TechTool Pro* on CD, then be sure you have copied the updated *TechTool Pro* program folder to another location (such as a removable disk) in case you need to use it. Keep current

backups of your work. Know where to find your *TechTool Pro* serial number, in case you need to call Micromat Tech Support.

Eliminate Easy Problems First

Try starting with extensions off (hold the shift key while booting) and see if that eliminates the problem. Run through all the tests in the MultiTester and opt to repair whatever problems might be found. Check the Desktop files and the PRAM (*TechTool Pro* can do this for you). It's possible one of the above items will help pinpoint or solve the problem.

Simplify/Isolate

Eliminate as many variables as possible. If your problem appears to be with an internal volume, then power down your machine and disconnect all external devices. If it is with an external drive/volume, then connect only that drive to the computer. Startup and run *TechTool Pro* from the *TechTool Pro* CD if possible. This will eliminate the possibility of extension conflicts or system corruption.

Keep Your Software Fresh

Many computer problems are actually software problems. The producers of most software will release regular updates to address incompatibilities and other issues that they discover. Do your best to have current versions of software, extensions, drivers, etc. Staying current may keep problems from developing in the first place, and updating an older piece of software may actually solve a nagging problem.

Make Use of Available Resources

There are many sources of assistance available to help you solve problems. These include local Macintosh Users Groups, specialized newsgroups on the Internet, and websites, listserves, and tech support provided by software and hardware vendors.

Document What You Do

As you try to solve your computer problems, keep notes about what you do and the outcome of these actions. This can be a valuable reference for you later and can be extremely helpful if you need to talk to a tech support representative. Knowing exactly what was done and the results (including any error messages) can make problem solving much easier. In addition, if you continue to have problems at a later time, you may be able to spot a pattern that would otherwise elude you.

Recovering Deleted Files

Deleted files can usually be retrieved if the Trash Cache was active when a file was erased. To recover a deleted file, simply go to the TechTool Protection control panel in the *Control Panels* folder, select Trash Cache, click the Displayed Cached Files button, and drag the deleted files back out onto the desktop. If Trash Cache was not active, the chances of recovery may have been diminished. The Data Recovery panel might be able to recover the file for you.

Repairing Drive Problems

You probably already know the importance of your hard drive. It contains the data that allows the computer to boot, as well as the programs you use and the files you've created. In most cases, this manual will refer to a drive as a "volume." A volume is simply a unit of storage that appears as an icon at the upper right side of your desktop. A CD-ROM is a volume. Your hard drive is a volume. A floppy disk is a volume. A removeable disk is a volume. A mounted drive from another server is a volume. The term "hard drive" and "volume" are almost interchangeable. Though a hard disk can contain more than one volume (multiple partitions), a volume cannot contain more than one hard drive. (This is not entirely true. Some forms of RAID disk setups can make many drives appear as one volume).

When you double-click a volume icon, and view the contents of that volume, you're not seeing the true nature of that volume. Every volume contains many invisible files and data files. This allows the computer to access the data on that particular volume. Items, such as the file catalog or directory, the extents tree and a host of other objects; dictate how data is stored on a particular device (see the Glossary section of this manual for definitions of these terms). These items comprise the "volume structure" of a particular volume. In most cases, when a drive fails and then is repaired with a utility like *TechTool Pro*, it is not the physical drive that is being repaired. It is the software that comprises the volume structure. If there is a problem with the structure of a volume, it can prevent the computer from being able to boot or prevent you from having access to your data. If there is an actual problem with the physical drive, like an electrical or mechanical problem, software will not be able to correct the problem.

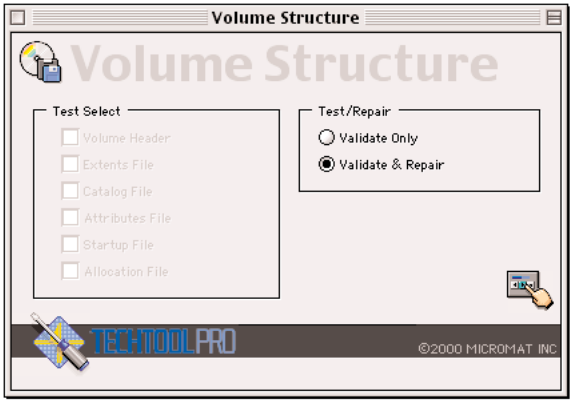
TechTool Pro is unique in that it can check the mechanical and electronic aspects of a drive (Drive panel), as well as repair the volume structures (MulitTester panel and Volume Structure panel).

Repairing Problems

First start by using the MuliTester panel of the program. This will conduct a series of abbreviated tests that can repair most volume problems, if found. Be sure the Volume Structure, Surface Scan and Drives tests are checked. If *TechTool Pro* finds a problem, it will ask you if you wish to repair the problem. If you still have access to your files, you should stop the test at this point. Make a current backup of your important files prior to proceeding with repairs. Then run the tests again and allow the repairs to proceed.

After the program has made repairs, it will create a pseudo-volume (which is a replica of your volume) on the desktop. This allows you to pre-check a repair before committing the changes and making them permanent. The pseudo-volume will behave like a normal volume: you can open files and folders. Once you're satisfied that the proposed repairs are accurate, the Replace button will make the repair permanent and will dismount the pseudo-volume.

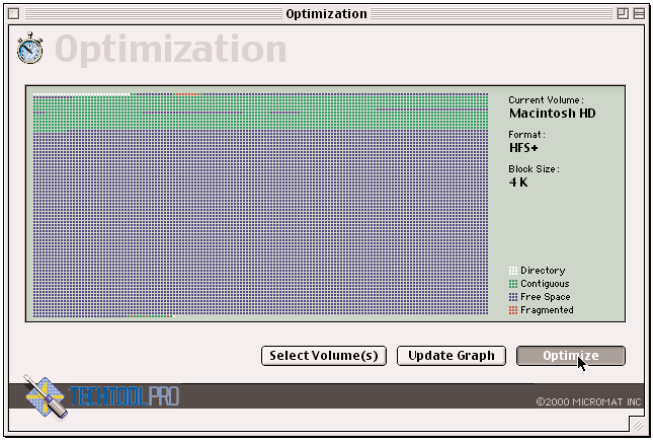
In the unlikely event that the MultiTester routines are unable to repair the volume, open the Volume Structure panel from the Navigation window. Check all of the test options and make sure Validate & Repair is selected. Using the Control Palette, run the tests and allow repairs to proceed.



If the repair is successful, the volume is probably in good shape. If the volume structures cannot be repaired, you should either reinitialize the volume, or reformat the drive and restore your data.

Optimization

In order to gain maximum performance from your hard drive, it is a good idea to defragment/optimize it occasionally. This will rearrange the data on your drive so that the data for each file is on a contiguous area of the drive, and all free space is consolidated into one contiguous area. Optimization is done from the Optimization panel of *TechTool Pro*. Before optimizing, you should validate the volume structures of the volume (and repair if necessary). This can be done either by running the full suite of tests in MulitTester or directly from the Volume Structure panel itself. Once the volume passes the Volume Structure tests, proceed to the Optimization panel, select the volume, and click on the Optimize button.

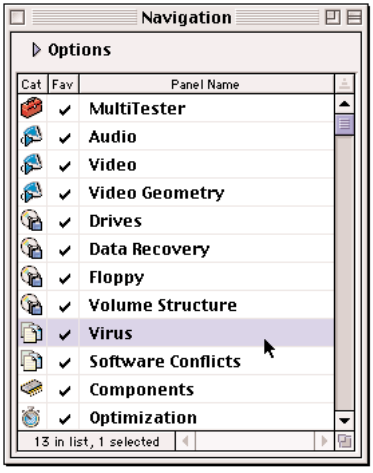


Testing Components

To check the chips on your computer go to the MultiTester panel and select the following tests: RAM, ROM, VRAM, PRAM, Processor, Components, and Cache. Then click **BEGIN**. This will run a test suite on each component and report any problems.

Checking for Viruses

A virus is a small program that can invade your computer and damage your files or volumes. Viruses may cause bizarre computer behavior and can wreak havoc on a system. It is a good idea to check for them regularly, particularly if you get files and programs from sources such as the Internet. To check for viruses, simply use the Virus panel in the *TechTool Pro* application; or use the virus checking portion of the TechTool Protection control panel. If a virus is found, you will be alerted and told what action was taken by *TechTool Pro* and how to proceed.

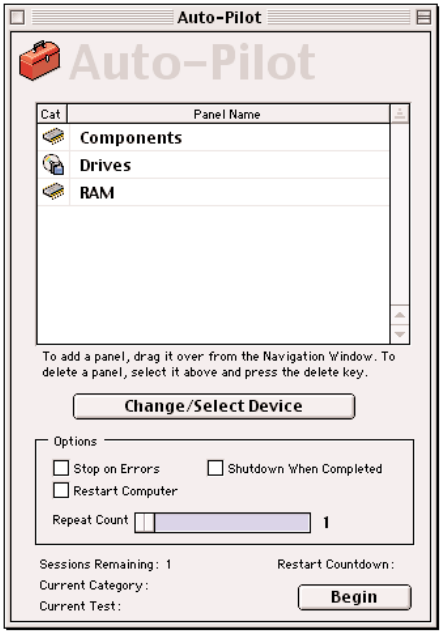


Checking for Software Conflicts

Because all the software on your computer is sharing the same memory when it is operating; it is possible for programs that are running simultaneously to interfere with each other. This can lead to crashes and other problems. Using a frequently updated database of known conflicts, *TechTool Pro* allows you to check for this type of problem. Use the Software Conflicts panel and run all the tests. At the conclusion of the tests, a report will detail any conflicts found and recommend possible solutions.

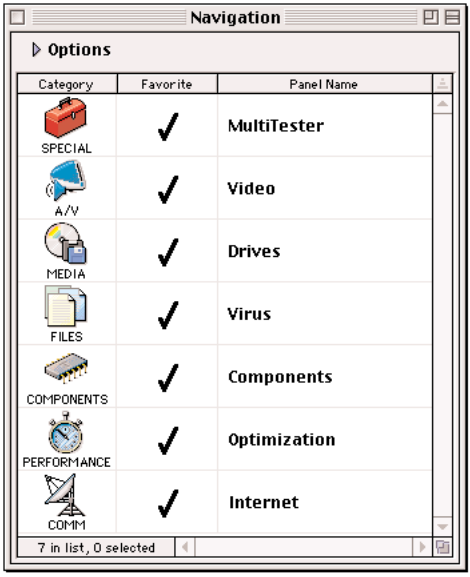
In-Depth Testing

The Auto-Pilot panel allows you to create a custom suite of tests that you may run for long periods of time. This is very useful when attempting to isolate an intermittent problem. Drag the desired tests to the Auto-Pilot panel and configure each test as you wish. Then click **Begin**. Each test will automatically be run in order. You may configure the tests to be run multiple times in order to thoroughly exercise your components. This is particularly useful when you are suspicious of faulty components, like RAM.



Reference

Navigation Window

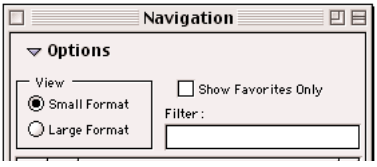


The Navigation window is your “Center of Operations” for *TechTool Pro*. It lists all the test suites and utilities available within the *TechTool Pro* application. To access any of the tests, simply double-click its entry in the list section of the window. The Navigation Window may be configured to make accessing your favorite tests as easy as possible.

Controls & Displays

Options

The *Options* disclosure triangle displays a number of controls that allow you to configure the Navigation window. Click on the **triangle** to display the options.



View

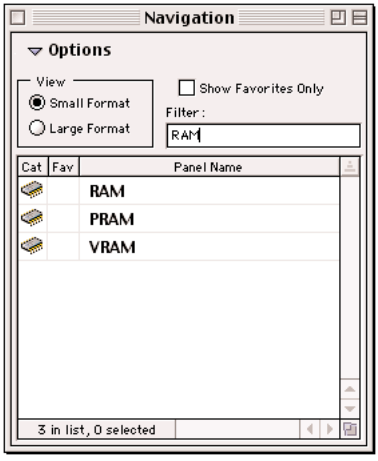
Allows you to display the Navigation icons in small or large format.

Show Favorites Only

When you select this option only your checked test suites will be shown in the list portion of the Navigation window. Favorites are chosen by clicking to place a checkmark in the Favorites column of the Test Display portion of the window.

Filter

The *Filter* text box allows you to view only tests that contain a certain series of characters. As you enter characters into the Filter text box, the Navigation Window will interactively display only those tests that contain the characters you have typed. For instance, if you wanted to see only the test suites that test RAM, typing “RAM” into the filter field would shorten the Navigation test list like this:



Test List

The Test list section of the Navigation panel is divided into three columns: **Cat(egory)**, **Fav(orites)**, and **Panel Name**. If you click in a column heading, the tests will be sorted according to that column. For example, if you click in the **Favorites** heading all your selected favorites will appear at the top of the list sorted alphabetically. The items not chosen as favorites will follow in alphabetical order. Clicking on the **Panel Name** heading will sort the list alphabetically by name, and clicking on the Category heading will sort by tool type. Clicking the "**stacked triangle**" on the right of the headings will reverse the sort order.

Each test or utility belongs to one of the following categories:

Special: Utilities that allow you to work with multiple tests.

A/V: Tools for testing the audio or visual components of your system.

Media: Tools for working with your drives and other media.

Files: Tools for working with (or on) files.

Components: Tools for analyzing the electronic components within your system.

Peripherals: Tools for checking external and third-party peripherals.

Performance: Tools relating to checking and improving the speed and performance of your system.

Communications: Tools for checking computer communications.

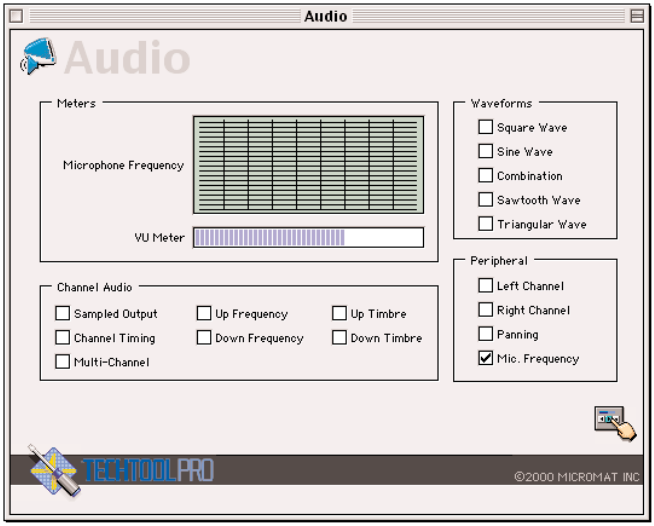
Sorting by category allows you to easily choose all tests that relate to only that category. For example, if you are having problems with a drive, then sorting by category easily allows you to see all the drive tests.

Tests

Double-clicking on a test listing in the Test list window will open the panel for that test suite. This allows you to set the parameters and options for that particular test suite prior to actually running those tests. Most test panels have a Control Palette button on their lower right that will display the Control Palette when clicked.

The following sections provide descriptions of each test suite and utility available from the Navigation Window.

Audio Tests



One of the features of the Macintosh that has always set it apart from, and ahead of, other platforms is its advanced, built-in audio features. Without the need for external devices or cards, any standard Macintosh can perform advanced audio signal processing. In fact, the first computer game to deploy digital audio sound was released only for Macintosh.

TechTool Pro has a multitude of audio tests to help you verify the proper operation of your Macintosh audio circuits. The Audio panel also offers a microphone frequency response test that actually checks the microphone by sending an audio signal out of the speaker while simultaneously sampling the sound back into the computer with the microphone.

Test & Function Descriptions

Square Wave
Utilizes internal synthesizer to generate square wave.

Sine Wave
Utilizes internal synthesizer to generate sine wave.

Combination
Utilizes internal synthesizer to generate combination sine and square wave.

Sawtooth Wave
Utilizes internal synthesizer to generate sawtooth wave.

Triangular Wave
Utilizes internal synthesizer to generate triangular wave.

Sampled Output
Loads sampled digital audio file and plays sound at sample rate.

Channel Timing
Times the number of milliseconds necessary to allocate and deallocate several sound channels.

Multi-Channel
Determines the maximum number of sound channels that can be opened simultaneously.

Up Frequency
Generates square wave while incrementing frequency level.

Down Frequency
Generates square wave while decreasing frequency level.

Up Timbre
Generates sawtooth wave while incrementing frequency level.

Down Timbre
Generates sawtooth wave while decreasing frequency level.

Left Channel
Sends sampled sound out of the left speaker (only noticeable on computers with stereo speakers attached).

Right Channel
Sends sampled sound out of the right speaker (only noticeable on computers with stereo speakers attached).

Panning
Pans sampled sound between left and right speakers (only noticeable on computers with stereo speakers attached).

Mic. Frequency
Samples and displays the microphone frequency.

Controls & Displays

Meters
Displays two meters:

- Microphone Frequency— Displays the frequency levels detected by the microphone during the *Mic. Frequency* test.
- VU Meter— A volume unit meter for audio input. Activated upon opening the panel.

Waveforms
Allows selection of the *Waveform* tests.

Channel Audio
Allows selection of the *Channel Audio* tests.

Peripheral
Allows selection of the peripherals used in the tests.

Control Button
Brings up the Control Palette.

Usage Notes
Like the Video Geometry tests, all Audio tests (except for Open Channel and Multi-Channel) are non-qualified tests. This means that there are no pass/fail marks. It is up to the user to determine whether the computer produced acceptable results.

All stereo tests (Left Channel, Right Channel and Panning) require the computer to be attached to stereo speakers to achieve the desired effect. Without separate speakers, the output of these tests will be monophonic.

Older Macintosh computers will not be able to utilize the microphone frequency response test if they do not support simultaneous audio in and out. Before executing the microphone frequency response test, you should position the microphone close to one of the Macintosh speakers and be sure the volume is turned up slightly above normal listening level. When the test is executing, *TechTool Pro* will emit various frequencies from the speaker as the sound is input to the microphone. The frequency display will create a graph bar for each frequency emitted.

Like the other audio tests, the microphone frequency response test is not meant to return a pass or fail result. Its purpose is to display the frequencies that the microphone is capable of detecting. Bear in mind that this is not a fair assessment of the microphone, since the quality of the speakers attached to the Macintosh will have a great bearing on the output of the frequencies.

Common Questions

Q: Why can't I select certain tests in the Audio panel?

A: Some Macintosh models do not have the audio capabilities that *TechTool Pro* inspects. In those cases, *TechTool Pro* will gray out those tests.

Q: Why don't I receive a pass or fail screen after running tests in the Audio Panel?

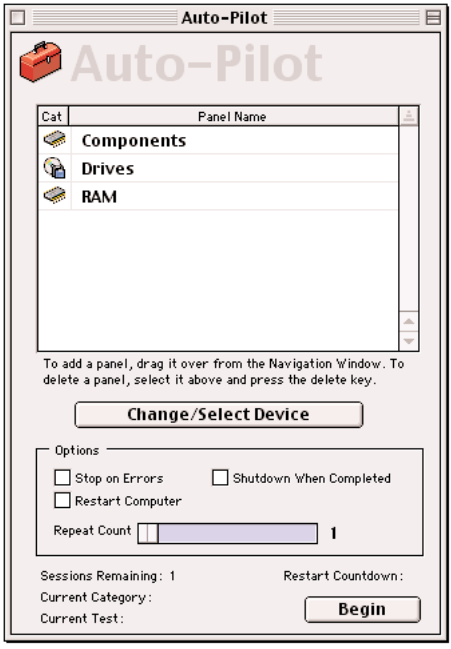
A: The Audio test in *TechTool Pro* is an interactive, subjective test. In other words, it is up to the user to determine whether the tests passed or failed.

Q: Why doesn't the VU Meter register any activity?

A: You may not have a sound input device installed or selected in the Sound control panel.

Auto-Pilot

TechTool Pro makes it easy to run several tests manually, but sometimes the conventional method of running a test, changing panels, running a test, etc. can be too time consuming. *TechTool Pro* allows you to automate a test session by using the Auto-Pilot Panel and by creating Test Suites.



To run a group of tests automatically, just drag the desired test panels from the Navigation window to the Auto-Pilot Panel. You can execute all the tests in the list by simply pressing the **Begin** button. This allows you to run your test session with little, if any, interaction with the program. If you would like to perform repetitive testing, the **Repeat Count** option allows you to select from 1 to 1000 test sessions to be run consecutively. Each time *TechTool Pro* completes a test session, the selected tests will be repeated until the number of sessions selected has been reached.

Controls & Displays

Test List
Displays the Category and Name of each test to be executed by Auto-Pilot. To add a test to Auto-Pilot simply drag it into the Test List from the Navigation window. To remove a test from the Test List, select the test and press the **delete** key.

Change/Select Device
Allows you to select which volume or device a particular panel will test.

Options
- Stop on Errors—This option causes *TechTool Pro* to halt any Auto-Pilot session if a failure is detected.
- Restart Computer—This option configures Auto-Pilot to reboot the system after each test session.
- Shutdown When Completed—This option instructs Auto-Pilot to shutdown the computer after all test sessions have been executed.
- Repeat Count—This slider lets you select the number of times the tests will automatically be performed.

Sessions Remaining Field
This field displays the number of Auto-Pilot sessions remaining to be executed.

Restart Countdown
This field displays a ten-second countdown that occurs before the computer is about to be restarted. The countdown enables you to terminate an Auto-Pilot session (by clicking the **STOP** button) before the system restarts. This field will only be activated if Auto-Pilot is configured for Auto-Boot.

Begin/Stop Button
This button starts or terminates an Auto-Pilot session.

Test Suites

TechTool Pro allows you to save Auto-Pilot settings for future use. For example, if you have situations where you only wish to run certain selections in the RAM and Mathematics panels, you could create a suite that would represent those settings. The next time you wish to run that particular configuration, you would simply LOAD the test suite you had previously created. Here are the steps for creating and later using a test suite:

- Launch *TechTool Pro*.
- Configure Auto-Pilot to use the desired tests.
- Select **Save...** from the **File** menu.
- Give the file a unique name.

If you wish to load a test suite you have created:

- Launch *TechTool Pro*.
- Select **Open...** from the **File** menu.
- Navigate to your saved test suite file.
- Double-click the file name or select **OPEN**.
- Auto-Pilot will configure itself according to the settings of the test suite.

A handy feature of the test suite option is that you can invoke Auto-Pilot just by naming your test suite file so that its name begins with “Auto-Pilot.” Following is an example:

- Configure Auto-Pilot as desired.
- Select **Save...** from the **File** menu.
- Name the test suite “Auto-Pilot My Suite”
- Quit *TechTool Pro*.
- Double-click the **Auto-Pilot My Suite** test suite file.

TechTool Pro will automatically launch and begin an Auto-Pilot session based on the tests you configured when you saved the suite.

Common Questions

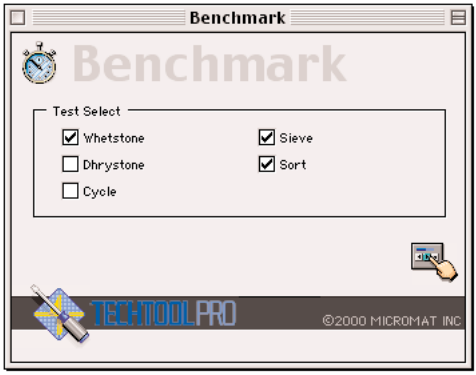
Q: Why can't I drag the Video Geometry test over to Auto-Pilot?

A: Auto-Pilot cannot simulate interactive tests requiring user feedback. Since Auto-Pilot cannot perform these tests, they are rejected by the test field.

Q: If I change settings for a test suite in the Navigation window, will it affect my settings in the Auto-Pilot panel?

A: No. The preferences for Auto-Pilot tests are separate from those for the Navigation Window.

Benchmark Tests



Computer users are often concerned about how fast their systems operate. The never-ending quest for better performance has created a significant industry of acceleration devices for computers. The question is, how do you tell if your computer is really running any faster after it's been upgraded? The answer is benchmark tests. These are tests designed for the sole purpose of determining computational speeds and rendering the results in a numeric format for comparison. For a computer manufacturer to simply say, "Our computers are faster than our competitor's" is not enough. People need hard evidence to believe such a claim; and the proof is in the numbers.

TechTool Pro provides several popular benchmark tests that will help you compare your computer's performance to that of other computers or against itself for upgrade testing.

Test & Function Descriptions

Whetstone
Tests mathematical processing speed using floating-point integer calculations. Results are displayed in whetstones per second. Larger numbers are better.

Dhrystone
Tests speed of string operations. Results are displayed in Dhrystones per second. Larger numbers are better.

Cycle
Calculates the number of event loops processed per second. Larger numbers are better. NOTE: System extensions will affect cycles per second.

Sieve
Tests mathematical processing speed calculating prime numbers. Results reflect sieve executions per second. Larger numbers are better.

Sort
Calculates the time necessary to sort a complex array. Results reflect amount of time necessary to complete test. Smaller numbers are better.

Controls & Displays

Test Select
Allows you to choose the Benchmark test you wish to run.

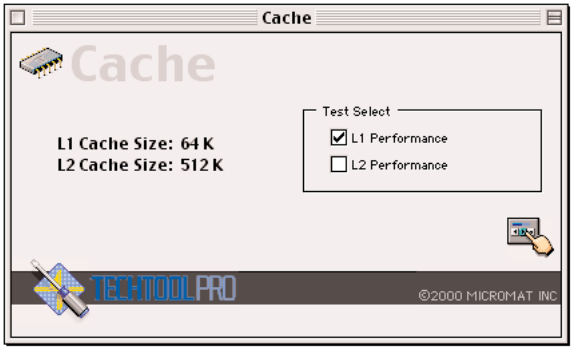
Control Button
Brings up the Control Palette.

Common Questions

Q: Why does the cycle rate differ so greatly with extensions on as opposed to extensions off?

A: System extensions add hooks to the System's event loop. Most extensions intercept the event loop looking for messages that they were intended to trap. For instance, a macro program intercepts an event related to keystrokes which could be an instruction to invoke a macro. As you add more extensions to your system, the cycle rate of the machine decreases meaning the computer is operating more slowly than it would with less or no extensions.

Cache Tests



Macintosh computers that have a PowerPC processor have an instruction cache built into the CPU called Level 1 cache. This cache speeds up processing speed by storing frequently used instructions. A good analogy to this would be writing down frequently used phone numbers on Post-It notes and keeping them on your wall for quick reference instead of having to look them up in the telephone book every time they are needed.

The next step above Level 1 cache is Level 2 cache. This is generally an optional card that is attached to the Macintosh logic board or integrated into the machine's logic board. Some third party upgrade cards also come with L2 cache. Just as the L1 cache holds frequently used CPU instructions, the L2 cache is a repository for frequently used blocks of memory.

TechTool Pro will show you how much L1 and L2 cache your system has available and will verify that it is working properly.

Test & Function Descriptions

L1 Performance

This test checks the amount of L1 cache contained in the computer and will verify that it is operational.

L2 Performance

This test checks the amount of L2 cache contained in the computer and will verify that it is operational.

Controls & Displays

Cache Size Fields
Displays the amount of memory in the L1 and L2 cache.

Test Select
Allows you to select which verification test will be performed.

Control Button
Brings up the Control Palette.

Common Questions

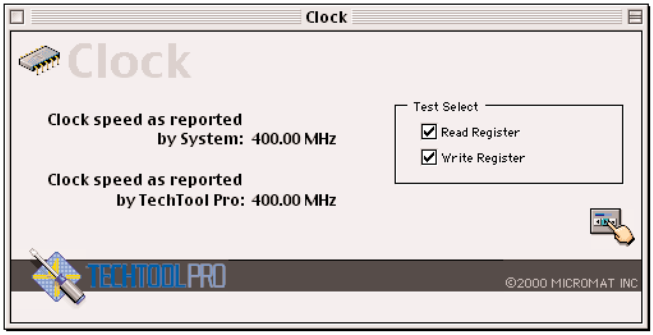
Q: Why does my ancient 68K Macintosh fail the L2 cache? I know that it did not come with L2 cache. So why is it failing?

A: Apple did not create any mechanism to detect the presence of L2 cache. So the L2 cache is inherently "blind" (if L2 is there and is damaged, the test fails and if L2 is not there the test still fails). We've worked closely with Apple on this problem and there is currently no way around this. Future versions of the system may allow us to do this.

Q: I have a third party processor upgrade card installed in my machine that includes its own L2 cache. TechTool Pro does not recognize it and either reports the L2 cache installed on the motherboard or does not report it at all. Why?

A: In some cases, third party upgrade cards are accompanied by software to make the upgrade visible to the system. Generally, *TechTool Pro* will see the correct L2 cache size and test it correctly. However, if this software is not active (possibly because extensions are off or you booted from the *TechTool Pro* CD) this information may not appear correctly. In that case *TechTool Pro* may test the L2 cache installed on the logic board instead.

Clock Tests



The term “clock speed,” when used in computer jargon, refers to a measure of performance, much like the automobile industry refers to the power of an engine in terms of “horse power.” Computer users can improve their computer performance by finding ways to increase their clock speed. This can be accomplished by either buying a new machine or upgrading the existing computer with an accelerator or faster clock chip.

The Macintosh clock provides base timing signals to the CPU. This dictates how many instructions per second the CPU can process. Sometimes comprised of a crystal unit and clock circuit, the computer’s clock determines the “heart beat” of the computer. The faster the rate, the faster the computer runs. The clock rate is measured in megahertz (MHz). One megahertz represents 1,000,000 pulses per second. The original 1984 Macintosh ran at a whopping 8MHz or 8,000,000 pulses per second (don’t confuse this with IPS – instructions per second). A Macintosh G4 might run at 500MHz or 500,000,000 pulses per second – quite a difference.

While clock speed has become the industry benchmark for comparing computer speeds, it is not the absolute speed indicator that represents computer performance. For instance, an old Macintosh G3 modified to run at 500Mhz may seem like it would perform better than a Power Macintosh G4 running at 450MHz, but that is not the case. The improved processor, newer bus architecture, and accelerated I/O of the G4 will boost performance above what can be achieved from older-generation systems.

TechTool Pro will help you verify your clock speed and test the circuit that comprises your Macintosh clock. While this is helpful in diagnosing an ailing machine, you will also find it useful for testing upgrades to verify that advertised gains in clock speed are being realized.

Test & Function Descriptions

Read Register
This test checks the clock circuitry output by requesting several thousand read commands and verifying the contents.

Write Register
The Write test checks the clock circuitry input by sending several thousand write commands and verifying that the contents of the clock registers contain what was sent by the program.

Controls & Displays

Test Select
Allows you to choose one or both of the clock tests.

Clock Speed as reported by System
This field displays the clock speed as determined by the MacOS during boot.

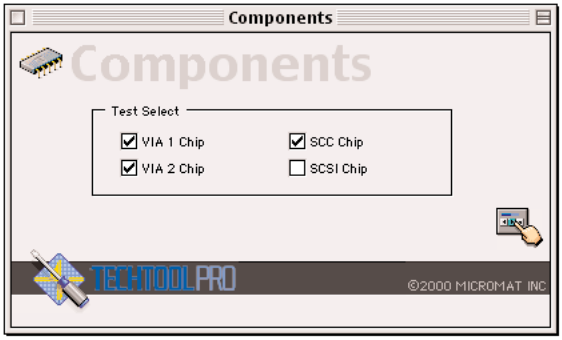
Clock Speed as reported by TechTool Pro
This field displays the results of a timing algorithm that calculates the approximate clock speed.

Control Button
Brings up the Control Palette.

Common Questions
Q: My computer is supposed to have a clock speed of 150MHz. Why does TechTool Pro report that my clock speed is 147MHz?

A: There are a couple of reasons why this could be happening. *TechTool Pro* employs a complex algorithm to estimate the clock rate of your machine. While this is accurate in most cases, there are situations where other software or hardware elements of your system might affect the outcome of *TechTool Pro's* calculation. In particular, interference by extensions and networking can cause the test to report a low result. To get a more accurate report, try running the test again with all extensions disabled and network services, such as AppleTalk and file sharing, turned off.

Components Test



The original Macintosh Plus (1986) contained four integrated circuits on the logic board that were very important to the operation of the computer. They were the VIA1, VIA2, SCC and SCSI chips. Shortly after the release of the first PowerPC Macs, Apple began implementing the functionality of these chips into newer, hybrid chips. These not only emulated the functions of the original chips (for backward compatibility), but also added additional functionality to support the evolution of the platform.

Your computer may have few, if any, of the tested components. However, these tests will still check the functionality of the new chips that now implement the functions of the original chips. A description of those chips and their functions is listed below for historical reference.

The VIA1 and VIA2 Chips

The 6522 VIA or Versatile Interface Adapter is an integrated circuit that was originally developed by Rockwell International as a generic computer interface circuit. It handled all of the Macintosh user input, such as from the mouse and keyboard, as well as helps in the operation of the floppy drives. Some computers have a second VIA which would handle timing and other functions for NuBus slot devices like video cards and modems. This chip was phased out with the introduction of the PCI format expansion slot.

The SCC Chip

The 5380 SCC or Serial Communication Controller is an integrated circuit that was originally developed by Zilog Incorporated for processing computer serial communications. It is the primary circuit model used in the operation of the serial ports that allows the use of modems, printers, and other input/output devices.

The SCSI Chip

The 8530 SCSI integrated circuit was originally designed by AMD to provide an easy interface to the ANSI standard of the SCSI parallel communication protocol. This chip provides the pathway interface for both internal and external SCSI. While the SCSI format is now a thing of the past, many users add cards to their systems that give them a SCSI port. This allows them to use older devices on newer generation systems.

Any problems with the above chips (or their hybrid counterparts), can make your computer unreliable or completely inoperable. A faulty VIA can cause numerous problems on the Macintosh including inconsistent cursor movement or complete failure of the mouse and keyboard. It can also cause unpredictable and untraceable freezes or system crashes. In the very worst case, it can prevent the Macintosh from booting. Indications of a damaged or faulty SCC are poor serial communications, no serial communications, or possible problems with the floppy drive (if the system has one). Signs of a faulty or inoperable SCSI chip are poor SCSI read/writes, repetitive SCSI read/writes, or the complete inability to communicate with SCSI devices. This chip is often damaged when a faulty cable or device is plugged into the bus. *TechTool Pro* checks all four of these components or their hybrid counterparts.

Test Descriptions

The component tests are designated by the four component names they encompass: VIA1, VIA2 (if installed), SCC and SCSI (if installed). The tests are comprised of assembler routines that test the individual registers of each chip at the lowest level available. By setting and checking each register, *TechTool Pro* is able to verify the proper operation of each component.

Controls & Displays

Test Select

This is a group of check boxes that signify each component test available.

Control Button

Brings up the Control Palette.

Common Questions

Q: Why can't I select the VIA2 test?

A: Your computer does not have this particular component. Many models did not employ this processor.

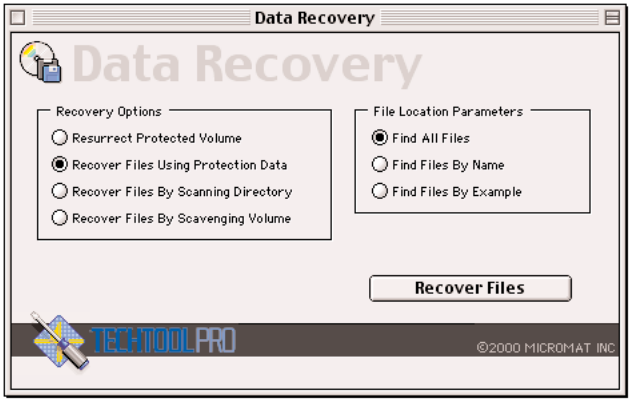
Q: Why can't I select the SCC test?

A: It is possible that your system may not have this chip or its equivalent hybrid. It is also possible that there is software that is interfering with *TechTool Pro's* ability to control and test the SCC chip. Some programs, such as fax and network software, will often take over complete control of the chip and not allow low level operations from outside programs. *TechTool Pro* checks for this condition and will prevent the operation of the SCC test if it will possibly interfere with the operation of your computer. Try restarting with extensions and AppleTalk disabled.

Q: Why can't I select the SCSI test?

A: Your computer probably does not have this particular component. Older Macs came with built in SCSI, but newer Macs do not contain SCSI unless you add a third party SCSI card.

Data Recovery



The *Data Recovery* panel can be used to resurrect damaged volumes, recover lost data from a crashed drive, and retrieve files that were erased by accident. This panel is usually used when the drive is completely inaccessible and attempts to repair the volume using the Volume Structures routines did not succeed.

If you can still access the drive and all or some of your data, consider backing up before proceeding, especially if you'll be using the Resurrect feature. If the data cannot be copied normally, then you can use Data Recovery to try to rescue your data.

When using Data Recovery it is important to recover files to a second volume to lessen the chance of overwriting other critical data on the original volume.

Some of the options of the Data Recovery panel work in unison with the data saved by the TechTool Protection control panel. It stores important file location data, allowing *TechTool Pro* to easily find files and, in most cases, quickly restore a lost volume to its earlier state. If the *TechTool Pro* extension and control panel were not installed, a volume recovery will be more complicated. Without the vital data that TechTool Protection saves, you will need to recover the files to another drive/volume, reinitialize the damaged volume, and then copy the recovered files back to the original volume. The *TechTool Pro* installer automatically installs and activates the control panel and extension. If you have removed or disabled these important components, you should seriously consider reinstalling or reactivating them to help guard against a potential future catastrophe. If you have multiple volumes on your system, be sure that

TechTool Protection is set to protect ALL of your volumes. The default is to simply protect your system volume.

In the event that the TechTool Protection File is not available or the damage to the volume is too serious, you should still be able to recover most, if not all, of your data. The Data Recovery panel offers options and features that make recovering your data very easy.

Controls & Displays: Recovery Options

Resurrect Protected Volume – This allows *TechTool Pro* to attempt a full volume recovery provided that a valid Protection File was created for the volume by the TechTool Protection control panel. Be aware that *TechTool Pro* will replace the current directory of the volume with the previously saved Protection copy of your directory. Any changes made after the Protection File was updated may be lost. You can tell that *TechTool Pro* recognizes a Protection File if the information about your drive in the volume window says *Protected: <date>*. The <date> indicates when the Protection File was made.

TechTool Pro will search all local volumes for the TechTool Protection File that is relevant to the target volume. If such files are found, *TechTool Pro* will select the most current Protection File. When you instruct *TechTool Pro* to resurrect the volume, that Protection File will be used in the attempt to restore the volume to its original state. If no serious structural or mechanical problems prevent a recovery, your lost volume will appear in the Finder with most, if not all, of your files intact.

Recover Files Using Protection Data – This option allows you to access an available Protection File to recover a file or to undelete a file that was accidentally deleted. This is especially useful for files that were deleted but not saved using TechTool Protection's Trash Cache feature. As long as the Protection File for the volume has not been updated by the TechTool Protection control panel since you deleted the file youhave a good chance of retrieving it. Remember, *TechTool Pro* extensions must have been installed and active in order to have a valid Protection File for the volume. If you are unable to recover the file(s) using this option, consider utilizing the "Recover Files By Scanning Directory" or "Recover Files By Scavenging Volume" options.

Recover Files By Scanning Directory – Selecting this option will search for files using available directory structure information existing on the volume/drive. This routine is faster than using "Recover Files By Scavenging Volume."

Recover Files By Scavenging Volume – Selecting this option will search the entire volume for valid files. This option is useful if you have not installed *TechTool Pro* on this volume, if TechTool Protection did not create a Protection File for this volume, or if the Protection File cannot be found. Since scavenging must

examine every sector of a drive, it may take a long time to build the recovery list, especially on large volumes. However it may be worth the wait if it can save you the frustration of losing a file that may have been accidentally deleted.

Controls & Displays: File Location Parameters

There are three Find File methods. If one of them does not find your files you should consider trying the others; they each use different techniques to scan your drive or volume. The following methods work in concert with the above recovery options for narrowing your search in the Data Recovery panel:

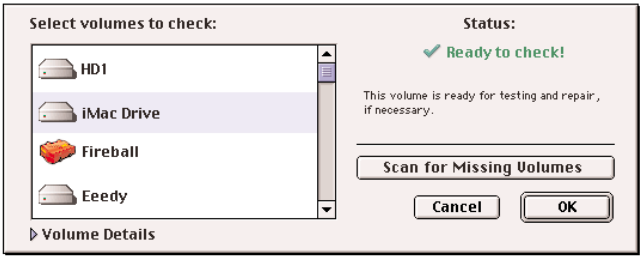
Find All Files – This option will scan the entire target volume for files that can recovered. Once *TechTool Pro* has scanned the volume, it will present a list of all files found.

Find Files By Name – This option allows you to search for a specific file based on the name of the file. After choosing the volume to search, you will be prompted to enter a name or a name segment to be used in the search. Once *TechTool Pro* has scanned the volume, it will present a list of files that match the search criteria you have specified.

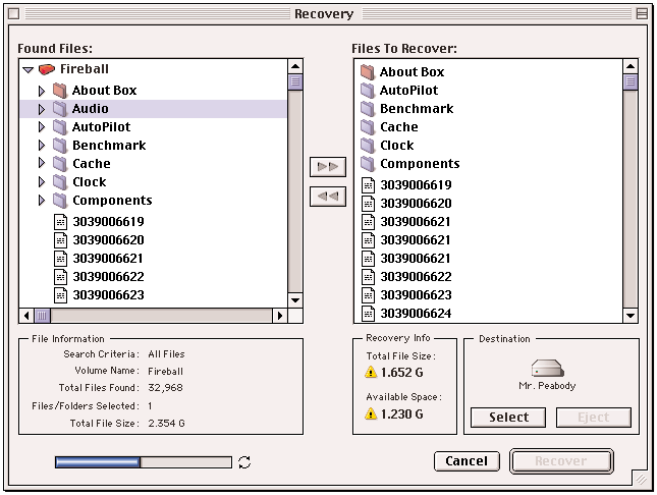
Find Files By Example – This option allows you to search for files based on their unique type and creator codes. Every Macintosh file has a type and creator code that uniquely identifies the type of document and the application with which it is associated. After choosing the volume you wish to search you will be prompted to select an example file of the type you wish to use in the search. For example, if you were searching for a lost Microsoft Excel file, you could "show" *TechTool Pro* what kind of file you were seeking (by navigating to an Excel document on another volume). Once *TechTool Pro* has scanned the volume it will present a list of the files it found that have the chosen type and creator codes.

Recover Files

This button brings up the standard Volume Selection dialog.



Choose the volume you wish to search. Then click **OK**. *TechTool Pro* will display the **Recovery Window.**



The window is divided into two sections. The left half relates to the files that were found and the right side refers to the files you wish to be recovered. Following are the main components of the window:

Found Files: – This list on the left of the *Recovery Window* will display files that match your search criteria. You can use the disclosure triangle beside a folder to open it and display its contents.

File Information – Located below the *Found Files:* list, this information box contains details about the volume and the search results.

Progress Bar – As the volume is searched, a progress bar is displayed below the *File Information* box. This is only active during the recovery process.

Files to Recover: – This list on the right of the *Recovery Window* contains the files you have selected for recovery.

Recovery Information – Located below the *Files to Recover:* list, this information box displays the total disk space required to hold the files in the list. It also displays the total disk space available on the selected recovery volume. A green check beside the items indicates that enough space is available for recovery to occur. A warning symbol means the destination does not have enough space to hold the selected files.

Destination – To the right of the *Recovery Information* box is the *Destination* information and selection box. It displays the selected destination volume (or indicates if one is not yet selected). Clicking the **Select** button in the box will display the standard *Volume Selection* dialog. This allows you to select a destination on which to save the selected files. Do not save them back onto the original volume. This may overwrite data that is not yet recovered. You may use the **Eject** button to eject the currently selected volume (if it is removable) and insert another. The Eject button will be grayed out for non–removable volumes.

Double–clicking a file or folder in either the **Found Files:** or **Files to Recover:** list will move it from one list to the other. Selecting a file or folder in either window by clicking on it once and then choosing the appropriate double-arrow will also transfer it to the opposite list as above.

You may use command-A to select all files, or shift-click or command-click to select multiple items in either list. Once you have transferred the files you wish to recover to the **Files to Recover:** list and have chosen a destination volume, simply click the **Recover** button to recover the files from the original volume to the chosen destination. Note that the Recover button will be grayed out if there is not enough space on the destination volume.

Common Questions

Q: My hard drive and Zip drive are grayed out and I cannot select them for Resurrect Protected Volume. Why?

A: In order to recover data from a volume, it is sometimes necessary to dismount the volume from the desktop. This means that the volume is no longer available for use by the System. There are three conditions that will prevent *TechTool Pro* from allowing you to operate with a volume:

The volume contains the active system.
Since the computer needs constant access to the System files, a System volume cannot be dismounted for the Resurrect Protected Volume option. You will need to boot from another volume or from the *TechTool Pro* CD-ROM, which has a bootable System file.

The volume contains the active TechTool Pro application.
TechTool Pro will not allow you to perform the Resurrect Protected Volume operation on the volume where *TechTool Pro* is residing and running. You will need to run *TechTool Pro* from another volume such as the *TechTool Pro* CD-ROM.

The drive has no media.
Removable drives, such as Zip and DVD-RAM, will not be a selectable option if they presently do not contain a disk cartridge. Insert the cartridge you wish to work on and then click the **Scan for Missing Volumes** button in the standard Volume Selection dialog to update the volume list in the Data Recovery panel.

Q: Can I recover files to a network volume?

A: Yes, the *TechTool Pro* CD contains the necessary networking extension to mount a remote shared volume over an AppleTalk network. Remember, though, that copying files over the network is usually slower than copying them to a local volume.

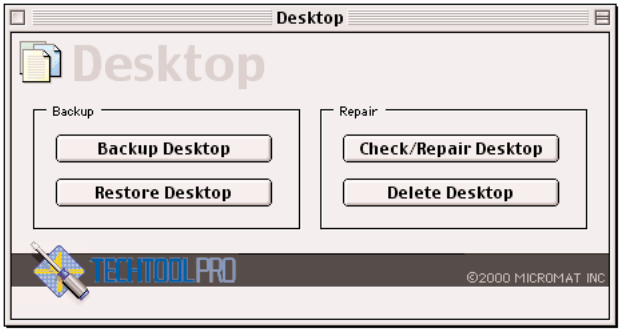
Step-By-Step Recovery Over a Network:

- Boot the computer that has the volume needing recovery from the *TechTool Pro* CD.
- At the Desktop go to the Apple Menu and select *Chooser*.
- In the Chooser select the network computer to which you wish to recover files.
- Enter the User ID and Password (if applicable) for the network volume selected. The volume should appear on the Desktop.
- Launch *TechTool Pro* from the *TechTool Pro* CD.
- Choose the Data Recovery panel from the Navigation Window.
- Select the recovery options you wish to use.
- Choose the **List Files** button.
- Use the standard Volume Selection dialog to choose the volume from which you wish to recover files and click **OK.**
- *TechTool Pro* will now search for files matching your search criteria and display the results in the **Recovery** window.
- Transfer the files you wish to recover from the *Found Files:* list to the *Files to be Recovered:* list.
- Click the **Select** button and choose the network volume you previously mounted.
- Click the **Recover** button—the selected files will be saved to the network volume. If the Recover button cannot be selected then there may not be enough room to hold the selected files.

Q: How can I select multiple files or folder within the Data Recovery window?

A: Hold down the **Command** key as you click on files or folders that you wish to recover.

Desktop Test



The Desktop Database is comprised of one or more invisible files that reside on Finder-mountable volumes. It contains file-to-parent application information and other attributes related to individual files. Data stored in the Desktop includes file and application icons, type and creator codes, file comments, and semi-critical directory information. The Desktop Database records are updated on an individual basis each time a new application is introduced (copied or mounted) to a given system. The Finder scans the new application for a BNDL resource, which provides the Desktop Database with icon and file type information for the application and its respective document icons. Once the Desktop has been updated for the new application, that application no longer needs to remain present on the system for its document icons to be correctly displayed at the Finder.

The Desktop Database, formerly the Desktop *File,* has been problematic since the first Macs were released in 1984. A problem that plagues the Desktop is bad data, often referred to as corruption. During normal use, the Desktop will be updated often by the System, Finder, or other applications. In the event that these updates are interrupted for any reason, because of a crash or an extension conflict, the data stored could be written incorrectly. In most cases the bad data may not affect anything important or be immediately noticeable, but it is possible for vital file segments to become damaged, rendering the machine completely useless or prone to crashes and freezes.

Rebuilding the Desktop is often necessary when documents fail to launch after double-clicking them, or when custom icons are unexpectedly replaced with generic document or application icons. Traditionally, holding the Option and Command keys before the Finder loads will force the invisible Desktop Databases to be rebuilt. This is sometimes ineffective because if the original Desktop Databases were damaged, then rebuilding them only yields updated Desktop Databases that may still be damaged.

TechTool Pro provides better solutions to rebuilding the Desktop. First, it provides a check/repair routine that can repair almost any Desktop related problem. Also, it can actually delete the original Desktop Database files. The Finder is the watchdog of the Desktop Databases. If the Finder loads and notices that a volume does not have Desktop files, it will begin the process of creating a new Desktop Database. *TechTool Pro* also allows you to save and restore Desktop Database files, in case something goes wrong with the rebuild.

Test & Function Descriptions

Backup Desktop

Allows the user to optionally save the Desktop Database files so that they can be used by the Restore Desktop option later, if needed. These Desktop files are saved to a folder with the same name as the volume inside the folder that holds the *TechTool Pro* application.

Restore Desktop

Allows the user to restore a Desktop Database previously saved with the Backup Desktop button. You would not normally need to use Restore Desktop. It is only included as an option so that you may return the Desktop to its previous state if needed.

Check/Repair Desktop

This test checks the file integrity of the Desktop Database and scans your volume's applications to make sure that there is a valid entry for each application's icon set (BNDL). This test should repair any difficulty you might be having with generic icons, provided that the parent application is resident.

If the *Check/Repair Desktop* finds an application that does not have a valid entry in the Desktop Database, *TechTool Pro* will create an entry. To make an entry, *TechTool Pro* must force all other applications to quit, including the Finder. If you know you'll be running the *Check/Repair Desktop* function, you may want to quit all other applications before launching *TechTool Pro*.

When you manually execute the *Check/Repair Desktop*, *TechTool Pro* will prompt you to select the volume(s) containing the Desktop Database you wish to examine.

Delete Desktop
Deletes the Desktop Databases. The next time the Finder is launched, it will create a new Desktop.

Controls & Displays

Backup
Allows you to backup or restore the Desktop Database files.

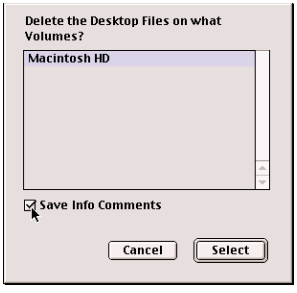
Repair
Allows you to check/repair or delete the Desktop.

Usage Notes

Backing up the Desktop:
Some users may find it desirable to save their Desktop Database prior to check/repair or deleting it for rebuild. This is not necessary, but provides a method to undo any potential side effects by using the **Restore Desktop** button. If you wish to save a copy of the Desktop Databases, be sure to do so ***BEFORE*** clicking the **Delete Desktop** button. The delete routine will not remind you or prompt you to save. If booted from a locked volume or CD-ROM the Desktop Databases and Finder Info comments cannot be saved.

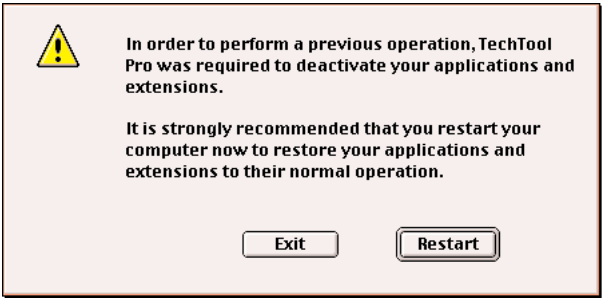
Deleting the Desktop Database:
When you click the **Delete Desktop** button, all applications running (except *TechTool Pro*) will be forced to quit (including the Finder). This is to avoid potential wrestling over command of the Desktop Database files. It is recommended that **Delete Desktop** be performed when booting and running from your normal startup volume.

You will then be prompted to select the volume(s) from which you wish to delete the Desktop Databases. If you want to keep comments you have made in the Finder's *Get Info* window, be sure to check the *Save Info Comments* box.

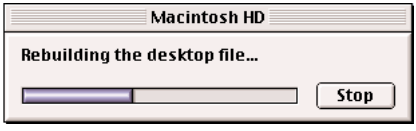


Remember that there is at least one Desktop Database to be deleted for each volume on your system, excluding write-protected media like CD-ROMs. To do a thorough job we suggest you delete the Desktop Database files from all available volumes.

The deletion takes only a few seconds. When finished, you'll receive confirmation:



TechTool Pro will prompt you to restart the computer after it deletes the Desktop Database files. It's up to the Finder to then create the new Desktop Databases and to rebuild them. When you see the following progress box after the restart, you'll know the new Desktops files are being created:



Don't interrupt the process! Nothing terrible will happen if you do; however, you'll end up with a bunch of generic document icons and will have to start again. Depending on the number of files and size of your volumes, this could take a long time.

Restoring the Desktop Database:

If for some reason you wish to restore the previous Desktop Databases, follow these steps:

- Click the **Restore Desktop** button.
- You will be presented with two dialog boxes explaining what will occur.
- You will then be prompted to choose a volume from the standard volume selection dialog. Select the volume you wish to restore.
- Click the **Restore** button to start the routine.

- Click **Restart** when prompted.

Potential Side Effects

- Documents that have lost their parent applications will become generic document icons.
- Comments will be lost unless the *Save Info Comments* box is checked.
- The Finder may repeatedly rebuild the Desktop Databases with each successive restart. This constant rebuild problem is an odd bug that can sometimes occur with the Apple extension Macintosh Easy Open. The same thing will apparently happen if you rebuild the regular way. Should this occur, try this:
- Disable Macintosh Easy Open.
- Delete the Desktop Databases again with *TechTool Pro*.
- Enable Macintosh Easy Open.
- Let the Finder complete the rebuild.

Common Questions

Q: I keep a lot of files and folders on my Desktop. Will I lose these by deleting the Desktop?

A: No. The Desktop that you see at the Finder, the open area where the trash can and your drive icons live, is in no way related to the invisible Desktop Database which *TechTool Pro* deletes. This correlation between names confuses many people. Apple should name the Desktop Databases something else.

Q: "Deleting the desktop" sounds so drastic. What if something goes wrong with deleting the Desktop? Will I lose everything on my hard drive?

A: Definitely not. Think of the Desktop Database files as preference files. When you delete an application's preference file, a new one is created the next time the application is launched. In this case, the Finder will just create new Desktop Database files the next time it is launched.

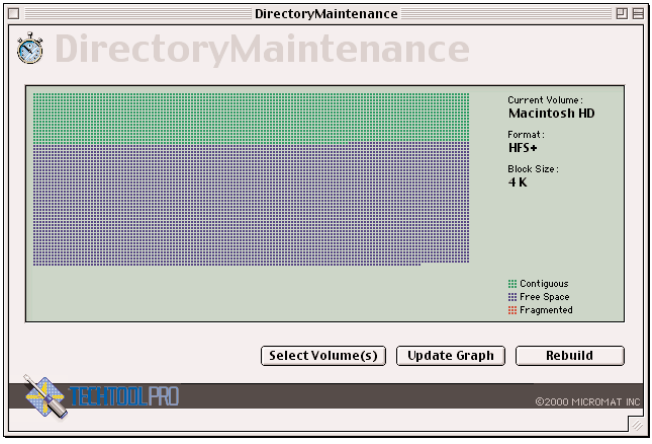
Q: Why should I save my Desktop files before rebuilding the Desktop and what should I do with the saved files afterwards?

A: *TechTool Pro* allows you to save the Desktop files just in case something goes wrong with the rebuild. In this case, you have a method of "undoing" the rebuild by using the **Restore Desktop** button. If you are confident that a rebuild was successful, you can trash the saved Desktop files.

Q: When the computer restarts after I delete the Desktop it freezes. Why?

A: You are probably experiencing an extension problem. Try disabling extensions when the computer restarts by holding down the *shift* key.

Directory Maintenance



The directory of a volume stores information about the files and folders stored on the volume and where they are located. As files and folders are added and deleted from the volume, the data structures that hold this information may become fragmented. This lowers the speed that this vital information can be accessed by the system. Rebuilding the directory structures optimizes them and improves overall system performance.

Controls & Displays

Information Screen

This screen shows a variety of information about your directory structures. In particular it lists the following:

- **Current Volume:** – the volume currently under examination.
- **Format:** – the format of the volume, either HFS or HFS+.
- **Block Size:** – the size of the blocks for the current volume's format.

The screen also displays a graph of the selected volume's directory allowing you to visually see the condition of fragmentation of the directory structures. The information is coded as below:

- **Green** – contiguous areas of the directory.
- **Blue** – free space in the directory.
- **Red** – fragmented areas of the directory.

Select Volume(s)
This button brings up the volume selection dialog.

Update Graph
This button displays a pictorial representation of the current state of the selected volume's directory in the Information Screen.

Rebuild
The Rebuild button rebuilds and optimizes the directory structures of the selected volume.

Drives

While there are utilities available to help recover lost files and repair damaged directory information, few utilities examine the mechanics of the hard drive. The controller board, heads, spindle motor, and head armature are just a few items that deserve equal, if not more, attention than the software attributes of the drive. Should one of these items fail, no software recovery program alone will be able to save your data.

TechTool Pro tests many important elements of your hard drive including the controller I/O, memory, and head-positioning mechanism to name just a few. These universal tests are applicable to almost any drive types. Some of the tests can even be performed on CD-ROM drives.

Test & Function Descriptions

Self Diagnostic
This test initiates a self-diagnostic on the target drive. These routines are designed by the drive manufacturer and provide excellent insight into the operational condition of the drive.

Test Unit Ready
Determines whether the target drive is able and ready to receive commands.

Read Buffer
This test is used in conjunction with the WRITE BUFFER command as a diagnostic function for testing target memory and the bus integrity.

Write Buffer
This test is used in conjunction with the READ BUFFER command as a diagnostic function for testing target memory and the bus integrity.

Seek
The SEEK command provides a way for the initiator to position the device in preparation for access to a particular logical block.

Random Read
Reads data from a random memory location.

Random Write
Writes data to a random free storage location.

Linear Read
Reads blocks of data linearly.

Linear Write
Writes blocks of data linearly to a free storage location.

Rezero Unit
This test is used to determine the target drive's ability to position the actuator at cylinder zero.

Controls & Displays

Test Select
Allows you to select which drive tests will be executed.

Control Button
Brings up the Control Palette.

Common Questions

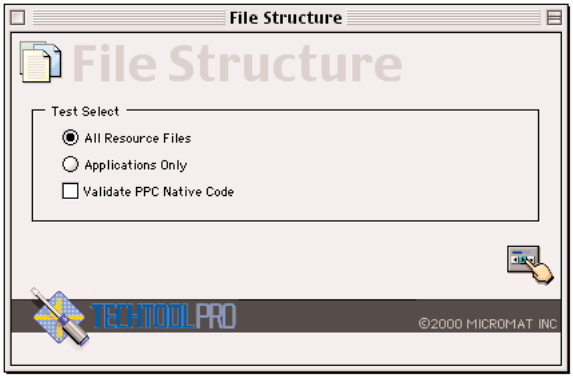
Q: When I test my CD-ROM drive at the Drive panel, the Read Buffer, Write Buffer, Random Read, Random Write, Linear Read and Linear Write tests reports that these tests are unavailable. Is there something wrong with the drive?

A: No. In order for *TechTool Pro* to be able to run these tests a file must be written to the drive. Even the read tests require that we write a file so that we can verify the validity of the read. Since the CD-ROM is a read-only device, any test that involves writing data will not be available for testing.

Q: Does TechTool Pro test USB and FireWire drives?

A: Yes. *TechTool Pro* is fully compatible with these types of drives.

File Structure Tests



The File Structures panel of *TechTool Pro* is used to determine whether individual files are damaged. Some of the items checked by this panel are:

Resources:
- Verifies that resource length is correct.
- Checks that resource map follows resource data.
- Verifies that type list offset is correct.
- Determines if reference list offset is correct.
- Checks if resource data length is correct.
- Verifies that resource name length is correct.

PPC native code in data fork:
- Determines if valid data fork exists.
- Verifies that fragment location and offset are valid.
- Scans data fork to determine if declared code is actually present.
- Tests for code fragment type matches.
- Verifies that fragment length is correct.

The combination of these tests can quickly determine the state of all the files on your volumes. Use these tests when looking for corrupted files.

Test & Function Descriptions

All Resource Files
Checking this radio button indicates that all resource files should be tested.

Applications Only
Checking this radio button indicates that only application files should be tested.

Validate PPC Native Code
Checking this box will cause the tests to validate PowerPC code fragments while testing file structures.

Controls & Displays

Test Select
Allows you to select the File Structure tests you wish to perform.

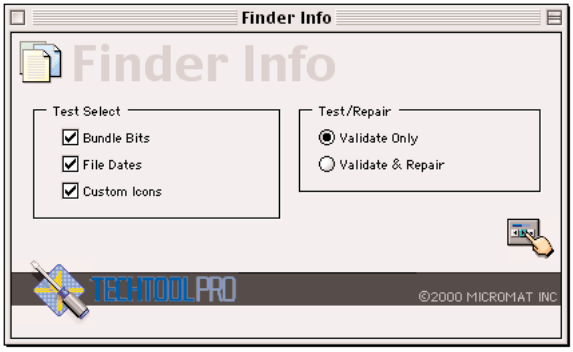
Control Button
Brings up the Control Palette.

Common Questions

Q: Will the File Structure tests repair any broken files they find?

A: In some cases they will, but in most cases the data needed to repair the files will not be available. If the files cannot be repaired then they need to be replaced from known good copies or backups.

Finder Info



The Finder Info panel corrects problems with the Finder information of a file. It will scan the selected volume(s) and validate and optionally repair problems that are found:

Bundle Bits

This resource within applications determines which documents belong to an application. If this resource is not correctly configured, the result will be generic icons for documents or failure of the application to launch when those documents are double-clicked.

File Dates

Sometimes file and creation dates will be incorrect because the Macintosh clock was incorrect when the file was created or modified. This results in files with improbable file dates such as January 1, 1904. While determining the true dates for a file may not be possible, *TechTool Pro* will change the file dates to the computer's current date if they are obviously incorrect.

Custom Icons

If you assign a custom icon to a file or application, a custom icon bit is set so that the Finder knows it should display the custom icon instead of the normal icon for that file. Sometimes this custom icon bit will be set incorrectly and the custom icon will not display. *TechTool Pro* will correct this problem by properly setting the bit.

Test & Function Descriptions

Bundle Bits
Allows you to activate or deactivate the Bundle Bit test and repair routine.

File Dates
Allows you to activate or deactivate the File Date test and repair routine.

Custom Icon
Allows you to activate or deactivate the Custom Icon test and repair routine.

Validate Only
Allows you to designate *TechTool Pro* to only scan for and display found problems. The problems will not be repaired.

Validate and Repair
Allows you to designate *TechTool Pro* to both scan for and repair problems based on the selected tests.

Controls & Displays

Test Select
Allows you to select the tests you wish to perform.

Test/Repair
Allows you to choose to validate only or to both validate and repair if problems are found.

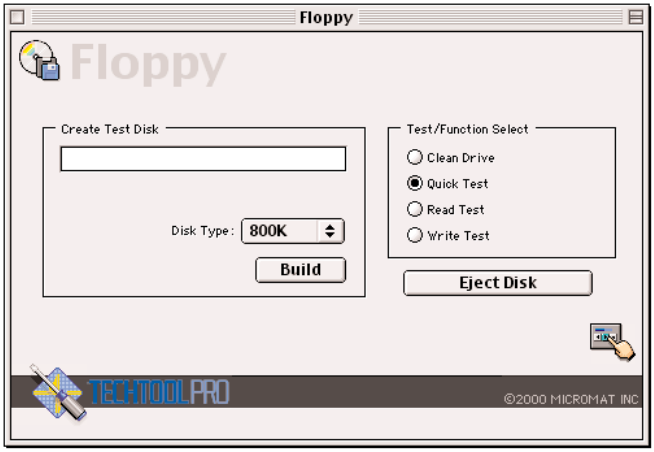
Control Button
Brings up the Control Palette.

Common Questions

Q: *I've run all of the Finder Info tests and my Microsoft Word icons are still generic. What do I do now?*

A: Be sure that the parent application for the document, in this case Microsoft Word, is on the volume. If it's not, there is no reference to the correct icon for that file. If the parent application is on the drive, it's probable that the problem lies in the Desktop Database and not in the application or document file. Go to the Desktop section of this manual and learn how to repair the Desktop Database files.

Floppy Tests



The floppy disk drive is a viable storage device on many Macintosh models. Although floppy disks are used less now than in the past, they are still an important means of distributing programs and data files. They also provide an easy and convenient way to backup smaller files. Many owners of new model Mac computers will buy an external floppy drive to attach to their USB port, enabling them to have access to legacy files and backups.

TechTool Pro's Floppy Drive panel offers a method of cleaning your floppy drive to prevent problems. This should be done as part of a regular maintenance routine. You will need to obtain a floppy drive cleaning kit. These kits can be obtained directly from Micromat and most computer retailers. Added to the benefit of repairing units that are malfunctioning due to dirty heads, *TechTool Pro* offers some diagnostic features otherwise found on industrial test systems. With only a few clicks of the mouse, you can find out if your floppy drive is good, salvageable, or requires replacement.

Test & Function Descriptions:

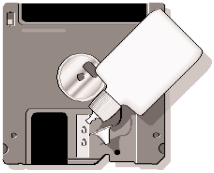
Clean Drive

- ***Overview:*** Imation, the company that manufactures the cleaning disk sold separately by Micromat, recommends that the read/write heads be cleaned every 40 hours of operation. If you have an Imation USB SuperDisk floppy drive you should contact Imation for a special cleaning disk. In environments

where there is a large amount of airborne debris, head cleaning should be performed on a more frequent basis. Think of periodic head cleaning as preventative maintenance: clean heads mean less trouble in the future.

- ***Prepare the Cleaning Disk*** (First time use only) Remove the protection tab from the cleaning diskette.

- ***Dispense Cleaning Fluid*** Dispense six (6) drops of cleaning solution onto the fabric exposed by the head access slot on the metal hub side of the cleaning diskette.



- ***Start Cleaning Routine*** Select *Clean Drive* and then choose **RUN** in the Control Palette.
- ***Insert Cleaning Disk*** *TechTool Pro* will prompt you to insert the cleaning disk.
- ***TechTool Pro Cleans Drive*** As *TechTool Pro* cleans the drive, you might hear an abrasive sound as the routine sweeps the drive. This does not mean that the diskette is harming your system. In fact, the cleaning fabric is less abrasive than industry specifications for actual magnetic recording media.
- ***Cleaning Completion*** *TechTool Pro* will take approximately 30 seconds to complete the cleaning cycle. As it cleans, you can monitor its progress by watching the progress bar.
- ***Completion*** When the *TechTool Pro* cleaning routine is complete, it will eject the cleaning diskette. Mark one of the boxes on the back of the cleaning diskette for usage reference. Put the cleaning diskette back in its protective bag and store it for future use.

Quick Test

The Quick Test is similar to the Read Test, but does not test every track and sector. It is meant to be used for fast verification of drives where the 20 minutes required for a full test is unacceptable. Should any of the Quick Test routines fail, it is recommended that the full Read Test be employed for verification.

This test utilizes either the 800K or 1.44M Test Disk depending on the model disk drive. Creating test disks is explained further in this section.

The test takes approximately 1 minute on either a 1.44M or 800K drive.

- **Select Test Disk** Select the appropriate Test Disk. If you are using an 800K drive (Macintosh II or below) use the 800K Test Disk. If you are using a 1.44M drive (SE/30 and above) then use the 1.44M Test Disk.
- **Start Quick Test Routine** Select *Quick Test* and then click **RUN** from the Control Palette.
- **Insert Test Disk** *TechTool Pro* will prompt you to insert the test disk.
- **Test Completion** *TechTool Pro* will take approximately 1 minute to complete the test cycle. As the tests proceed, you can monitor progress by watching the progress bar. When the Quick Test routine is complete, it will eject the test diskette. If any test failures occur *TechTool Pro* will prematurely end the entire test, eject the test disk, and display the error in the Test Log.

Read Test

The Read Test verifies several aspects of the accuracy of your floppy drive. This test utilizes either the 800K or 1.44M Test Disk depending on the model disk drive. This test verifies the following aspects of the drive:

- Relative Head Alignment
- Read Integrity
- Head to Head Integrity
- Random Seek
- Maximum Seek

The test takes approximately 12 minutes on a 1.44M drive. An 800K drive will take approximately 19 minutes to complete.

- **Select Test Disk** Select the appropriate Test Disk. If you are using an 800K drive (Macintosh II or below) use an 800K Test Disk. If you are using a 1.44M drive (SE/30 and above) then use a 1.44M Test Disk.
- **Start Read Test Routine** Select the *Read Test* and then choose **RUN** from the Control Palette.
- **Insert Test Disk** *TechTool Pro* will prompt you to insert the test disk.

- **Test Completion** *TechTool Pro* will take approximately 12 to 19 minutes to complete the test cycle. When the Read Test routine is complete, it will eject the test diskette. If any test failures occur, *TechTool Pro* will prematurely end the entire test, eject the test disk, and display the error in the Test Log.

Write Test

The Write Test verifies the write integrity of your floppy drive. The test takes approximately 23 minutes on a 1.44M drive. An 800K drive should take approximately 22 minutes to complete the test. You must create a scratch disk for use by the Write Test prior to running the test.

Creating Disks for the Write Test

The Write Test does not use data that currently exists on the floppy for verification. Instead, it writes data to a scratch diskette and reads the data back to verify that the information was properly recorded.

You should use high-quality diskettes as scratch disks, since any defects on the disk will cause a failed Write Test and an incorrect drive diagnosis.

1) Use a high-quality diskette of the same type as your drive. In other words, if you have a 1.44M floppy drive, use a 1.44M diskette (these always have an HD symbol stamped on them). If you have an 800K floppy drive, use an 800K floppy disk. Most drives are 1.44M and only very old Macintosh models (prior to 1987) use the 800K drive.
2) While at the Finder, insert the diskette into the floppy drive.
3) If the Finder prompts you, initialize the disk then click the **Erase** button.
4) When the initialization is complete, eject the disk and mark it as a scratch diskette.

Start Write Test Routine

Select the *Write Test* and then choose **RUN** from the Control Palette.

Insert Test Disk

TechTool Pro will prompt you to insert the scratch disk.

Test Completion

TechTool Pro will take approximately 23 minutes to complete the test cycle. When the Write Test routine is complete, it will eject the scratch diskette. If any test failures occur, *TechTool Pro* will prematurely end the entire test, eject the scratch disk, and display the error in the Test Log.

Controls & Displays

Create Test Disk

The primary floppy disk test employed by *TechTool Pro* is *alignment*. Alignment indicates the ability of a drive to accurately position its read/write head over the sectors of a disk. When a drive is out of alignment, the heads do not correctly position themselves. This results in read and write errors.

To properly check alignment with *TechTool Pro* it is necessary to use alignment disks. These are disks that were created on known good floppy drives and contain precision alignment information.

You should create a test disk only on a properly functioning floppy drive. If you are not currently having difficulties with your floppy drive, you do not need to create your test disk on a different machine. Follow these steps to create your test disk:

1) Use the *Disk Type:* popup menu to select the appropriate disk format for the type of floppy drive you wish to test. Then click the **Build** button.
2) *TechTool Pro* will prompt you to insert a blank diskette of the appropriate format. Use a high-quality diskette and insert the diskette into any floppy drive.
3) *TechTool Pro* will create the test disk. This can take a very long time since the program verifies each track and sector as it is written. If for any reason you wish to cancel the build, click the **Cancel** button.

Test/Function Select

Allows you to choose the type of floppy test you wish to perform.

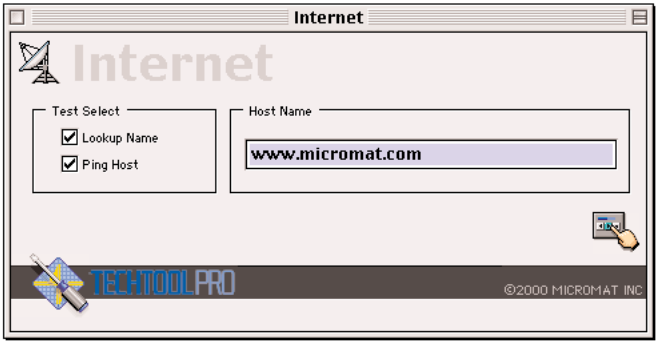
Eject Disk

The **Eject Disk** button will eject a floppy disk currently in the drive.

Control Button

Brings up the Control Palette.

Internet Tests



The Internet testing capabilities incorporated into *TechTool Pro* allow you to verify the connectivity between your Macintosh and your Internet Service Provider (ISP) or another host. Instead of using an e-mail program or a web browser to check your Internet connectivity, *TechTool Pro* can run an independent test of your connection. *TechTool Pro* can execute a domain name lookup and will also ping the specified host to see if possible problems exist.

Test & Function Descriptions

Lookup Name

This test will confirm the ISP domain that you entered in the *Host Name* field and return an IP number. A reverse domain name search is then executed with the IP number to determine whether the correct host name is returned.

Ping Host

A series of communication packets are sent to the target host. These “pings” are then sent back to the machine under test and the integrity of the data, as well as the round-trip time, is analyzed to determine acceptable connectivity.

Controls & Displays

Test Select

Allows you to click to select which test(s) to perform.

Host Name Field

This field is used to enter the target host domain name or address for the tests.

Control Button

Brings up the Control Palette.

Usage Notes

In order for this test to run successfully you must have a current, live connection to your ISP. Be sure that you have selected an appropriate host name in the *Host Name* field. For example, to check communication between your computer and a web server you might enter:

www.micromat.com

To test connections to a mail server you could enter:

mail.micromat.com

To test connections between specific hosts, simply replace the domain with the appropriate domain name. For example, if you wish to test communications with your ISP's mail server, and your email address is john@monster.net, you would enter:

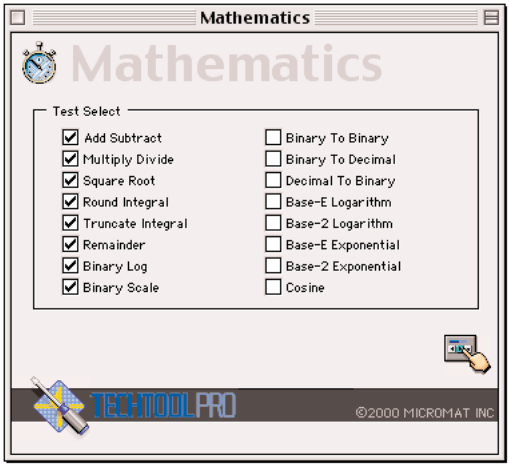
mail.monster.net

Common Questions

Q: Where would I find my Internet Service Provider's domain name or address?

A: Usually when you first sign up with an Internet Service Provider (ISP), they provide you with documentation that tells you how to correctly setup the Internet software on your computer. In that documentation you should be able to locate your Internet Service Provider's domain name or email address.

Mathematics



This panel allows you to check for correct operation of your computer's mathematical processing hardware and software routines. Ancient models of Macintosh use a separate chip called a *floating-point unit* or FPU. This is also sometimes called a math coprocessor. If available, this chip helps the CPU calculate floating-point and other complex math operations and functions. While many machines have separate and independent FPU chips, the recent trend has been to super-integrate these circuits into the CPU. This saves the manufacturer money by reducing the number of components and assembly time. The user gains by reduced product costs and a nominal computational speed increase since an integrated FPU does not have to contend with bus arbitration and the other delays of processor-to-processor communications.

Whatever type of mathematical processing your computer employs, *TechTool Pro* will test it by requesting both simple and complex floating point calculations from the system. These are thousand-iteration tests that use a cascading scheme that exponentially increase in complexity.

Test & Function Descriptions

TechTool Pro uses the follow computational functions to test the accuracy and timing of the FPU chip or FPU circuit of the CPU:

Add/Subtract	Binary To Binary
Multiply/Divide	Binary to Decimal
Square Root	Decimal to Binary
Round Integral	Base-E Logarithm
Truncate Integral	Base-2 Logarithm
Remainder	Base-E Exponential
Binary Log	Base-2 Exponential
Binary Scale	Cosine

Controls & Displays

Test Select

Allows you to check the test(s) you wish to perform.

Control Button

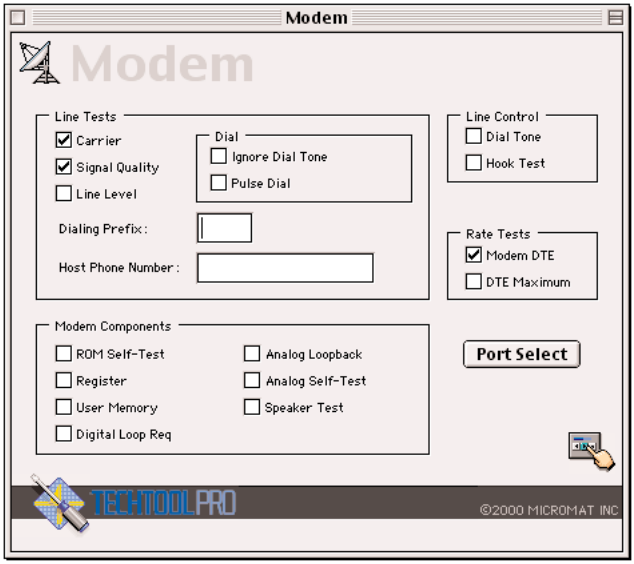
Brings up the Control Palette.

Common Questions

Q: *Many years back, Intel had problems with the math calculations on their Pentium processor. Would TechTool Pro's Mathematics tests help me find a similar problem if it existed on my Macintosh?*

A: Yes. The Pentium chip failed several floating-point calculations similar to the ones employed by *TechTool Pro*. Should your FPU or CPU begin to incorrectly calculate floating-point operations, *TechTool Pro* will flag that test as failed.

Modem Tests



One of the most popular peripheral add-ons would have to be the modem. Modems let your Macintosh communicate with popular online services, your bank, shopping services, and the Internet. Modems will eventually become a thing of the past, making way for high-bandwidth digital connections like DSL and T1. However, they probably will always be on laptop computers for the wayward traveller that may not have access to a broadband connection.

The modem takes binary signals from your Macintosh serial or USB port and turns them into a series of tones (MOdulate-DEModulate) that are compatible with conventional phone lines. Just like everything else in the computer business, modems have become faster and better over the years.

Those of you who have had to configure a modem to get it to work with a particular service have probably suffered some configuration problems. Handshaking, AT commands, and S registers can make setting up a modem daunting. As you try different configurations with no success, you may have wondered, "Is this modem even working correctly?" *TechTool Pro* offers a battery of tests that allow you to test the most critical functions of your modem. Since TechTool Pro's Modem test panel utilizes the Apple's Communications Toolbox, you can test any Hayes-compatible modem regardless of which port it uses.

Before running the modem test, be sure to read the Port and Dialing configuration sections. Note also that some modems do not support all the self-tests.

Test & Function Descriptions

Carrier
Connects to a user-defined host computer and establishes an initial connection.

Signal Quality
Executed during the carrier test, this test measures the quality of the phone line.

Line Level
Executed during the carrier test, this test measures the line level of the phone line.

Dialing Prefix:
This is where you enter a telephone number prefix if necessary. For instance, if you need to dial a "9" to reach an outside line.

Host Phone Number:
This is where you enter the telephone number to connect to an outside host such as your Internet Service Provider.

Ignore Dial Tone
Check this option to ignore dial tone detection (blind dialing).

Pulse Dial
Check this option if the phone service requires pulse dialing.

ROM Self-Test
Initiates the modem self test routine (if it has one) and interprets the results.

Register
Performs a read/write test of the modem configuration registers.

User Memory
Tests the modem memory (if present) allocated to user settings.

Digital Loopback Req
Tests whether modem can enter digital loopback mode.

Analog Loopback
Initiates an internal analog loopback test.

Analog Self-Test
Initiates a self-test of the analog circuitry.

Speaker Test
Takes phone off hook to dial four times, each time at a different speaker volume.

Dial Tone
Determines whether the modem is attached to a live phone line.

Hook Test
Tests the hook relays (the switch that “picks up the phone”).

Modem DTE
This test confirms proper communication between the computer and the modem.

DTE Maximum
This test determines the maximum possible communication speed between the modem and the computer. This is useful for revealing whether your computer’s ports are fast enough to communicate with a high-speed modem.

Controls & Displays

Line Tests
Allows you to choose tests concerned with line integrity and quality.

Dial
Allows you to choose dialing options.

Modem Components
Allows you to choose tests to perform on the modem itself.

Line Control
Allows you to perform operations on the line.

Rate Tests
Allows choice of tests to check modem speed.

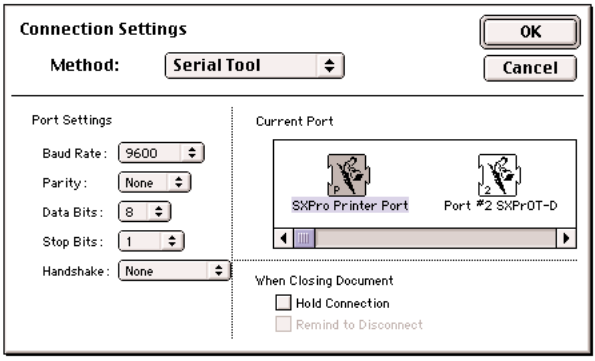
Port Select
Brings up a dialog allowing you to select the port to which the modem is attached and various port parameters. See below for further details.

Control Button
Brings up the Control Palette.

Configuring Modem Port

To configure the modem port:

- Click the **Port Select** button. The following dialog will appear:



- Hold down the *Method* pop-up menu and select *Serial Tool*. If the Serial Tool option is not available, it means that the Serial Tool was not installed in the System Folder and needs to be reinstalled using the *TechTool Pro* installer.
- Select the port the modem is attached to in the *Current Port* field.
- Set BAUD RATE to 9600
- Set PARITY to NONE
- Set DATA BITS to 8
- Set STOP BITS to 1
- Set HANDSHAKE to NONE
- Set HOLD CONNECTION to disabled.
- Click **OK**.

Configuring Dial Settings

- If your phone service does not support touch-tones, enable the *Pulse Dial* option.
- If your modem is attached to a PBX, enter the appropriate information to gain an outside line in the *Dialing Prefix:* field. In most cases you would insert **9,**.
- Enter the phone number of a computer service in the *Host Phone Number:* field. This could be the phone number of your BBS, your Internet Service Provider, or another computer with a modem ready to accept calls.

Common Questions

Q: Why is the carrier test option grayed-out?

A: That test will not be available until you enter a host telephone number.

Q: Why are the Signal Quality and Line Level test options grayed-out?

A: These two tests are executed during a carrier test. If the carrier test has not been selected or configured, Signal Quality and Line Level tests will not be available.

Q: Why do the results from the Signal Quality and the Line Level tests report unavailable after testing?

A: Your modem probably does not support these types of tests.

Q: Why does my new modem keep failing the User Memory test? The modem seems to be working fine.

A: Some newer modems do not have a User Memory feature and this would explain why your modem fails this test consistently. The user memory was used with older modems when software was not used to store information like frequent phone numbers and settings. Since software now controls these aspects of the modem, many modem vendors no longer employ this feature.

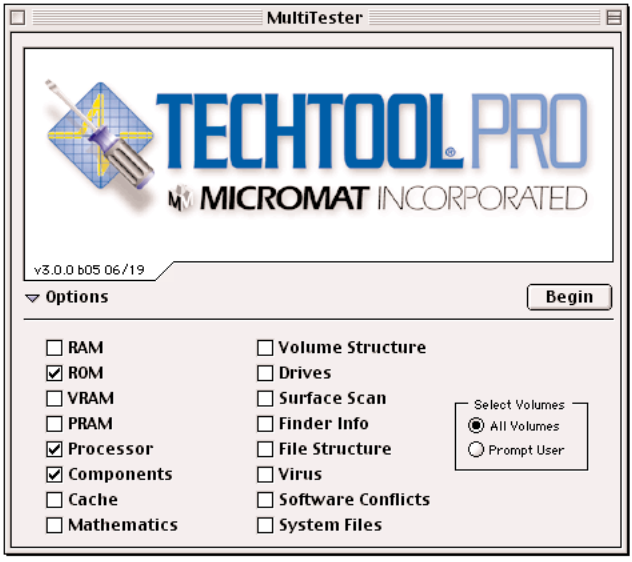
Q: When I go to the Modem panel a message appears stating, "Communications ToolBox Missing." What is the Communications ToolBox and how do I get this to work?

A: The Communication ToolBox error is indicating that the Serial Tool extension (which is a part of the *TechTool Pro* installation) is either not enabled, is missing, or is damaged. Usually enabling the extension or reinstalling the Serial Tool from the *TechTool Pro* installer resolves this problem.

Q: Will the Modem tests check my DSL, ISDN, Frame Relay, T1, or cable modem?

A: These are digital connections. Hayes-compatible modems are analog devices. To test the above digital devices use the Internet panel to check for connectivity.

MultiTester Tests



The MultiTester panel allows you to easily run a comprehensive suite of tests on your computer. One mouse click is all that is needed to perform a thorough check of your computer and many of its peripherals. By clicking the **Options** disclosure triangle you can see the list of tests that can be run by MultiTester. Each test can be activated or deactivated by clicking to check or uncheck its box. Using **Select Volumes** allows you to choose whether to run the tests on all the attached volumes/drives or on only selected ones. Once your choices are made, just click on **BEGIN** to perform all the selected tests for the selected volumes.

Test & Function Descriptions

RAM

The RAM test will do a quick check of the memory chips in your computer. RAM problems can cause intermittent crashes that are not dependent on the particular software you are using.

ROM

The ROM test checks the ROM chips on your computer. ROM stores your computer's hard wired System routines.

VRAM
This test checks the video memory of your system.

PRAM
The PRAM stores various System settings. This test checks the integrity of this component.

CPU
This test will check your computer's central processing unit—the heart of your computer.

Components
These tests verify the operation of various peripheral chips such as the serial chips and SCSI chip if present.

Cache
This test checks the special fast memory, or cache, on your computer.

Mathematics
These tests verify the operation of the math hardware and software routines of your computer.

Volume Structure
These tests check the validity of the directory and other critical volume data structures on local volumes.

Drives
This tests the proper hardware operation of your drives.

Surface Scan
This tests for physical damage to the surface of your drives. Also known as a Block Scan.

Finder Info
This checks for corruption in the Finder Info of all your files, such as bad modification dates, bundle bits, and custom icons.

File Structure
This test checks for corruption in the structure of your files.

Virus
This test will scan your drive for files that are infected with a known virus or other virus-like programs.

Software Conflicts
This test will check all the software on your computer and attempt to locate programs that will conflict with each other.

System Files
This test will check the critical operating system files for modification or corruption.

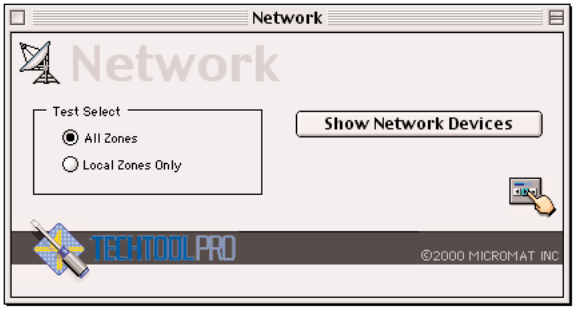
Controls & Displays

Options
Displays and allows you to choose the tests performed by MultiTester.

Select Volumes
Allows you to perform the tests on the volume(s) or drive(s) of your choice.

BEGIN
Starts the selected tests on the selected volumes.

Network Tests



The networking hardware and software of your Macintosh is very important if your computer resides on a local area network (LAN). The ability to print, communicate with other computers in your local network, and connect to Internet services is dependent on proper operation of these components.

The network tests incorporated in *TechTool Pro* permit you to verify that your network connection is working properly. It is necessary to have at least one other device on your network (printer, router, or another computer) to use these tests since it is necessary to ping another device to determine communication abilities.

Test & Function Descriptions

All Zones

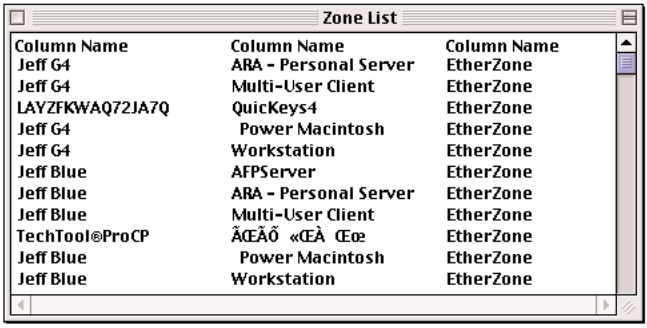
This test will broadcast and receive on all available zones on your network to confirm proper network communications.

Local Zone Only

This test will broadcast only to other devices that are available within the same network zone as your machine.

Show Network Devices

This button will display a node list of what devices were found on the network and display the zones that were accessed during the test.



Controls & Displays

Test Select

Allows you to select the test you wish to perform.

Show Network Devices

Displays a node list of network devices.

Control Button

Brings up the Control Palette.

Usage Notes

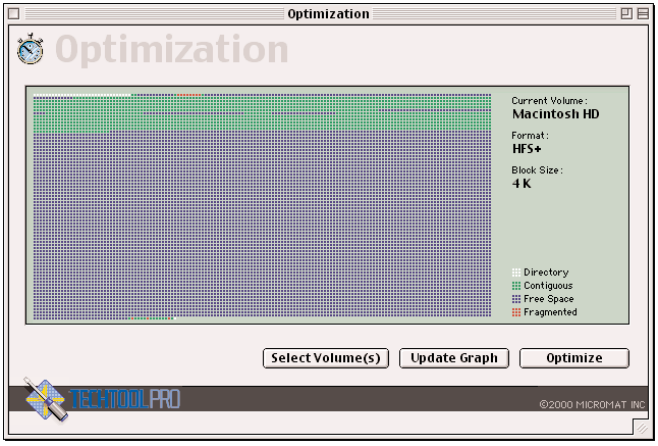
The Network panel sends a getNameList command to an available zone. Successful returns from all machines, including the machine on which the tests are executed, determines whether testing was successful.

Common Questions

Q: After running the Network test the dialog box indicated the zone as "." Why?*

A: The asterisk "*" represents the local zone. If your computer is connected to a LocalTalk bridge that enables you to have multiple zones, then the node list will display the actual zone names.

Optimization



As your hard drive saves and deletes files, the file system will instruct the drive mechanism on where and how to store the information. It can place this information anywhere there is available free space on the drive. If there is not a contiguous area on which to save a file then your drive will fragment it, saving a piece here and a piece there. This is transparent to you. Although the file itself appears as one complete logical item, in most cases it is actually physically scattered around the disk in many pieces.

Fragmented files can slow down file access on your hard drive. Instead of your drive being able to scoop up a requested file in one swoop, it must find all the pieces at various places on the drive. This increases the amount of time needed to read and write files and results in a degradation of performance.

A cure for fragmented files is to optimize your drive. This involves using software (such as *TechTool Pro*) to rearrange all of the file fragments and reassemble them into contiguous areas on the disk. This is done much like the game “Hanoi Towers” is played. Several files may be moved until the target file will have enough free space to be written contiguously. This process is repeated many times until all or most of the files are no longer fragmented.

There are two methods for optimizing files on a disk. One is to use low-level calls, rewriting the directory and extents information. This method involves many modifications to the basic file structure of the drive. While this method is fast, it could cause a loss of some or all of your data in the event of a power failure, crash or some other event that interrupts recreation of critical drive files.

The other method, employed by *TechTool Pro*, uses standard file write-copy-delete methods to rearrange the files. While this method is sometimes slower than using low-level calls, it is far safer since there is no risk to the data. You can literally unplug your machine during optimization with no ill effect to your drive or data.

Controls & Displays

Information Screen

This screen shows information about space usage on your volume. In particular it lists the following:

- **Current Volume:** – the volume currently selected.
- **Format:** – the format of the volume, either HFS or HFS+.
- **Block Size:** – the size of the blocks for the current volume's format.

The screen also displays a graph of the selected volume's disk usage allowing you to visually see the fragmentation of the volume.

The information is coded as below:

- **White** – disk space used by the directory on the volume.
- **Green** – space used by contiguous files on the volume.
- **Blue** – free space on the volume.
- **Red** – space occupied by fragmented files on the volume.

Select Volume(s)

This button brings up the standard Volume Selection dialog.

Update Graph

This button displays a pictorial representation of the current state of the selected volume's use of space on the Information Screen.

Optimize

Selecting this button will quit all open applications except *TechTool Pro* and then begin optimization on the selected volume(s). It is recommended that the computer be restarted upon completion of optimization.

Usage Notes

The optimization feature should be used as a general disk maintenance routine for your Macintosh.

It is highly recommended that you perform a **Volume Structure** test (and repair if necessary) prior to running optimization on the volume. This will allow

TechTool Pro to optimize more efficiently and keep any volume structure problems from getting worse during optimization.

Common Questions

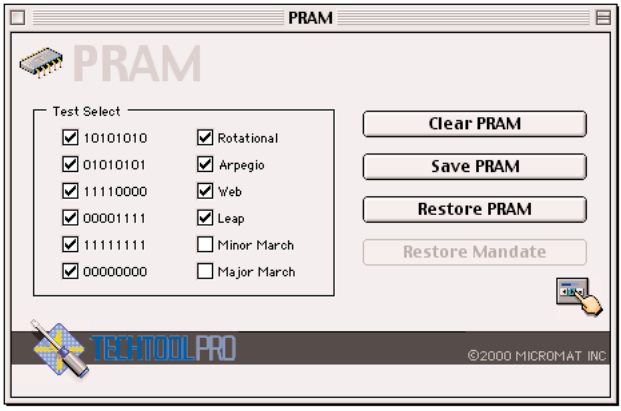
Q: Do I need to run the optimization feature from my TechTool Pro CD every time I want to optimize my hard drive(s)?

A: Not necessarily. If you are using OS 8.6 or below *TechTool Pro* can optimize the boot volume and/or the program volume. However, if you are using OS 9 or above, then you must both boot your computer and run *TechTool Pro* from a volume other than the one you are attempting to optimize.

Q: When I run the optimization feature, I get a message indicating that "there isn't enough contiguous free space" on my volume. What does this mean?

A: In order for *TechTool Pro* to perform the optimization feature on your volume, you must have enough available free space on the volume for the routines to operate. *TechTool Pro* uses an extremely safe method of optimizing. It uses high-level file moves to move each file to a contiguous area of the volume before it deletes the original copy of the file. However, this means that *TechTool Pro* must have enough contiguous free space on your volume to hold your largest file. If there is not enough contiguous space, then *TechTool Pro* will issue the warning indicating that it cannot proceed. If this happens then you need to temporarily copy some files to another volume to make more room available. As a general rule, it is recommended that you have at least 15% free space available on your volume. However, the amount of free space necessary to optimize is dependent on a number of factors, including the degree of fragmentation and the size of the files on the volume being optimized.

PRAM Tests



Pronounced “pee-ram,” the parameter RAM is a non-volatile RAM chip residing on your Macintosh motherboard. This device holds special parameters independent of the System or hard drive. Some of these settings include mouse speed and designated startup device. This information is stored in the standard area of PRAM (usually the high 128 bytes). Below the upper 128 bytes is an area of PRAM that contains more critical settings like boot services, manufacture date and hours of use (mandate), and other reserved areas used by the System software.

Some software and hardware developers have used the reserved lower areas of PRAM to store settings. Although Apple has been warning developers not to use reserved sections of PRAM because they are used by System software, some vendors have adopted this practice. This can lead to reliability problems with your computer. Inexplicable crashes and freezes are mild symptoms. In some scenarios, the computer will not even boot. Changing the System, removing extensions, or “zapping” the PRAM using the conventional method does not cure the problem. The traditional method—hold the command, option, P and R keys—only clears the upper bytes of RAM where the problem does not reside. Historically, the only way to correct lower PRAM problems was to open up the computer and momentarily remove the PRAM battery. This would clear all of the PRAM memory allowing the Mac ROM to replace the data with default settings. *TechTool Pro* will clear ALL of PRAM without the need to disassemble the computer. The program also offers the ability to save the PRAM data before it is cleared and the ability to restore this information should the need arise. *TechTool Pro* also allows you to test the physical memory that comprises the PRAM.

Test & Function Descriptions

The PRAM panel employs the same memory testing routines for PRAM that are used by the RAM test panel. For test details please refer to the *Test & Function Descriptions* area of the RAM test section.

TechTool Pro allows you to save and restore your PRAM data using conventional file saving methods. The **Save PRAM** button will copy the contents of the PRAM data and save it as a file to your hard disk. The **Restore PRAM** button will restore the data saved in a PRAM data file to the PRAM chip.

Clicking the **Clear PRAM** button empties the contents of the PRAM chip in order to correct potential PRAM problems. You'll be prompted to save the contents of your PRAM in case you've forgotten. The program will quickly clear the PRAM chip and the computer will automatically be rebooted. The reboot is necessary to avoid potential problems that might be caused by software such as the System or extensions when they attempt to use the now empty PRAM chip.

When the PRAM is cleared and the Macintosh is rebooted, the computer ROM will check the PRAM. If the contents are not valid (they won't be since it has been cleared) the ROM will install the factory default settings. Some models of Macintosh keep track of the Date of Manufacture and Hours of Use (the Mandate). If this information is maintained by your Macintosh model, it will be automatically restored at this time. Many people find the thought of "clearing" the PRAM distressing, since they feel they will lose some important information. This is not the case. Apple designed the PRAM to be self-sufficient should the PRAM battery wear out or fail.

Controls & Displays

Test Select

Allows you to select the various PRAM tests.

Clear PRAM

This control will clear the contents of PRAM. The factory default settings will be loaded back into the PRAM from ROM next time the computer is rebooted. In addition, the mandate information will be restored if appropriate. Using this button will force a restart immediately after the PRAM is cleared.

Save PRAM

This button will save the contents of PRAM to a file. This is the data that will be used if you decide later to restore the original PRAM settings.

Restore PRAM

Clicking this button will prompt you for a previously saved PRAM file and then restore that information to the PRAM chip. It will force a restart in order to write the PRAM file data back to the PRAM chip.

Restore Mandate

This control allows you to restore the Mandate information (manufacture date & hours of use) to the PRAM chip without the need to restore the entire original contents of the PRAM chip. Clicking this button will prompt you for a previously saved PRAM file to restore the mandate information. This button will be grayed out if your computer does not maintain Mandate information (newer Macintosh models do not).

Control Button

Brings up the Control Palette.

Common Questions

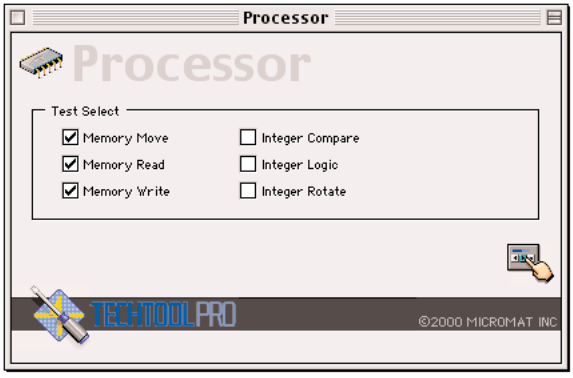
Q: After clearing my PRAM, I've found that my system is using up all of my memory and I can't open large programs because of lack of memory. What happened?

A: This can happen on ancient Macintosh computers. When your computer's ROM replaced the PRAM with the factory defaults, it deactivated 32-bit addressing, reverting your system back to 24-bit addressing. The 24-bit addressing can only map a maximum of 13 megabytes and any additional memory is ignored. Open your memory control panel and enable 32-bit addressing, then immediately restart your computer.

Q: Why should I save my PRAM before zapping the PRAM and what should I do with the saved files afterwards?

A: *TechTool Pro* allows you to save the PRAM data just in case something goes wrong when the PRAM is cleared. In this case, you have a method of "undoing" the operation by using the Restore button and selecting the saved PRAM file. If you are confident that a PRAM operation was successful, you can trash the saved PRAM data files.

Processor Tests



Every computer contains a CPU or *Central Processing Unit*. This is essentially the "main brain" of your computer. As you might remember from the Clock section of this manual, the clock provides the timing signals that the CPU needs to operate. While clock speed is a major factor in overall computer performance, the CPU is the main component that dictates a machine's overall speed of operation.

Although the CPU is the master component in a computer, its function is very simple. It takes data supplied by other components, moves it, does simple math, and outputs the result. The magic lies in the vast amount of data processing it can do in a very short amount of time. Your CPU is processing thousands, possibly millions of instructions per second. And while each individual instruction is very simple, the fact that it can do many calculations quickly allows your computer to perform very complex tasks within a reasonable time.

TechTool Pro verifies the operation of your CPU chip with both machine-level native instruction tests, and more complex system-level data operations.

Test & Function Descriptions

Memory Move
Floating-point move instructions copy data from one floating-point register to another altering the sign bit (bit 0).

Memory Read
Memory load test using little-endian byte ordering.

Memory Write
Memory store test using little-endian byte ordering.

Integer Compare
Compares instructions algebraically with the UIMM operand.

Integer Logic
Compares instructions logically with the UIMM operand.

Integer Rotate
Rotates the contents of a register. The result of the rotation is inserted into the target register using mask bit 1 and mask bit 2 operations.

Controls & Displays

Test Select
Allows you to select the various CPU tests.

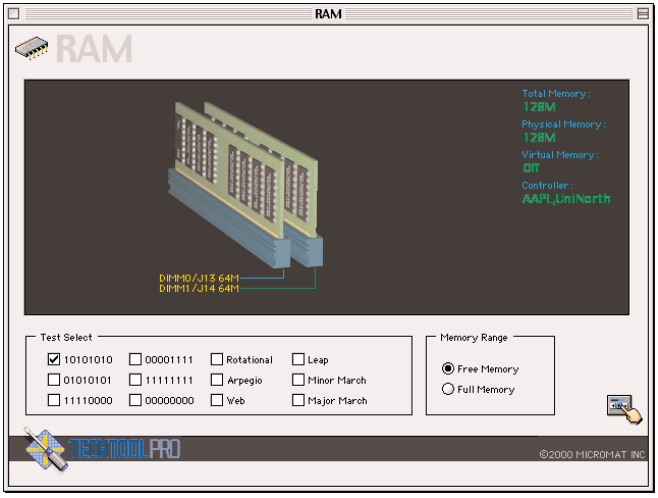
Control Button
Brings up the Control Palette.

Common Questions

Q: My Macintosh G3 has an accelerator with a G4 processor. Why does TechTool Pro say that I have a G3 processor?

A: The actual processor designation may vary when *TechTool Pro* is testing a computer with an off-board accelerator. This can be caused by CPU shielding, a technique used by some accelerator manufacturers to ensure compatibility by tricking the system into thinking it is still using the original processor. Other accelerators require proprietary system extensions to activate their boards. Starting with extensions off would disable the custom software needed to operate the accelerator resulting in the computer using the original processor.

RAM Tests



RAM is one of the components of your computer most susceptible to damage and failure. This is due to the fact that RAM is one of the most popular items to upgrade and hence is handled more than most other components. Because almost every operation done on a computer passes through RAM, its accuracy is critical to the operation of the computer. Like any chip, it is susceptible to overheating and thermal fluctuations.

Most other failures on your computer are more obvious than a RAM failure. For example, if your hard drive began to exhibit problems, you would probably start to see read and write errors appear via dialogs displaying messages like, “Could not write file because of a disk error.” However, RAM errors are much less obvious since different software uses different areas of RAM at different times. RAM problems usually manifest as unexplained and inconsistent crashes. There is no clear error message indicating a RAM failure.

RAM is very susceptible to damage. Static, heat and even normal air moisture can damage the RAM used to store your Mac’s workspace. In its worst form, damaged RAM will prevent the Mac from booting and will cause a “Sad Mac” screen. The most common symptom of bad RAM is much more deceiving. Usually the symptom will be an inexplicable system freeze that is difficult to reliably reproduce. Conventional troubleshooting techniques won’t isolate the problem. In fact, standard techniques will prove to be more frustrating since

the problem will appear intermittently, leading you to believe you've solved the problem only to later discover the problem still exists.

Unlike faulty storage bits on your hard drive that can be remapped by software so that they are no longer used, faulty RAM bits cannot be mapped out of use. While a technician with adequate equipment and replacement components can repair a RAM module, the cost to do this would greatly outweigh the cost to replace the entire module.

TechTool Pro offers you the most comprehensive software-based memory tester available for Macintosh. A wide variety of RAM tests allow you to thoroughly check your Macintosh memory. Simple pattern tests can quickly scan your memory for blatant RAM problems. Matrix tests, like the Web test, can find problems with faulty multiplexors and memory managers. *TechTool Pro* even offers two variations of the March test; hailed as the most intricate RAM test available on any platform. This section describes how each test works and how to use the RAM test panel of *TechTool Pro*.

Test Description

10101010
This test works by writing the binary pattern 10101010 consecutively throughout the memory matrix, reading and verifying each pattern after it has been written.

01010101
This test works by writing the binary pattern 01010101 consecutively throughout the memory matrix, reading and verifying each pattern after it has been written.

11110000
This test works by writing the binary pattern 11110000 consecutively throughout the memory matrix, reading and verifying each pattern after it has been written.

00001111
This test works by writing the binary pattern 00001111 consecutively throughout the memory matrix, reading and verifying each pattern after it has been written.

11111111
This test works by writing the binary pattern 11111111 consecutively throughout the memory matrix, reading and verifying each pattern after it has been written.

00000000
This test works by writing the binary pattern 00000000 consecutively throughout the memory matrix, reading and verifying each pattern after it has been written.

Rotational
The Rotational test sets the first memory address to 0 and verifies that 0 has in fact been stored at that address. It then writes 1 to that address and verifies that 1 has been stored at that address. This is repeated for each bit in the memory matrix.

Arpeggio
The Arpeggio test sets the first memory address to 1, then sets the eighth memory bit to 1, then it sets the 16th memory address to 1. The test then verifies that memory addresses 1, 8 and 16 still contain binary 1. It then begins the entire process over again with memory locations 2, 9 and 17 and continues this progression until it reaches the end of the memory matrix.

Web
The Web test works much like a spider builds its web. It starts from the outside and progresses inward. The first memory location is set to 1 and the last memory location is set to 1. The first and last memory locations are then verified that they still contain the value 1. The test then repeats this process for the second memory location and the second to last memory location. This process is repeated until both ends "meet in the middle." The entire routine is then repeated with binary 0.

Leap
This test is much like the game "leap frog." All memory locations are set to binary 0. Then the first memory location is set to 1 and the third memory location is set to 1. The test then verifies that memory locations 1 and 3 are still set at 1 and that memory locations 2 and 4 are still set at 0. The test then resets locations 1 and 3 to 0 and repeats the process by setting the second and fourth memory locations to 1, then verifying these two locations contain binary 1 and that locations 3 and 5 still contain binary 0. The entire routine is repeated until the entire memory matrix has been tested.

Minor March
The Minor March works very much like the Major March test, except that instead of performing a bit-by-bit test; it performs a byte-by-byte test. Though it is less discriminate than the Major March test it is considerably faster. All memory locations are set to binary 0. Then the first byte of memory is set for 11111111. The test then reads every other byte of memory (except the one set at 11111111) to verify that it has retained the value 00000000. The entire

process is then repeated, advancing to the second byte of memory, with all other memory locations verified for the value 00000000. This entire routine is repeated until each byte of memory has been cross tested to every other byte of memory.

Major March

The most complex (and time consuming) memory test available, the March test works like this: all memory locations are set to binary 0. Then the first memory location is set to 1. The test then reads all remaining memory locations to verify that they have retained the value 0. The entire process is then repeated, advancing to memory location 2, with all other memory locations verified for the value 0. This entire routine is repeated until each memory location has been cross tested to every other memory location.

The March test requires an unreasonable amount of time to execute. This test was originally designed to test memory on super computers and mainframes

Free Memory

Runs the selected tests only on free memory (as opposed to Full Memory below).

Full Memory

Runs the selected tests on the maximum amount of memory (as opposed to Free Memory above). See *Special Considerations* below for more detailed information.

Controls & Displays

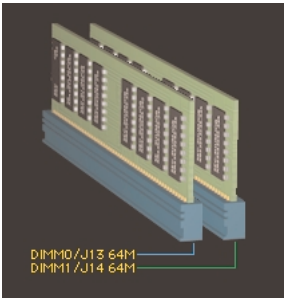
Display Screen

This area displays information about your RAM configuration. This includes the following information:

- Total Memory—the amount of memory currently recognized by the system. This includes physical and virtual memory.
- Physical Memory—the actual amount of physical RAM installed in the computer
- Virtual Memory—whether virtual memory is on or off
- Controller—identifies the actual memory controller chip

If the computer being tested uses a special Apple ASIC (application specific integrated circuit) called a “Hammerhead,” then the RAM display will offer an additional benefit. The Hammerhead chip is found in the 8500 and 9500 models and some variations of those models. In addition, newer Macs that support a Name Registry will also show the DIMM configuration of installed

RAM. If a Hammerhead chip or support for Name Registry is present, this additional portion of the screen will be present:



Information shown on this additional screen includes:

- DIMM Layout – Shows which sockets have what kind of memory.
- Interleave Status – Indicates what memory is correctly interleaved (Hammerhead chip machines only).

This information is very useful when planning memory upgrades since you can see the exact memory configuration without the need to disassemble the computer.

We are currently working with Apple to try to establish a method of offering this information for other computer models.

Test Select
This area lists and allows selection of the available RAM tests.

Memory Range
Allows you to run the tests on only the free memory or on the full range of memory.

Control Button
Brings up the Control Palette.

Special Considerations

Memory Tested
With *Memory Range* set to *Full Memory*, the RAM tests included with *TechTool Pro* tests ALL of the memory in your system (including system heap, hardware heaps, and application partitions) with the following exceptions:

- One megabyte scratch: One megabyte of memory is reserved for storing memory contents of the range currently under test.

- 3K: 3060 bytes are reserved to protect the temporary partition that constitutes the test.

Offending Extensions

It is suggested that you disable all extensions before running any RAM test. Some extensions may lock certain memory locations that can lock up the system or cause the test to return erroneous error reports.

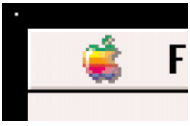
Other System Settings

Having AppleTalk active may cause erroneous errors, so the full memory RAM test will not operate until AppleTalk has been disabled and the computer has been restarted. Furthermore, Virtual Memory can cause problems with the RAM tests and must be disabled before tests can proceed.

Confirming RAM Test Activity

Since the full memory RAM test must render the computer completely inactive (by commandeering all system interrupts), the progress indicator and the error field will only be updated after each consecutive megabyte of memory has been tested. On the shorter tests, like the Pattern tests, this will only take a few seconds. On the more complex tests, this will take considerably longer.

Since there will be no screen activity and the mouse will be locked out, it might appear that the test has crashed the computer. This is normal. If you suspect that the RAM test is not operating, check the upper left corner of your screen for a blinking pixel. If the pixel is blinking then you will know the test is still operational.



Cancelling Full Memory RAM Tests

As mentioned above, the screen will only be updated after each individual megabyte of memory is tested. If you wish to cancel a test, place your caps lock key in the locked or down position or hold down the button on your mouse. The program will only check for user input for a few seconds between each megabyte of memory being tested. On the shorter tests, this will be almost immediately. On the longer tests, like the March tests, this can take much longer. If you do not want to wait this long for the test to abort, you may press the restart button on your computer or use the power switch to turn off the computer. Shift–Command–Escape or any other escape sequence will not work. Pushing the restart button or powering off the computer will not harm *TechTool Pro*, your hardware or any of your software in any way.

Common Questions

Q: What's the difference between Free Memory and Full Memory?

A: *Free Memory* only tests memory that is not currently being used. Memory that contains the system, extensions, and all applications currently loaded (including *TechTool Pro*) is not tested. *Full Memory* tests all memory except for a small portion set aside that contains the instructions that actually run the test. The biggest difference is that the Free Memory test is friendlier, since it does not intrude on portions of memory reserved for the system and other applications. When using Full Memory, *TechTool Pro* becomes the priority application, locking out the entire system and user interface, so no feedback is provided to the user except for the blinking pixel mentioned earlier. Full Memory is also more susceptible to extension conflicts, since some extensions will not relinquish control of memory to *TechTool Pro*.

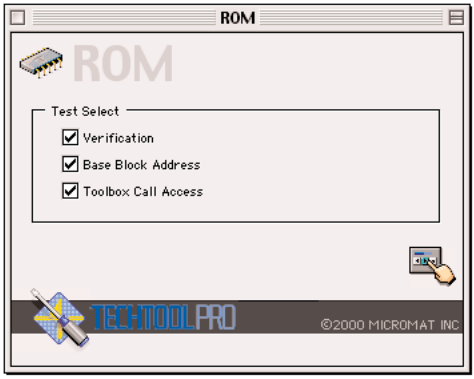
Q: Will TechTool Pro tell me the speed (in nanoseconds) of each RAM chip installed?

A: Currently, there's no way to ascertain that information by software. Some hardware-based RAM testers can do this.

Q: Which tests should I run if I think I have RAM problems?

A: Boot your computer and run *TechTool Pro* from the CD. Run all the tests except the Major and Minor March. Choose the option to run Full Memory. You might also run the tests when the computer is cool (right after turning it on) and after it has warmed up and has been running awhile.

ROM Test



ROM stands for Read Only Memory. Traditionally, this means that ROM is a chip or group of chips that contains information which cannot be altered. Newer generation Macintosh computers use an open firmware design that allows ROM to be altered.

Think of your ROM chips as software. They contain information designed to dictate the behavior and interaction between all the different components of your system. The only difference between ROM software and the software stored on your hard drive is that ROM programs are burned into chips. So instead of calling ROM “software” it is referred to as firmware; a cross between hardware and software.

The software in the Macintosh ROM contains all of the low-level instructions necessary to make a box of computer parts into a Macintosh. ROM contains the instructions that tell the computer how to load the system at boot time. It contains the ToolBox routines used by programmers to make windows, menus, and all other things Macintosh.

TechTool Pro uses several routines to test the contents of ROM and to test the reliability of the circuits used to extract information from ROM.

Test & Function Descriptions

Verification

This test verifies that the system can read the full scope of instructions contained in ROM.

Base Block Access
This test checks the instructions located in the low-level bytes of ROM.

Toolbox Call Access
This test passes several toolbox calls to the system verifying that the system receives the proper response/reaction from ROM.

Controls & Displays

Test Select
Allows selection of the tests to be run.

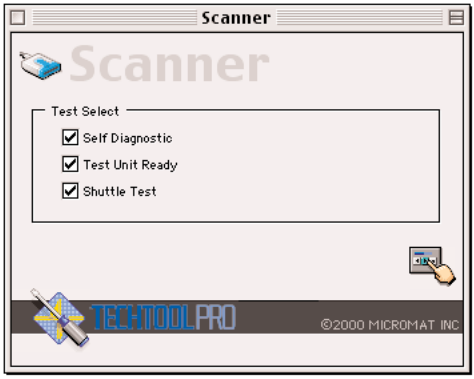
Control Button
Brings up the Control Palette.

Common Questions

Q: I've read elsewhere that ROM has routines that check itself at boot. Why would I need to test ROM with TechTool Pro.

A: One advantage would be checking for thermal failure. When a computer is first powered up, all the components are at room temperature or cooler. As the machine warms up, the inside case can reach temperatures close to 100 degrees Fahrenheit. The ROM chips could pass self-tests when the system is cool, but once operational temperature has been attained, the ROM chips can fail.

Scanner Test



Scanners are a useful peripheral for many Macintosh users, particularly because the prices of scanners have been dramatically reduced over the years. The Scanner tests provided by *TechTool Pro* allow you to verify that a SCSI scanner is operating properly. This can help you answer the common question, "Is there a problem with my software or my scanner?"

Test & Function Descriptions

Self Diagnostic
This test initiates a self-diagnostic on the scanner. These routines are designed by the scanner manufacturer and provide insight into the operational condition of the unit.

Test Unit Ready
Determines whether the scanner is able and ready to receive commands.

Shuttle Test
This test checks the scanner to make sure that the optical mechanism within the scanner is moving and tracking correctly.

Controls & Displays

Test Select
Lists available scanner tests and allows selection of individual tests.

Control Button
Brings up the Control Palette.

Usage Notes

Before testing, be sure that the scanner you wish to test is a SCSI scanner and is attached to a SCSI port.

With the scanner attached, switch on the power to the scanner so it is recognized on the SCSI chain. Once the scanner has been booted, go to the *TechTool Pro* Scanner panel.

Your scanner should appear in the Device List. If not, confirm that the scanner is powered on. If the scanner was off, switch the power on, and then click the Rescan Devices button. This should make the scanner appear in the Device List and make it selectable for testing.

NOTE: In order to properly test a scanner, the scanner must support ANSI SCSI calls. If your scanner does not connect to a SCSI port, your scanner will not be suitable for testing with TechTool Pro.

Common Questions

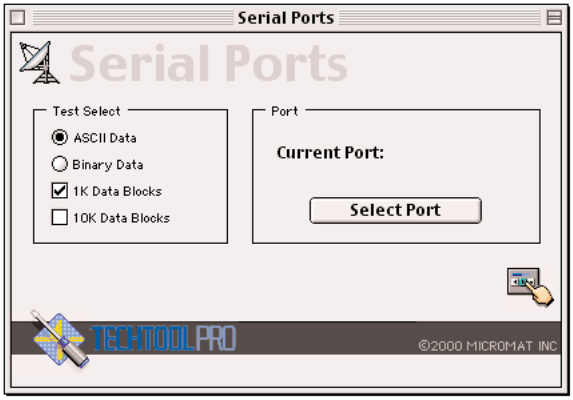
Q: I have my scanner attached appropriately and TechTool Pro says, "Sorry, no scanners were found." Why?

A: Make sure that the scanner is connected correctly and the scanner power switch is activated. Remember that if your scanner doesn't connect to the SCSI port of your computer, *TechTool Pro* will not be able to test it.

Q: I have a USB scanner. Will TechTool Pro test it?

A: Unfortunately, no. *TechTool Pro* can only check SCSI interface scanners at this time. We do plan to add this capability in the near future.

Serial Ports



The serial ports on your computer allow you to connect to modems, printers, local and wide area networks and a myriad of other serial-based devices. Besides the standard modem and printer ports, both of which are serial ports, many companies offer cards that plug into a NuBus, USB, or PCI expansion slot allowing you to have more serial ports.

Serial ports are very susceptible to damage. Should lightning strike nearby, a powerful static charge can travel through your phone line, through your modem, and right into your computer via the serial port. The result is usually a loss of one or more serial ports. These ports can also be damaged if an external device or cable plugged into the port has a short circuit.

TechTool Pro allows you to test any serial port on your computer. Using a Hayes-compatible modem or a loopback device, the program verifies incoming and outgoing serial transmission to verify proper operation of your serial ports.

Test & Function Descriptions

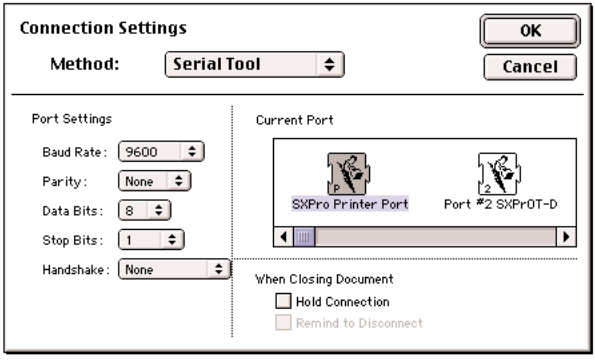
ASCII Data
Tests transmission and receipt of ASCII data. This is standard character data using only the lower 7 bits of each byte.

Binary Data
Tests transmission and receipt of binary data. This test uses all 8 bits of each byte.

1K Data Blocks
Transmits and receives data in 1024 bit (1K) chunks.

10K Blocks
Transmits and receives data in 10K chunks.

Select Port:
This button brings up the standard Port Selection dialog.



Use this dialog to choose the port you wish to test. All other selections should be set as above.

Controls & Displays

Test Select
Allows choice of the tests to be run.

Port
Allows selection of the port to be tested and as well as other port related parameters.

Control Button
Brings up the control palette.

Usage Notes
Before testing a port, you must attach a Hayes-compatible modem or a loopback device to the port you plan to test. (The Hayes modem standard is the most common one in use today and almost every modem available for the Macintosh is Hayes-compatible.) It is suggested that you power off the computer prior to disconnecting or connecting the modem to the port.

Be sure *Serial Tool* is selected from the *Method:* pull-down menu at the top of the Serial Port dialog. Select the port you wish to test and then click **OK**.

Common Questions

Q: I have a serial card plugged into my PCI slot, but when I attempt to configure the serial port test to check that port, I can't see my extra ports in the dialog box. How can I test my extra ports?

A: Most third-party serial port cards come with special driver software that is traditionally installed as an extension. If that software is not present, *TechTool Pro* (and any other software) has no way of knowing that the additional ports exist. Some vendors do not utilize the Communication Toolbox. *TechTool Pro* requires serial cards to be Communication Toolbox compliant in order to utilize the serial port test.

Q: I tested my Printer Port with my printer connected to that port and TechTool Pro results in failure. The printer seems to be working fine. Why would I be receiving this error?

A: *TechTool Pro* requires that you attach a Hayes-compatible modem or a loopback device to your printer port to test that port. *TechTool Pro* will send out signals and verify that the signal is reflected from the modem. Unfortunately, a printer won't mirror received commands.

Q: When I go to the Serial panel a message appears stating, "Communications ToolBox Missing." What is the Communications ToolBox and how do I get this to work?

A: The Communications ToolBox error is indicating that the Serial Tool extension (which is a part of *TechTool Pro* installation) is either not enabled, is missing or is damaged. Usually enabling the extension or reinstalling the Serial Tool from the *TechTool Pro* installer resolves this problem.

Q: Why is the Printer Port unavailable?

A: This is usually caused when AppleTalk is active and the computer is using a LocalTalk connection through the printer port. The printer port is dedicated to AppleTalk at startup, rendering the printer port as busy. Turning off or disabling AppleTalk resolves the issue.

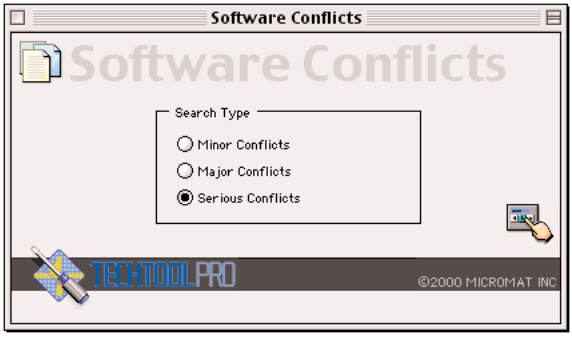
Q: Why is the Modem Port unavailable?

A: Usually fax software causes this to occur. Disabling the fax software resolves this issue.

Q: Can I check the port of my internal modem?

A: Yes. Use the **Select Port** button in the Serial Ports test and select the Internal Modem for the Current Port.

Software Conflicts



Software conflicts are actually a type of software bug—that is to say improperly written code. One program may fail to take into account the requirements of another program. Since the Macintosh operating system and all its software share the same memory space in the computer, it is possible for one program to interfere with the memory area used by another, inadvertently corrupting other programs' data and/or code. In addition, earlier versions of software may not work reliably with newer versions of the operating system itself due to changes made in the latter. All this can lead to a variety of problems—most notably freezes and crashes. The only solution is to not run conflicting programs simultaneously or to update your software to non-conflicting versions.

TechTool Pro maintains a regularly updated database of known software conflicts and will scan your volumes and alert you to known incompatibilities. This will alert you to software combinations on your computer that are incompatible. It will also allow you to check for updates that might resolve the conflict.

Test & Function Descriptions

Minor Conflicts
Searches for software combinations that may cause occasional system freezes or crashes.

Major Conflicts
Searches for software combinations that are incompatible and will cause a system crash or freeze.

Serious Conflicts
Searches for software conflicts that can result in serious damage such as data loss, inability to boot the computer, or other dire consequences.

Controls & Displays

Search Type
Allows you to choose the type of software conflicts *TechTool Pro* will search.

Control Button
Brings up the Control Palette.

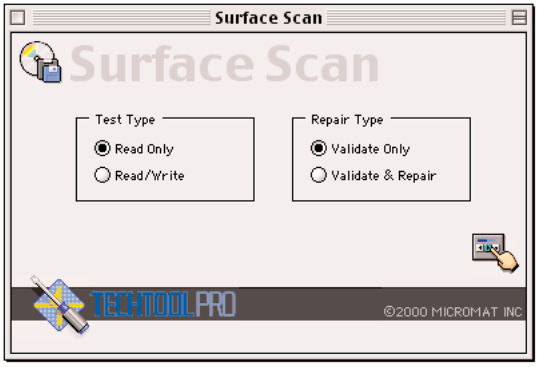
Usage Notes
To search for software conflicts simply choose the type of conflict you are interested in and choose RUN from the Control Palette. This will bring up the standard Volume Selection dialog so that you may choose the volume(s) on which you wish to find conflicts. Upon completion of the tests the standard Report will detail all the conflicts found.

It is recommended that you regularly update the *TechTool Pro* conflict database available at www.micromat.com.

Common Questions
Q: Will TechTool Pro find extension conflicts?

A: Once we receive and verify an extension conflict it will be added to the conflict database. *TechTool Pro* will not actively test your system for conflicts. It will only search your volumes and report known conflicts that are listed in the conflict database.

Surface Scan



Bad blocks are areas of media that cannot store data reliably. All hard disks have a few bad blocks when they are created, but these are “mapped-out” by the manufacturer and when the drive is formatted. Mapping out bad blocks prevents data from being written to these defective areas of the media. Occasionally a good block will go bad. If this occurs and a file resides on that block, the file may be damaged.

The Surface Scan panel of *TechTool Pro* will scan your drives for bad blocks. If any are located, *TechTool Pro* will instruct the file system of that device to map out that block so it is not used, which will prevent future data loss.

Controls & Displays

Test Type
You may choose between *Read Only* or *Read/Write*. The Read/Write test is more thorough.

Repair Type
You may choose to *Validate Only* or to *Validate & Repair*.

Control Button
Brings up the Control Palette.

Usage Notes
When you select **RUN** in the Control Palette you will be presented with the standard Volume selection dialog. This allows you to choose the volume(s) you wish to check.

Common Questions

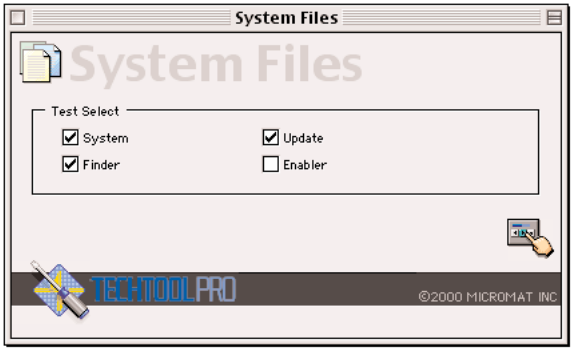
Q: I often get errors like, "Could not copy file because a disk error occurred." Could this problem be due to a bad block?

A: Probably. You should run the block scan in Validate and Repair mode and see if that corrects the problem. If not, there may be a problem with the drive mechanism itself. Try running the test(s) from the Drives panel. Also, this could be indicative of a SCSI error (if the drive is a SCSI drive.) Consider also running the SCSI chip test at the Components Panel.

Q: Why does the Surface Scan test always freeze in the same place?

A: If you have booted and run *TechTool Pro* from the CD and the surface scan test consistently freezes, then you probably have a bad block that is causing the test to fail. When *TechTool Pro* discovers a bad block it asks the disk driver to repair it. If for some reason the driver is unsuccessful, it may lock up and freeze the computer. If this happens, it is recommended that you backup your data and perform a low level format of the drive. This will remove **ALL** data from your drive.

System Files



The standard reply from Macintosh-advice givers to those seeking help with their Macintosh problems often seems to begin with, “Have you done a clean system install?” This is a valid question since many problems that plague Macintosh users stem from damaged or brutally modified System files. While reinstalling the System is not an extremely technical task, it is a time consuming chore that can be overwhelming to new users. Sometimes merely replacing the System file is not enough. Problems are not uncommon with the Finder file, System enablers, and System update files.

TechTool Pro offers you a better solution than blind replacement of critical System files. *TechTool Pro* looks at almost every resource within the files that make up the System and verifies the checksum and file offsets of each resource. In addition, it also inspects the checksum and offset of the file’s data fork. This is then compared to an internal database maintained by *TechTool Pro* called Software Profiles. This database was created by analyzing thousands of different System files from a broad base of Mac models.

Test & Function Descriptions

System File

Checks the System file located in the selected System Folder.

Update File

Checks System Update files. These files contain resources that supersede many of the resources of the System file. These are usually located in the main System Folder, but sometimes exist in the Extensions folder. Not all computers have or require an Update file. In that case the Update File option would not be available.

Finder File
Checks the Finder file located in the selected System folder.

Enabler File
Checks Enabler files. These files are much like System update files, but contain hardware specific resources. Enabler files allow Apple to release new hardware without the need to rewrite new System software for each new device. Enablers are usually located in the main System Folder, but sometimes reside in the Extensions folder. Not all computers have or require an Enabler file.

Controls & Displays

Test Select
Allows selection of the System files to be checked.

Control Button
Brings up the Control Palette.

Common Questions

*Q: I have other utilities that check my System file. What's different about TechTool Pro's **System File** check?*

A: Other programs can check the System file for structural damage. *TechTool Pro* also does this at the File Structures panel. These tests look for corrupt resource forks and incorrect drive file directory entries. This type of diagnosis is rudimentary at best and will usually only uncover System files damaged severely enough to prevent the computer from booting at all. *TechTool Pro* locates the more common and sinister problem of defective resources. Using the Software Profiles database, *TechTool Pro* knows (with exact numbers) what the resource and data structure of your System files should be.

*Q: Why is the **Enabler** test selection grayed out?*

A: There are a few reasons why one or more of the tests may not be available. Either you don't have the file (many machines don't use Enabler or Update files) or the Software Profiles database does not have an entry for the version of System files utilized by your machine. There is also the possibility that the Software Profiles database file has been moved and *TechTool Pro* cannot find it. Be sure that it is in the *Application Support Files* folder.

Q: Why are all my test select options at the File test panel grayed out?

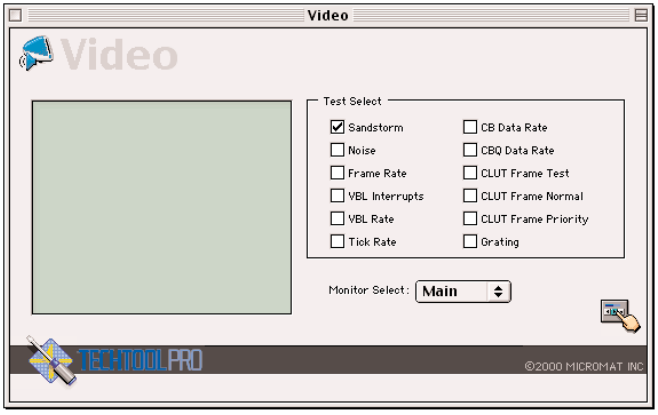
A: You are probably running a newer version of System software than is supported by the Software Profiles in your current version of *TechTool Pro*.

You can contact our Tech Support Department about this issue and/or check out our web site at http://www.micromat.com/ for any updates that we have posted to address new versions of the operating system.

Q: Why does TechTool Pro freeze during the System File tests?

A: This is not common. When it does occur it is usually due to a severely damaged System file. A clean installation of the System software should correct the problem.

Video



TechTool Pro tests the video circuitry of your computer. It does this whether it is embedded on the main logic board or it is a card located in a PDS, NuBus, or PCI expansion slot. This circuitry takes the binary information from the logic board of your computer and controls the pixels of your monitor. These display the text and graphics images that you ultimately see on the screen.

The problems that can occur with video circuitry are screen noise, improper screen updates, unbalanced color, flicker, or complete loss of all video signals. Sometimes these problems can be caused by the analog circuitry in the monitor or the cabling and connectors that interface the monitor to the computer's video circuitry. When trying to isolate video problems, it's important to locate the damaged portion of the display subsystem. *TechTool Pro's* Video tests will prove to be very helpful in testing the video components that lay between the monitor and the logical functions of the computer.

Test & Function Descriptions

Sandstorm
Communicates directly to the VDAC (video digital to analog converter) and generates a field of pixel noise.

Noise
Identical to the sand storm test, but uses a wider pixel field.

Frame Rate
Times the display frame rate of the video circuitry.

VBL Interrupts
Tests the VBL (vertical blanking loop) interrupt.

VBL Rate
Times the VBL rate.

Tick Rate
Tests the video tick rate time.

CB Data Rate
Tests the data rate of the CopyBits function.

CBQ Data Rate
Tests the data rate of the CopyBitsQuickly function.

CLUT Frame Test
Times the frame rate of the CLUT (color look up table) during high speed graphics.

CLUT Frame Normal
Times the frame rate of the CLUT during normal speed graphics.

Clut Frame Priority
Times the frame rate of the CLUT while video has interrupt priority.

Grating
Calculates and measures video timing during a grate calculation.

Controls & Displays

Display Screen
Shows the video output of some of the tests as they are running.

Test Select
Allows you to select the various video tests.

Monitor Select
Allows selection of the video circuit to be tested.

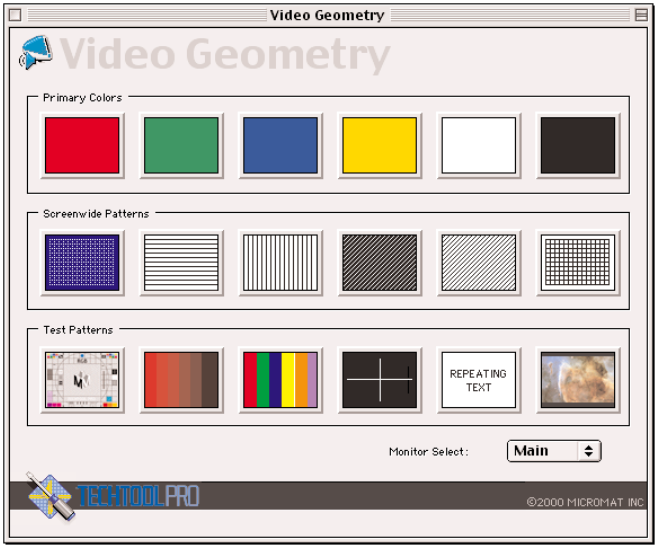
Control Button
Brings up the Control Palette.

Common Questions

Q: Sometimes my monitor flickers or goes black. Will this test help me find the problem?

A: It could if the problem is related to the video card or circuitry. There are other tests you should try if this one does not find the problem. The Component tests could help you determine whether this is being caused by a faulty VIA chip. The VRAM tests another important aspect of your video circuitry—the video memory. There is still the possibility that the problem lies in the analog circuitry in your monitor, which software-based diagnostics cannot test. Sometimes a problem like this is caused from something simple like a bad or incorrectly attached video cable. It might also be caused by incorrectly written software or software conflicts.

Video Geometry



Video geometry tests are often used by technicians to assist them in adjusting the internal controls of the monitor. These tests display patterns that make problems in adjustment readily apparent. Video geometry tests are also helpful in confirming a monitor's color output and for making adjustments with the front panel controls.

TechTool Pro offers a variety of different geometry test screens including TV test patterns, color sweeps, grids, and cross hatches.

Test & Function Descriptions

Red Screen
Paints the entire screen red.

Green Screen
Paints the entire screen green.

Blue Screen
Paints the entire screen blue.

Yellow Screen
Paints the entire screen yellow.

White
Paints the entire screen white.

Black
Paints the entire screen black.

White/Blue Grid
Displays a white dot grid on a blue background.

Rows
Paints black horizontal lines on a white background.

Columns
Paints black vertical lines on a white background.

White/Black Diagonal
Draws white diagonal lines on a black background.

Black/White Diagonal
Draws black diagonal lines on a white background.

Black/White Grid
Displays a black grid on a white background.

TV Test Pattern
Traditional TV test pattern.

Red Spectrum Color Sweep
Draws a horizontal red gradation.

Primary/Secondary Color Sweep
Displays several columns of primary and secondary colors.

Center Point
A cross hair that pinpoints the center of the screen.

Black Text
Small black text on a white background.

Custom Picture
Displays a reference picture.

Controls & Displays

Primary Colors
Displays a full screen primary color.

Screenwide Patterns
Displays a variety of full-screen patterns.

Test Patterns
A variety of patterns to help fine tune colors and font displays.

Monitor Select
Allows you to select the monitor that will display the test pattern on a multiple display system.

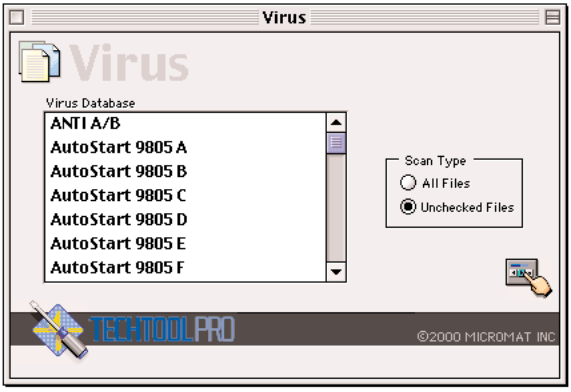
Usage Notes
Each button shows the pattern that will be displayed. Simply click on a button to display the test pattern. Click again to return to the Video Geometry panel.

You may designate your own picture for use in the *Custom Picture* test. The picture must be saved in **PICT** format with the name **Geometry Picture** and reside in the Application Support Files folder. The picture will be displayed actual size. It will not be scaled to fit in the window.

Common Questions
Q: The color on my monitor seems to be incorrect. Should I open it up and adjust the color controls?

A: The first thing to try is using the external color controls if your monitor provides them. Both Apple and other monitor vendors offer software solutions allowing you to adjust the color settings with software. If software color controls can't get your monitor closer to true color, you should have an experienced technician check the internal adjustments. Most color monitors have high voltage that can exceed 6000 volts. That's enough voltage to kill someone, or at least cause serious injury.

Virus



A virus is a program that attaches itself to other programs on a computer. In most cases it replicates itself and will often purposely cause damage to the system. Although viruses are not as common on the Macintosh as on some other platforms, new ones occasionally appear. If you are experiencing odd problems with your computer it is a good idea to perform a scan for viruses to eliminate them as a possible source of the problem—or to take corrective action if they are found.

Viruses can affect programs or data files. These include the System itself, applications such as your word processor or spreadsheet, and documents. Their presence is often manifested by intermittent problems such as crashes, odd messages displayed by the computer, strange sounds coming from the speakers, and shrinking disk space. Viruses and related programs generally invade your system when you load programs or documents from another source—either directly off a disk or from a network (including the Internet). It is a good idea to check new programs and files for viruses before opening or running them. Luckily there are not as many viruses written for the Macintosh as there are for some other systems. In addition, most Macintosh viruses tend to be of the harmless “joke” variety. However, they can still do damage, even if only inadvertently, and it is better to be safe and remove them from your computer if they are detected.

TechTool Pro will scan your system to look for viruses and their relatives. These include Trojan Horses and Worms. A true virus is parasitic (that is, it attaches to another program), replicates itself, and performs some other usually destructive task. A Trojan Horse is merely a program that misrepresents itself—it appears to be useful but actually performs some unexpected function. A Worm is a small

program that is not parasitic but simply replicates itself. When *TechTool Pro* detects any of these types of programs it will warn you and attempt to repair the file or render it harmless.

Test & Function Descriptions

All Files
Scans all files on the selected volume(s) for virus infection.

Unchecked Files
Scans only files on the selected volume(s) not checked since the last virus scan for virus infection.

Controls & Displays

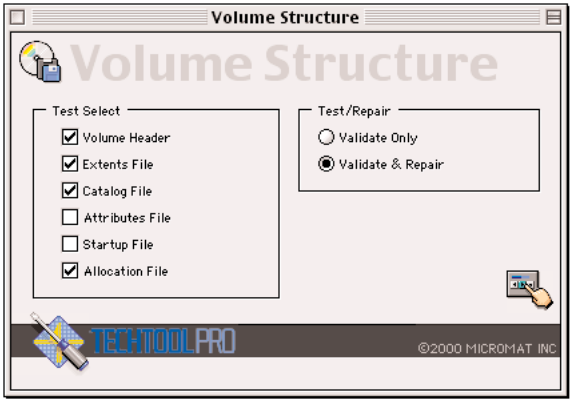
Virus Database
A list of all viruses checked for by *TechTool Pro*.

Scan Type
Allows the test to be run on all files or only files checked since the last scan.

Control Button.
Brings up the Control Palette.

Usage Notes
To check for viruses choose either to scan *All Files* or only *Unchecked Files*. Then choose **RUN** from the Control Palette. You will be presented with the standard Volume Selection dialog. Once you have selected the volume(s) to check, the tests will be run. Depending on your preferences settings, infected files will either be repaired if possible or moved to the *Infected Files* folder on the Desktop. A list of infected files will also be available in the standard Report. Note that the first time your run the virus function on a particular volume, ALL FILES on that volume will be checked regardless of whether you checked scan *All Files* or only *Unchecked Files*.

Volume Structure



There are a variety of invisible files, settings, and parameters that the Macintosh file system uses to locate files, free disk space, and for other maintenance and management routines. These are known collectively as the Volume Structures. The “Catalog” and “Disk Directory” are part of the volume structures. Damage to these critical data structures can result in lost or damaged files and may necessitate a complete reformat of the media. Reformatting a drive destroys **ALL** data on the media.

TechTool Pro can scan your volume(s) for problems related to the numerous structures that are necessary for the volume(s) to operate correctly. If problems are found, *TechTool Pro* can try to repair them. Before repairing volume structure problems, you should be sure to have any important data saved to another volume if possible. Use *TechTool Pro’s* data recovery routines if necessary.

Test & Function Descriptions

TechTool Pro can analyze and repair the following attributes of a volume:

Volume Header

This block of data is created when the volume is created and contains important data about the rest of the volume such as its name, number of files and folders, and the amount of free space available on the volume.

Extents File

This file contains the extent data for the entire volume. Extents are the separate components of a fragmented file.

Catalog File
This file keeps track of all the files and folders on the volume.

Attributes File
This file tracks all of the attributes of each file and folder on a volume. Some attributes include whether the file is locked or not.

Startup File
This parameter contains the information used by the computer ROM to determine what program will boot the computer. In almost every case, this will be configured to point to the System.

Allocation File
Acts as the main directory indicating the blocks that are allocated for use and the blocks that are free.

Controls & Displays

Test Select
Allows the selection of the tests to be run when validating a volume.

Test/Repair
Allows the choice to either validate only or to both validate and repair a volume.

Control Button
Brings up the Control Palette. When you select RUN you will be presented with the standard Volume Selection dialog so that you can select the volume to examine and/or repair.

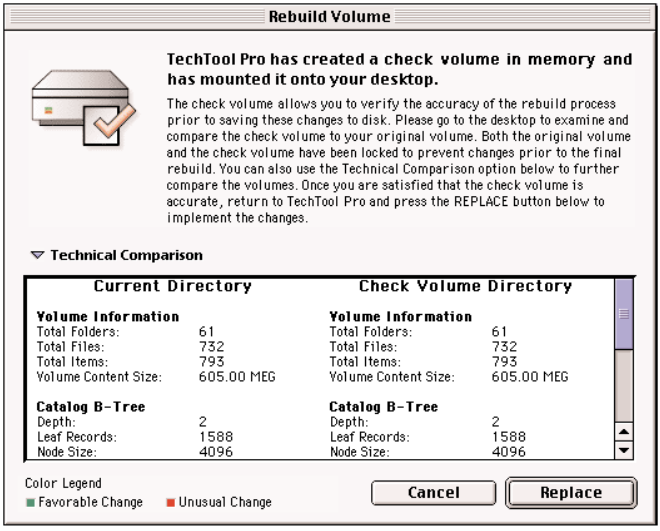
Usage Notes
Utilizing Validate & Repair is a helpful maintenance routine for several reasons:

- It can detect and correct small problems in the volume directory before they become large problems.
- Repairing the directory will create a smaller, optimized directory that can increase access speed on the volume and can shorten boot time for the computer.

Validate & Repair's *Check Volume* feature allows you to preview a volume repair prior to committing those changes to disk. *TechTool Pro* will mount a temporary icon of that volume onto the desktop using a newly created directory.

You can then open this "Check Volume" to inspect the contents and to help verify that no problems will occur if you accept the repair. Files, folders, and applications can be opened for inspection or copied to another volume from the Check Volume (however; changes to files on the volume cannot be made since both the original and Check Volume will be locked at this time). Once you are satisfied with the results, you can return to *TechTool Pro* and choose to make the repair permanent if desired.

To make comparing the original volume to the Check Volume easier, use the *Technical Comparison* feature.



The Technical Comparison runs in tandem with the Check Volume feature. As explained previously, the Check Volume is a temporary copy of what the

repaired volume will look like after repairs have been executed. The Technical Comparison option allows you to view technical data about the original volume and the Check Volume for further verification of volume integrity before opting to make the repair. Changes in the new directory are highlighted. Green indicates a normal change and red indicates an unusual change. Note that a red change is not necessarily a bad change. It is just a change that is unusual and suggests that you look closely at the Check Volume before committing to the repair.

Common Questions

Q: The volume select dialog says that the drive I want to repair is "not ready" for repairs. Why?

A: In order to repair a volume it is sometimes necessary to dismount it from the desktop. This means that the volume is no longer available for use by the System. There are three conditions that may prevent *TechTool Pro* from repairing a volume:

The drive contains the active System.
Since the computer needs constant access to the System files, the active System volume cannot be dismounted for repair operations. You'll need to boot from another volume such as the *TechTool Pro* CD.

The drive contains the TechTool Pro application.
TechTool Pro will not allow you to perform repair operations on the volume where *TechTool Pro* is located and currently running. You'll need to run *TechTool Pro* from another volume such as the *TechTool Pro* CD.

The drive has no media.
Removable drives, like Zip and DVD-RAM, will not be a selectable option if they do not have a disk cartridge in place. Insert the cartridge you wish to check and then click the **Scan for Missing Volumes** button in the standard Volume Selection dialog to update the volume list.

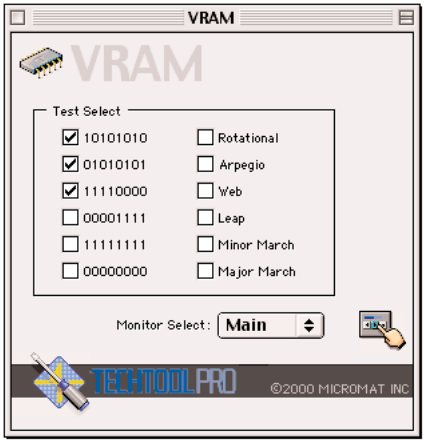
Q: My zip disk does not show up in the Volume List window so I cannot check or repair it. Why?

A: Verify that the zip disk is formatted for Macintosh. *TechTool Pro* can only work on HFS and HFS+ volumes. Zip disks are often sold preformatted in PC DOS format. The Macintosh can usually recognize and work with these disks because it contains PC translation software, however *TechTool Pro* will not recognize them since they use a foreign format. You can discover a disk's format by selecting the disk and choosing Get Info from the Finder's menu. The Get Info window will indicate the format of the disk.

Q: *After running Validate Only on one of my volumes, the Attributes File and Startup File tests report that they are unavailable. Why?*

A: These two areas of the volume structures are not currently fully implemented in Apple's HFS and HFS+ standards. If these structures are implemented then *TechTool Pro* will be able to test them.

VRAM



Video RAM, like the other critical components of your computer video circuitry, must always be fully functional for graphics to be correctly displayed. Damaged VRAM can cause missing bits, screen noise, system lock ups, or freezes. Some legacy computers, like the Macintosh IIci, allocate a portion of the standard RAM as VRAM. So while a VRAM test on a machine like this may appear to be redundant, *TechTool Pro's* wide matrix VRAM memory tests (like the web test) can still locate problems in the support components that control VRAM. Some third-party video boards have expandable memory that use conventional SIMM/DIMM sockets just like the main logic board. These types of boards can often have VRAM related problems due to improper installation or damaged SIMM/DIMM sockets.

Test & Function Descriptions

The VRAM panel employs the same memory testing routines that are used on the RAM test panel. For test details please refer to the *Test & Function Descriptions* area of the RAM test section.

Controls & Displays

Test Select

Allows you to select the various VRAM tests.

Monitor Select:
On multiple display systems allows you to select the monitor whose controlling VRAM will be checked.

Control Button
Brings up the Control Palette.

Usage Notes

If the VRAM test fails, try setting your monitor to 256 color mode and run the test again. This is a standard setting that will work for all video cards and will allow *TechTool Pro* to accurately check all the VRAM attached to the chosen monitor (including VRAM not currently accessed for the resolution and color depth being displayed). If the test still fails then the VRAM probably needs to be replaced.

When you use the VRAM test, you'll notice that the computer screen will be painted in different patterns that vary according to the current test. All links to the *TechTool Pro* interface, like the progress bar and mouse pointer, will no longer be visible. This occurs because VRAM is the memory that holds the pixel map that translates into the images seen on your screen. In writing directly to VRAM to perform the VRAM tests, *TechTool Pro* is literally "painting" over the memory that is normally used to display the interface.

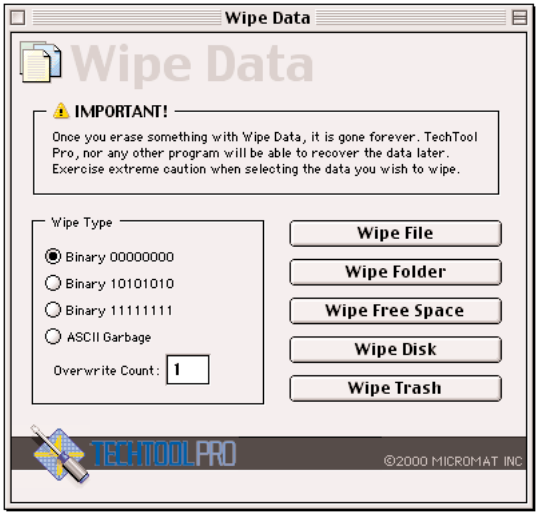
Since you cannot select the **STOP** button on the Control Palette while the tests are running, the VRAM test allows you to use the keyboard to stop testing. You can control the **STOP** button by pressing the space bar or by pressing and locking down the **Caps Lock** key.

Common Questions

Q: When I run the VRAM test at thousands or millions of colors, TechTool Pro says that my VRAM has failed some tests. However, when I run it at 256 colors the VRAM passes. Why?

A: Since all Macs and video cards can display 256 colors, *TechTool Pro* is calibrated to test correctly when the monitor depth is set to that resolution. Some manufacturers (both Apple and third-parties) use proprietary memory allocation techniques for settings above 256 colors (or 8-bit). Make sure that you have your monitor set to 256 colors before testing.

Wipe Data



When a file is saved to a disk an entry is made for the file in the disk's directory. This directory entry details where the pieces of the actual file are stored. When a file is deleted from the disk only its directory entry is deleted, the file data itself is still left on the drive and the locations occupied by the data are made available to be used to store other information. Until the data is overwritten by new information it is possible for the data to be recovered using a data recovery tool (such as *TechTool Pro*) or other software.

There are times when one needs to permanently delete a file for security reasons. To permanently delete the data from the drive it must be completely overwritten. This is the purpose of Wipe Data. *TechTool Pro* offers a variety of methods to securely overwrite the data. Once the data is overwritten by *TechTool Pro's* Wipe Data routines there is no possibility of recovering the data. Note that this feature works in tandem with the Trash Cache feature of the TechTool Protection extension set. A file that has been wiped will also be removed from Trash Cache if a copy of that file exists.

Test & Function Descriptions

Binary 00000000
Overwrites the file with all zeros.

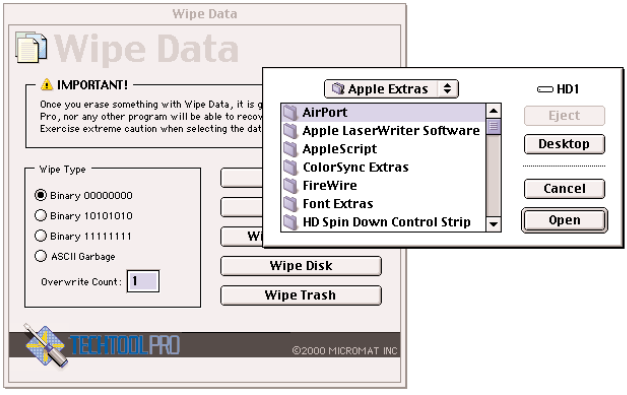
Binary 10101010
Overwrites the file with alternating ones and zeros.

Binary 11111111
Overwrites the file with all ones.

ASCII Garbage
Overwrites the file with pseudo-random pattern of zeros and ones. Helpful when trying to hide the fact that a file has been wiped.

Overwrite Count:
Indicates the number of times the pattern will overwrite the file data.

Wipe File
This button brings up a standard File Selection dialog so that you can choose the file to permanently delete. Once you have selected the file, pressing click the Wipe button will overwrite its contents with the selected pattern.



Wipe Folder
This is similar to Wipe File, except you will be prompted to choose a folder. The folder and its contents will be permanently deleted.

Wipe Free Space
This button brings up the standard Volume Selection dialog enabling you to choose to overwrite the free space with the selected pattern on that volume.

Wipe Disk
This button brings up the standard Volume Selection dialog so that you can choose a volume to completely overwrite with the selected pattern.

Note that this will completely erase the entire contents of the volume. There will be no chance of recovering the data using any standard means once this has been done.

Wipe Trash
This button will overwrite the contents of the Trash Can with the selected pattern.

Controls & Displays

Alert Box
A warning message about the irreversibility of the Wipe Data operations.

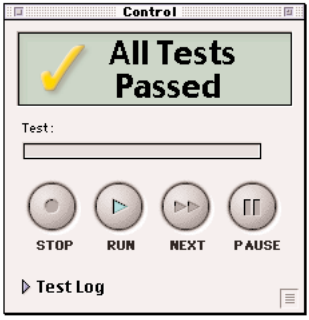
Wipe Type
Allows you to choose the data pattern to be used to overwrite the file and the number of times the data will be overwritten.

Usage Notes
Although overwriting the data once is normally sufficient to permanently erase the data, some government agencies specify that data must be overwritten a specific number of times to be considered securely deleted.

When you wipe a file, TechTool Pro will also check for a file with the same name in the Trash Cache and also overwrite that file if found. Once a file is overwritten it cannot be recovered.

Wipe Disk will permanently delete all files on the disk. They will not be able to be recovered so use this option with care.

Control Palette



The Control Palette allows you to operate the various *TechTool Pro* tests and gives you feedback about the progress and results. It is similar to a typical handheld remote control. The upper text box on the palette indicates the test panel in operation and will display general messages and final test results. Below this is a text box showing the exact test currently running from that panel. You may control test operations using the various buttons.

Controls & Displays

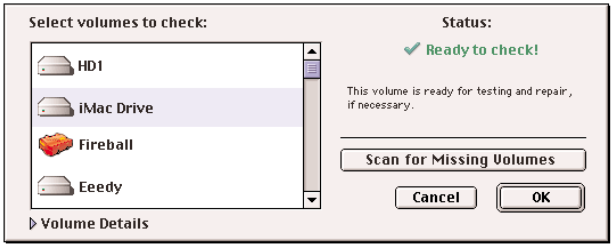
Feedback Panel
Displays information about the currently selected test set, about tests as they are executed, and whether or not the test(s) passed or failed.

Test
Displays the name of the current test.

Progress Bar
Graphically indicates the progress of the current test as it executes.

STOP
Halts all the tests selected in the current panel.

RUN
Runs the tests currently selected in the frontmost test panel. Many tests will require that a volume be selected prior to operation. In those cases a *standard Volume Dialog* may appear when you select **RUN**.



The following displays and controls are available in the dialog:

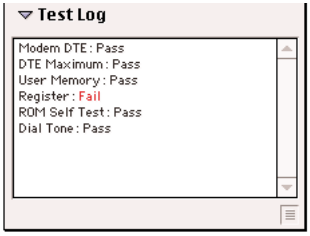
- **Select volumes to check** — Allows you to select the volumes where the the test will operate.
- **Status** — Indicates the status of the selected volume.
- **Scan for Missing Volumes** — This button will rescan for available volumes. Try this if a volume does not appear in the volume list.
- **Volume Details** — The Volume Details disclosure triangle will open a window showing important technical information about the selected drive.
- **OK** – Clicking this button will accept the current choices and begin running the tests.
- **CANCEL** – Clicking this button will return you to the test panel.

Note: These options may vary depending on the test panel.

NEXT
Aborts the current test and proceeds to the next test.

PAUSE
Temporarily halts operation of the current test.

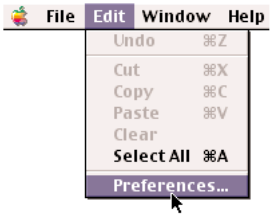
Test Log



There is a progress log kept as the tests are run. The log is revealed by clicking the **Test Log** disclosure triangle. The log provides feedback about the success or failure of the tests.

TechTool Pro Preferences

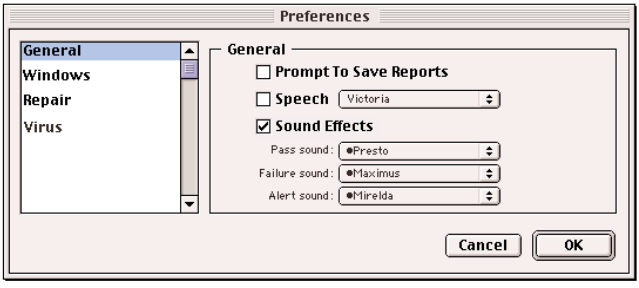
The *TechTool Pro* Preferences dialog allows you to configure and save a number of program settings. It lets you customize the operation of *TechTool Pro* to your liking. The Preferences dialog is accessed via *TechTool Pro's* Edit menu.



The Preferences window consists of four sections: *General, Windows, Repair,* and *Virus*. The options in each section may be selected/deselected by checking/unchecking the appropriate box.

Do note that *TechTool Pro* is a dynamic program under continuous development. As new features are added and old features improved, these options may vary from what is described in this manual.

General



Prompt to Save Reports

If selected, you will be prompted for a name and location to save the *TechTool Pro* reports when you quit the program. Otherwise, reports will not be saved.

Speech

Allows you to enable or disable the speech feature of *TechTool Pro*. When active, the program will speak test information using the Text-To-Speech features of the Macintosh. You'll need to have Text-To-Speech installed and active. Text-To-Speech is not included in the *TechTool Pro* installation, but is available directly

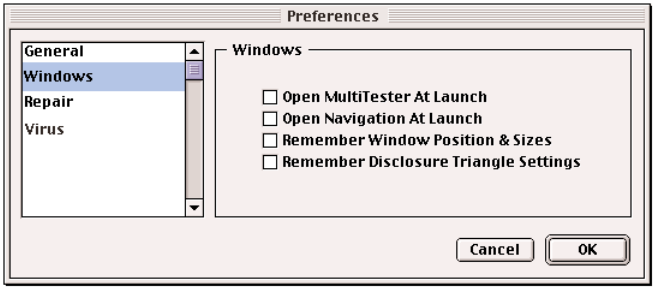
from Apple or from your Macintosh OS installer CD-ROM. The Voice: popup menu lets you select the voice used by *TechTool Pro*.

Sound Effects

Allows you to disable and enable *TechTool Pro* control sounds.

Several pull-down menus allow you to select the sounds that will be used for tests passed, tests failed, and general alerts. Sounds included with *TechTool Pro* will be preceded with a bullet "•" character. These menus will also list and allow you to alternately use sounds installed in your System file. If you wish to use custom sounds with *TechTool Pro*, simply add them to your system file. Next time the program is launched, you'll find them available in this preference screen.

Windows



Open MultiTester At Launch

When selected the MultiTester panel will be opened automatically at launch. This lets you easily run the MultiTester suite of tests with one click of the mouse.

Open Navigation At Launch

When selected the Navigation Window will be opened automatically at launch.

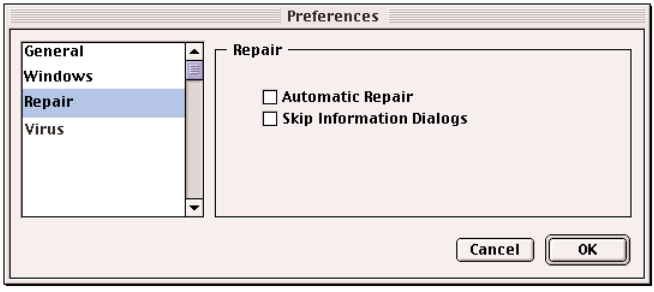
Remember Window Positions & Sizes

When selected *TechTool Pro* will remember and use the current positions and sizes of the *TechTool Pro* windows. This allows you to customize your window arrangement and use it each time you launch *TechTool Pro*.

Remember Disclosure Triangle Settings

The current setting (open/closed) of Disclosure Triangles will be remembered between sessions.

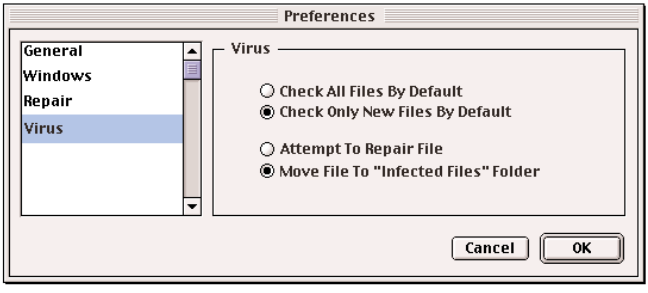
Repair



Automatic Repair
When selected repairs will be made automatically. Otherwise, you will be prompted before repairs are attempted.

Skip Information Dialogs
When selected the Information Dialogs will not be presented and *TechTool Pro* will continue automatically. Otherwise, *TechTool Pro* will stop and display the dialogs.

Virus



Check All Files by Default
Automatically checks all files when running the virus scan.

Check Only New Files by Default
Checks only files added to the volume since the last virus scan.

Attempt to Repair File
If selected, when *TechTool Pro* finds an infected file it will try to repair the file if possible.

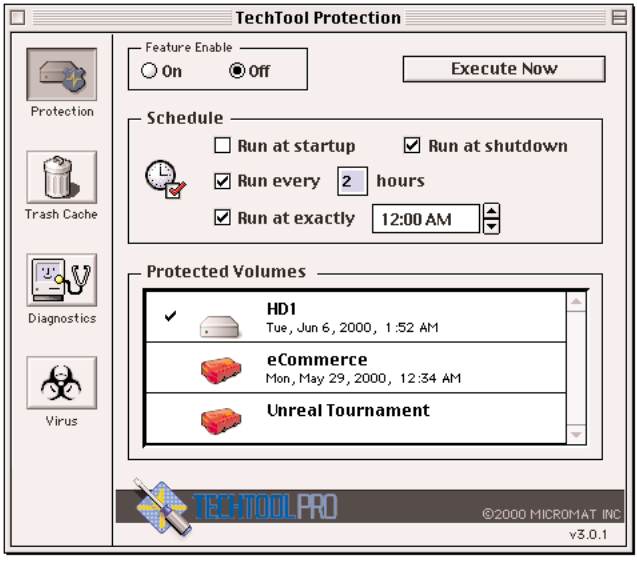
Move File to “Infected Files” Folder

If selected, this option will have *TechTool Pro* move any infected files it finds into the *Infected Files* folder on the Desktop.

TechTool Protection Control Panel

When *TechTool Pro* is installed, the TechTool Protection control panel and the Protection Extension are installed. They provide your computer with some automatic diagnostic and protection features. The control panel allows you to set up and configure the operation of the extension. There are four main sections in the control panel: Protection, Trash Cache, Diagnostics, and Virus. Clicking the appropriate button on the left of the control panel displays the configuration screen for that particular section.

Protection



The purpose of Protection is to periodically save “Protection Files.” These are invisible backup files of critical volume data. Protection Files can greatly assist the *TechTool Pro* application in recovering lost files or volumes. The Protection window allows you to choose the volumes you wish to protect. Be sure that each volume you choose to protect has a unique name. This is especially

important for removable media. By clicking on a volume's icon in the **Protected Volumes** window you may choose what volume(s) to protect and to which volume(s) you want to save the Protection File.

By opting to save to more than one volume, you increase the chances of having a valid Protection File available should you have a drive/volume failure.

By default, Protection is run at shutdown. However you may choose to run it at startup, at a predetermined time interval, or at a specific time every day. You may turn this feature off using the *Feature Enable* radio buttons if you wish.

Controls & Displays

Feature Enable

Allows you to enable or disable the Protection function by selecting the **On** or **Off** radio button.

Execute Now

Instructs TechTool Protection to immediately write the Protection File(s).

Schedule

Allows you to choose when the Protection File is automatically created.

- Run at startup—the file is created at startup.
- Run at shutdown—the file is created at shutdown.
- Run every X hours—the file is created at the interval specified.
- Run at exactly XX:XX—the file is created at the exact time specified.

Protected Volumes

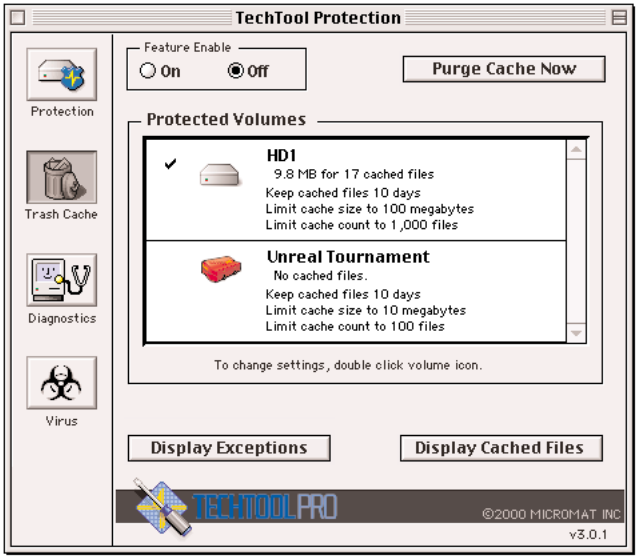
Indicates the available volume(s) and indicates by a checkmark the volume(s) for which Protection File(s) will be stored. When you click on one of the volume icons in the **Protected Volumes** window you will bring up the Protection File Location window.

Protection File Location

This window lets you select where the Protection File for a particular volume will be stored. Just place a check mark in the box beside each volume where you wish to save the Protection File. If your system has mulitple volumes, it is a good idea to store the Protection File on at least one drive other than the one being protected. That way, if there is serious damage to the drive itself, the Protection File may be available on another volume. Then when you use the Data Recovery options that rely on Protection data, all local volumes will be checked for Protection Files and the newest one found for that volume will be utilized.

Once you have selected the volume(s) (if any) to hold the Protection File(s) simply choose **OK** to accept the settings (or **Cancel** to return to the Protection window with the settings unchanged.)

Trash Cache



The Trash Cache provides you with an "undelete" feature. If you delete a file and empty the trash, then later decide that you want to retrieve the deleted file, you can simply open the TechTool Protection control panel and recover the lost file by dragging it to the desktop.

Since Trash Cache saves ALL deleted files, not just the ones that you manually delete, it's helpful for recovering lost work. Many programs create invisible "scratch" files as you work on a document. These are continually created and deleted, often irrespective of how frequently you actually saved your work. For example, imagine you spent many hours on a long document and neglected to use the SAVE command. Then your computer crashes or you experience a power failure. In most cases, your document would be lost forever. Even *TechTool Pro's* data recovery features couldn't help you because, technically, a file never existed in the first place. With Trash Cache, chances are good that you'll be able to retrieve your document's scratch file and salvage most, if not all, of your work. While the success of this feature is entirely dependent on the application in question and the nature of its scratch file, you might find that it provides that "last chance" you need to get back some important work.

Another benefit of Trash Cache is that, when used in conjunction with your normal trash can, it offers a kind of trash management system. The Trash Cache

section of the TechTool Protection control panel permits you to specify how often cached files are purged and how large the cache may become.

Controls & Displays

Feature Enable

Allows you to enable or disable the Trash Cache function by selecting the **On** or **Off** radio button.

Purge Cache Now

Allows you to immediately empty the Trash Cache. When selected, you will be presented with three options:

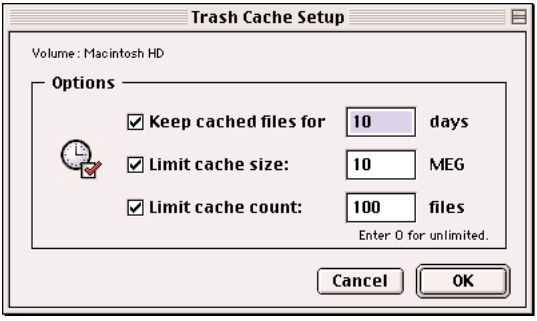
- Delete Now—the default option. Immediately and permanently deletes all items stored in the Trash Cache.
- Move to Trash—moves the items in the Trash Cache into the regular Finder Trash Can.
- Cancel—returns you to the Trash Cache configuration window.

Protected Volumes

This window is shown when you first choose Trash Cache and when you select the **Display Settings** button. It displays the available local volumes and indicates by a check mark the volumes for which Trash Cache is enabled. Beneath the volume name is a display showing the current size of the cache and the number of cached files. It also displays the current limits set for the Trash Cache for that volume. Double-clicking on a volume icon in the **Protected Volumes** window will bring up the Trash Cache Setup dialog.

Exceptions

Exceptions are files that will be ignored by Trash Cache. These files will **NOT** be cached and, hence; not recoverable using Trash Cache. This window is shown when you select the **Display Exceptions** button. The display lists the File Name, Type, and Creator of all current Exceptions. Exceptions are useful if there are particular files, or types of files, that you know you will never want to retrieve. By making them Exceptions, you will not take up cache space storing them.



Trash Cache Setup

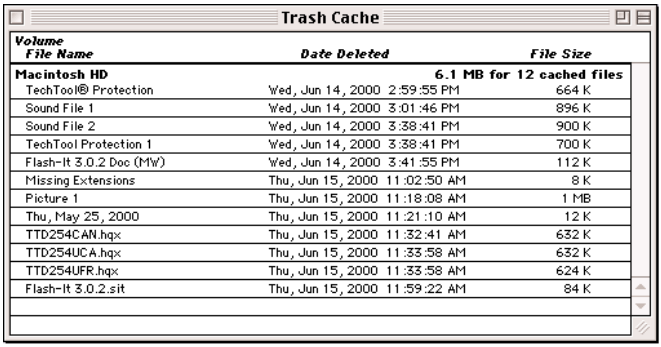
Allows you to configure the parameters that Trash Cache will use in determining how to maintain the cache. A checkbox by an option activates that option.

- **Keep cached files for X days**—lets you specify the maximum number of days to keep a file in the cache. A zero indicates an unlimited number of days.
- **Limit cache size to X MEG**—lets you specify the maximum size in megabytes for the Trash Cache. A zero indicates an unlimited size.
- **Limit cache count to X files**—lets you specify the maximum number of files that will be cached. A zero indicates an unlimited number of files.

Once you have set up Trash Cache to your liking, simply choose OK to accept the settings (or Cancel to return to the Trash Cache window with the settings unchanged).

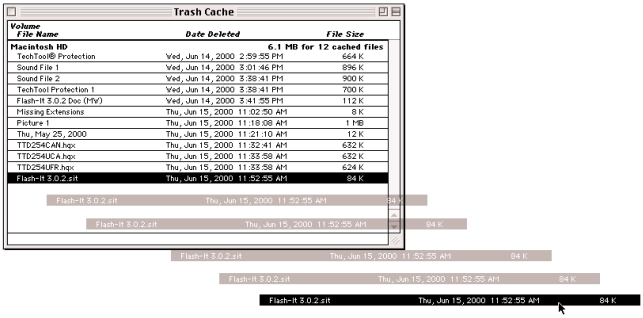
If any of the above parameters is enabled and its limits are exceeded, then the oldest items will be deleted from the Trash Cache to make more room. The settings for the Trash Cache are very important. If you have a small drive, you might want to set a lower size limit for the cache. If you work with large files (such as digital photographs) and have a large drive, you might want to increase the cache size.

Display Cached Files

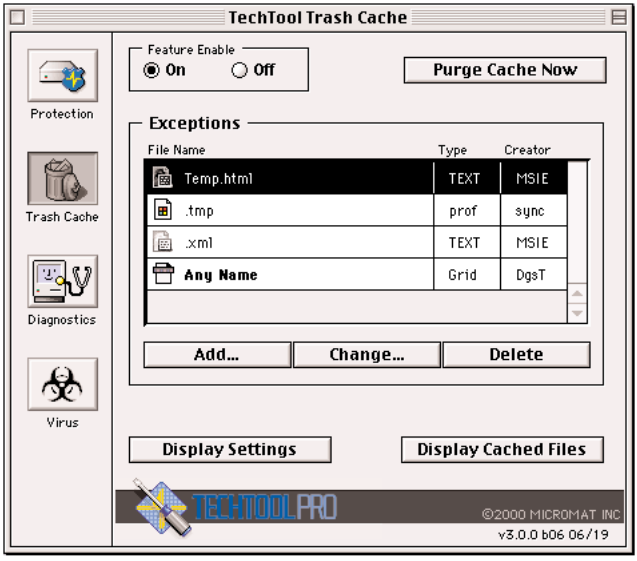


Gives a list of the files currently stored in the Trash Cache.

The file name, date of deletion, and size are shown. To retrieve a file, simply drag it from the Cached Files window and drop it onto the desktop.



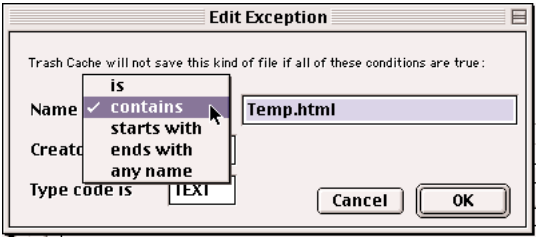
Display Exceptions



Alternates with the Display Settings button. Shows a list of files that the Trash Cache will ignore. It is sometimes useful to avoid caching files made by certain applications so as not to unnecessarily fill the cache with items you would never want to recover. To make an Exception, just drag a file into the Exceptions Window. You may drag a file directly from the Cached Files window into the Exceptions window if you desire.

The window contains three buttons:

- **Add…**—presents a file selection dialog so that you can choose a file to make into an Exception.
- **Delete**—deletes the currently selected Exception.
- **Change…**—brings up the Edit Exception window so that you may alter the parameters for an Exception.



Edit Exception

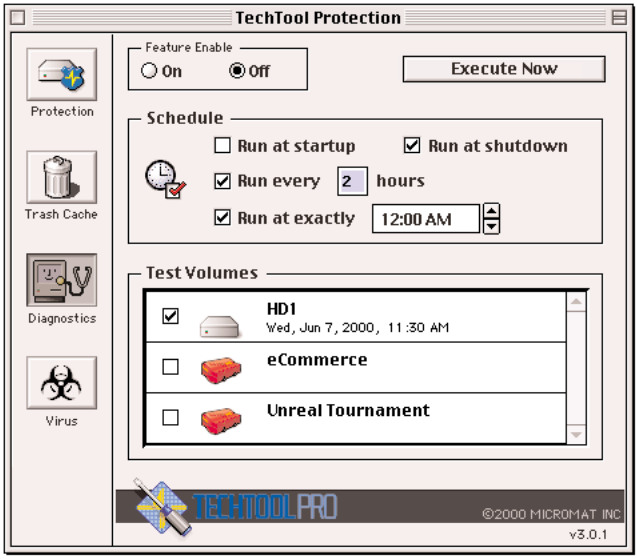
The *Name* popup in the Edit Exception window allows you to specify how the file you chose is to be treated. You may choose name “is,” “contains,” “starts with,” “ends with,” or “any name.” “Any name” is useful if you want to make an exception for any file of a certain type created by a certain application. “Ends with” is useful to make an exception for files created by a certain application that end with a certain extension, such as “temp.” You may also directly edit the Creator Code and Type Code by entering the desired code in the appropriate field.

When finished click **OK** to accept the changes (or click **Cancel** to return to the Display Exceptions window without making any changes.)

Display Settings

Alternates with the **Display Exceptions** button. Takes you back to the *Protected Volumes* display.

Diagnostics



This feature adds some automation to the *TechTool Pro* suite. It runs a quick check of your volume structures and alerts you to any problems so that you can deal with them before they get out of hand. While this check is not as robust as the tests in the *TechTool Pro* application, it will find many problems that may surface and will suggest that you run the *TechTool Pro* application to correct the problems that were found.

Controls & Displays

Feature Enable
Allows you to enable or disable the Diagnostics function by selecting the On or Off radio button.

Execute Now
Allows you to run the Diagnostics immediately.

Schedule
Allows you to choose when the diagnostic test is executed.

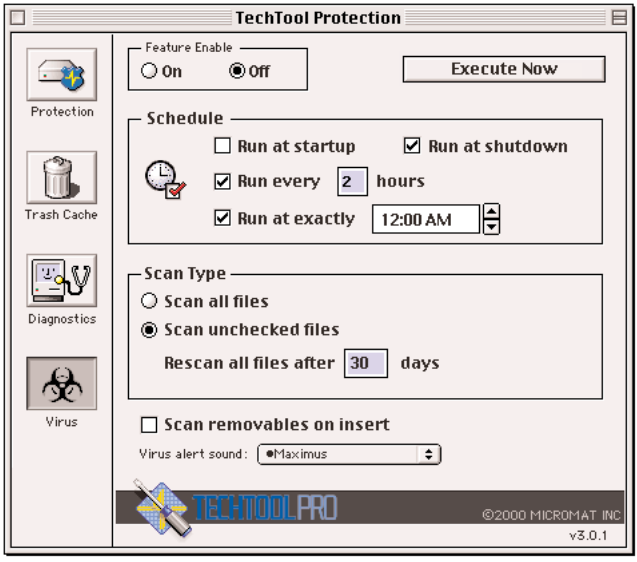
- **Run at startup**—if checked, Diagnostics are executed at startup.

- **Run at shutdown**— if checked, Diagnostics are executed at shutdown.
- **Run every X hours**—Diagnostics are performed at the interval specified.
- **Run at exactly XX:XX**—Diagnostics are performed at the exact time specified.

Test Volumes

Displays the available local volume(s). A check in the box before the volume icon indicates that Diagnostics will be performed on that volume. Uncheck the box to disable it. A date beneath the volume name shows the last time a diagnostic was performed. If the date is shown in red, then a problem was found when the diagnostics were performed on that date.

Virus



The Virus section of TechTool Protection allows you to regularly scan your volume(s) for virus infection and to configure *TechTool Pro's* automatic virus scanning routines. For more information about viruses, refer to the information in the Reference section of this manual under the Virus panel.

Controls & Displays

Feature Enable

Allows you to enable or disable the Virus function by selecting the **On** or **Off** radio button.

Execute Now

Runs the Virus scan immediately. The files that are checked will be determined by the settings in the *Scan Type* display.

Schedule

Allows you to choose when the virus scan is performed.

- **Run at startup**—if checked a virus scan is performed at startup.
- **Run at shutdown**—if checked a virus scan is performed at shutdown.
- **Run every X hours**—Virus scanning is performed at the interval specified.
- **Run at exactly XX:XX**—Virus scanning is performed at the exact time specified.

Scan Type

The following controls allow you to determine when the virus scanning routines will be performed:

- **Scan all files**—all files on the selected volume(s) will be scanned
- **Scan unchecked files**—only files that have not been previously scanned will be checked. This will include files that have been changed since the last scan.
- **Rescan all files after X days**—lets you specify how frequently to rescan all files for viruses. This feature is only enabled when the Scan Unchecked Files option is selected.

Scan removables on insert

If this box is checked, then all removable media will be scanned whenever inserted.

Virus Alert Sound

Allows you to select which alert sound (if any) will be played when a virus is discovered.

A pull-down menu allows you to select which sound will be used for the virus alert. Sounds included with *TechTool Pro* will be proceeded with a bullet "•" character. This menu will also list and allow you to alternately use sounds installed in your System file. If you wish to use a custom sound, simply add it to your System file as you would any other System alert sound. Next time the control panel is open, you'll find it available in this menu.

Problems and Solutions Using TechTool Pro

Problems and Solutions Using TechTool Pro

TechTool Pro can help you detect and cure a wide variety of problems that occur on the Macintosh. Here are some usage tips listed by symptom.

Flashing question mark at startup

When the computer refuses to boot and the screen displays a flashing question mark, it means that your computer is not finding a valid System Folder from which to boot. If this happens, then you should startup the computer using your *TechTool Pro* CD. If your hard drive icon mounts on the desktop, then copy any files you do not have backed up onto another drive just in case you have a drive problem. If the hard drive icon does not show up, then use the data recovery options in *TechTool Pro* to try to recover the files. Next check the volume structures in the Volume Structure panel and repair any problems that may be found. If problems were found and repaired successfully, then try starting up from your hard drive again. If no problems were found or if you still see the flashing question mark then you need to reinstall your system software. We recommend doing a "clean" install since this will put a fresh new System Folder on your drive. To do this, boot up from the Apple System CD, run the System Software Installer, and choose the option to do a "clean" install. The installer will rename your old System Folder and leave it on the drive. You should then be able to start up your computer from your hard drive and copy your third party extensions and control panels from the old System Folder into the new one.

Computer freezes at startup

There are a number of possible causes for a freeze during startup. These include corruption in the PRAM or Desktop Database files, software conflicts, and volume structure problems. First try to restart the computer with Extensions off (hold down the **shift** key at startup until you see the "Extensions Off" dialog box). If the computer starts up, then the problem is indeed an extension conflict. In that case, use the normal procedures to isolate extension problems. If the problem is not an extension conflict then start up your computer from the *TechTool Pro* CD and go to the PRAM panel and clear the PRAM. Next go to the Desktop panel and delete the Desktop. Finally, if the problem persists, go to the Volume Structures panel, check the volume structures and repair them if necessary (as always try to backup any important data first.)

Drive will not mount on the desktop

If your computer starts up but does not mount a hard drive on the desktop, then you should first attempt to save any files you don't have backed up. See "Recovering Files on a Damaged Drive" below. Once you have recovered what you can, go to the Volume Structures panel, select your drive, then choose

Validate & Repair, and *RUN*. If the repair is successful, your drive should be in good shape and should mount on the desktop. If the repair is unsuccessful, you should reformat the drive and reinstall your data.

Recovering files that have been deleted

If *TechTool Pro* was installed on your drive when the files were deleted, simply go to the *Control Panels* (under the Apple menu,) choose *TechTool Protection*, select the *Trash Cache* button, and *Display Cached Files*. Find the deleted files and drag them back to the desktop. If the Trash Cache was not enabled or the files were not in the cache, you should try to recover them by using the scavenge routines in the Data Recovery panel.

Recovering files on a damaged drive

If your drive/volume will not mount or if it has volume structure problems and you do not have all your important data backed up, you should try and recover your files before doing anything else. To do this you will need another drive/volume on which to save any recovered files (do not try to save recovered files back to the original drive/volume.) Boot up the computer and run *TechTool Pro* from the *TechTool Pro* CD. Go to the Data Recovery panel and try *Recover Files By Scanning Current Directory*. When prompted where to save recovered file(s) be sure that you choose your second drive/volume as the destination.

If this is not successful or there are more files that need to be recovered, check to see if there is a valid Protection File for your volume. You can determine this by looking under the hard drive icon in the Data Recovery window—if you see "Protected: <date>" then there is a Protection File made on the indicated date. You can then try *Recover Files Using Protection Data*. This routine will try to find files as of the date the Protection File was made. As a last resort use *Recover Files by Scavenging Volume*. Try all three Find File Methods for best results.

Intermittent crashes

Inexplicable and intermittent crashes at random times in different applications might be caused by an extension conflict, a virus, software conflicts, or faulty RAM. To try to resolve this, first try starting up with extensions off (hold down "shift" at startup until you see the "Extensions Off" dialog) and see if the problem is resolved. If not, then go to the Virus panel and check for viruses. If none are found, go to the Software Conflict panel and check for conflicts. Finally, check the RAM at the RAM panel. Since RAM is sensitive to temperature, you might want to check it just after start up when the computer is cold and after it has had a chance to warm up. To thoroughly check RAM, it is recommended that you startup and run *TechTool Pro* from the *TechTool Pro* CD. Choose the RAM panel and select all tests except the Major and Minor March.

Select the option to test *Full Memory*. This should thoroughly exercise the RAM and report any problems that are found.

Sluggish performance

If your computer's performance seems to be degrading over time, it is possible your hard drive is becoming highly fragmented or overly full. You should keep at least 15% free space on your drive to be safe. Then you can optimize your drive. Before optimizing, go to the Volume Structures panel and check it by running *Validate Only*. If problems are found, then repair them before doing optimization. To optimize your drive, simply go to *TechTool Pro's* Optimization panel, select the volume you wish to optimize, and click the *Optimize* button. (If you are using OS 9 then you will need to boot and run *TechTool Pro* from the *TechTool Pro* CD or some other volume in order to optimize.)

Generic or incorrect icons

If your file or application icons appear generic or are incorrect, then you probably have a corrupt Desktop Database file. To correct this problem, run *TechTool Pro* from the hard drive and choose the Desktop panel. Select *DELETE DESKTOP*. *TechTool Pro* will then delete the Desktop files and restart your computer. Upon restart the System will construct new Desktop Database files. If you still have a problem then open the Finder Info panel, choose *Bundle Bits* and *Custom Icons*, select *Validate and Repair*, and *RUN*.

Computer settings don't stay set

If settings such as mouse speed and startup disk are inexplicably changing, then you may have a problem with your PRAM. You should run the tests in the PRAM panel. If they pass then try clearing the PRAM and adjusting your settings. If they still do not stay set correctly then you may need to replace the PRAM battery in your computer.

Strange computer behavior

If your computer is making odd noises, displaying odd messages, or behaving in an otherwise puzzling manner, it may have become infected by a virus. Use *TechTool Pro's* virus checking tests to see if this is the problem.

Optimization will not complete

Sometimes optimization will not complete due to a lack of "contiguous space." *TechTool Pro* uses a very safe method of optimizing. It copies each file to a contiguous spot on the disk before deleting the original file. Hence, an interruption in the optimization process should not cause data loss. However; this means that there must be a large enough contiguous area of free space on

your drive to hold your largest file. If there is not, then you will need to temporarily move some files to another volume until there is enough contiguous space. Once optimization is complete, you can copy the files back.

Hard Drive space is disappearing

If the space on your volume does not get smaller when you empty files from the Trash, then it is possible your Trash Cache settings are too high. Go to the TechTool Protection control panel, choose **Trash Cache**, click on the icon for your volume, and adjust the settings as needed.

Making a TechTool Startup Volume

Interim updates for *TechTool Pro* are often available at *www.micromat.com*. Unfortunately, the updaters cannot update the *TechTool Pro* CD. They can only update the program installed on your hard drive. There are situations where you need to boot your system and run *TechTool Pro* from another volume, so that you can repair your normal startup drive. In that case, another startup volume will be needed. A *TechTool Pro* startup volume requires two items. The first is a minimal System Folder that will startup your computer (to minimize the possibility of extension conflicts.) And the second is the entire updated *TechTool Pro* program folder copied from your hard drive. (Do not copy the *TechTool Pro* extensions to the System Folder on your new startup volume.) If you are making a CD, be sure you choose the option to make the CD bootable when you burn it.

Alternatively, the latest version of *TechTool Pro* on bootable CD can be obtained from Micromat for a reasonable price to owners of the current release. This CD can be purchased online at *www.micromat.com* or directly from Micromat sales.

Troubleshooting TechTool Pro

Troubleshooting TechTool Pro

Computer does not startup from the CD

Check that the *TechTool Pro* CD is not dirty or scratched. Be sure you have the latest version of the CD to startup your model of Macintosh. To startup your computer from the *TechTool Pro* CD, insert the CD into the drive, restart the computer, and then hold down the "C" key during startup (until you see the *TechTool Pro* splash screen.) Please be patient because it takes much longer to boot from the CD than from the hard drive. If this does not work, try choosing the CD as the startup disk using the Startup Disk control panel. If problems still persist, try starting up again after unplugging all unnecessary USB and SCSI peripherals. Be sure to use the original Apple keyboard and mouse and to disconnect any third party mice, trackballs, etc.

Not enough RAM to boot from the CD

The *TechTool Pro* CD is a multi-system CD. It contains four System Folders. By default, the *TechTool Pro* CD chooses the proper *System Folder* according to your machine type. It will use the latest System supported by your computer. However, you may be running a PowerMac with System 7.5.3 and only have 16 MB of physical RAM installed. Since the machine is a Power Macintosh, the *TechTool Pro* CD will attempt the boot under Mac OS 9.0.4. Unfortunately, 16 MB of physical RAM will not boot Mac OS 9.0.4. Therefore; we have included a routine that allows you to select the *System Folder* that more closely matches your current situation.

Procedure:
When booted from an active system volume, go to the Startup Disk control panel in the *Control Panels* folder. With the *TechTool Pro* CD inserted in your CD drive and mounted on the desktop, choose the *TechTool Pro* CD as the startup disk in the control panel. Restart the computer and then hold down one of the number keys shown below (use the number keys above the letter keys, not the numeric key pad keys) to select the operating system from which you would like to boot:

1 key – System 7.5.5 will be used to boot during startup

2 key – System 7.6.1 will be used to boot during startup

3 key – System 8.1.0 will be used to boot during startup

4 key – System 9.0.4 will be used to boot during startup

This feature gives you better flexibility with machines that have a limited amount of physical RAM installed. Please keep in mind, that some machines may not support the version of the System that you are attempting to use to

boot. In this case, select the next higher version of the operating systems to boot your machine.

When you have completed the diagnostics and repairs while booted from the *TechTool Pro* CD-ROM, go to the Apple Menu and select the Startup Disk control panel. In the Startup Disk control panel select your normal startup volume. You should now be able to restart your machine and boot as normal.

Program will not accept the serial number

If the *TechTool Pro* application will not accept your serial number first make sure that you are using the correct number. The serial number is 14 digits in length, contains no alphabetic characters and begins with the number 7. If you are certain that you entered the number correctly, then it is possible that your program preferences have become corrupted. Go to the *TechTool Pro Prefs Folder* and delete the file "Application Prefs." Note that there may be a *TechTool Pro Prefs Folder* in the *TechTool Pro* program folder and in the System Folder's *Preferences* folder. In that case, delete the Application Prefs from the program folder itself. Rerun *TechTool Pro* and then enter the registration information again.

If you still have a problem with the above, restart the computer with extensions off, and then try entering the serial number. If none of these procedures help, please contact our technical support group.

Control Panel indicates serial number in use

If the TechTool Protection control panel will not open and gives you a message that the number is already in use, you should check to be sure that there is no other installation of *TechTool Pro* with the same serial number on your network. Although *TechTool Pro* can be used to diagnose and repair multiple computers, the license agreement allows it to be installed on only one computer at a time. You may purchase additional serial numbers directly from Micromat.

TechTool Pro crashes during testing

If *TechTool Pro* crashes while running a test, you may be experiencing an extension or software conflict. Be sure no other programs are running. Then try rerunning *TechTool Pro* after starting up with extensions off (hold down the "shift" key until you see the message "Extensions Off".) An even better solution is to start up and run *TechTool Pro* directly from the *TechTool Pro* CD. If *TechTool Pro* still crashes, see if you can determine which test is running when this occurs.

If the problem occurs during the Surface Scan test, then you probably have a bad block that the disk driver cannot lock out at this time. In this case, you should consider backing up your work and reformatting the drive. Use Apple's

Drive Setup (or other formatter) and choose the options to perform a “low level format” and “zero all data” if available. If the reformat is successful, then reinstall your data. Otherwise the drive should be replaced since the drive can no longer map out bad blocks.

If the freeze is during the RAM test, then it is possible that you actually have a RAM problem. Although *TechTool Pro* will normally complete the tests and give an error message if it finds RAM problems, there are situations where the fault is in just the wrong spot. This can cause TechTool to quit unexpectedly. If this happens, you may need to remove RAM modules and rerun the tests until you isolate the problem module(s).

Can’t select a volume for repair or optimization

TechTool Pro cannot repair (or under OS9 optimize) an active volume. These operations require that you both startup your computer and run *TechTool Pro* from another volume. The easiest way to do this is to boot and run *TechTool Pro* from the *TechTool Pro* CD. If, however; you have updated *TechTool Pro* and do not have the current CD, you can copy the updated *TechTool Pro* folder to another volume such as a zip disk. Then you can boot up from any CD that will start your computer and run *TechTool Pro* from the second volume. This should allow you to select your main drive to repair or optimize.

Glossary

Glossary

ADB: See Apple Desktop Bus.

Allocation File: This file in the volume structures keeps track of the blocks that are used and those that are free.

Apple Desktop Bus: The Apple Desktop Bus is a low speed serial bus that Apple established in 1987 for input devices to connect to the Macintosh. It is used mainly to connect a keyboard and mouse. The ADB protocol has been discontinued and Apple now relies exclusively on the USB protocol.

Apple Sound Chip: The Apple Sound Chip, or ASC, is a custom manufactured sound chip made for Apple by Sony. Often referred to as a DAC, or Digital to Analog Converter, the ASC provides the Macintosh with advanced sound creation capabilities.

AppleTalk: A protocol developed by Apple for networking computers and peripherals.

ASC: See Apple Sound Chip.

ASCII: American Standard Code for Information Interchange. A numeric ID assigned to every number, letter, or other symbol that enables different programs and different computers to consistently share information. The standard code consists of an 8-bit coded number.

ATA: See IDE/ATA

Attributes File: This file in the volume structures, if present, tracks the attributes of a file—such as whether the file is locked or not.

Backup: An exact copy of computer information. In case of data loss or corruption, the original data can be retrieved from the backup.

Benchmark Test: In a given configuration, the test used to evaluate the performance of computer software and hardware.

Bit: A bit is the smallest unit of information that can be stored by a computer. It is represented as a zero or a one.

Booting: The term booting originated from bootstrap. It is the process by which the computer starts itself and reads the Operating System. When you boot from a CD you are starting and reading the OS from the CD.

Bundle Bit: A bundle bit is a resource located in most Macintosh applications. If active, it indicates that the file contains icon information.

Bus: A bus is the path that transmits information between a computer and connected devices. An example is the USB bus, which connects the computer to USB devices such as keyboards and mice.

Byte: A byte is a unit of information stored in the computer. A byte consists of eight bits. An ASCII character consists of one byte.

Cache: A high-speed intermediate buffer memory that lies between the processor and main memory in the computer's memory hierarchy. It can reduce memory access time.

Catalog File: Part of the Volume Structures that keep track of the files and folders on a volume.

CDEV: see Control Panel Device.

Central Processor Unit: The Central Processor Unit or Main Processor Unit is a chip that maintains the processing and sequencing facilities for machine-related functions such as initial program booting and instruction execution.

Chip: A "chip," or Integrated Circuit, is a miniature electronic component with specialized functions within the computer.

Circuit: A conductor through which an electric current can flow; the entire course traversed by an electric current. Parts and components assembled to function together in an electric or electronic device or system.

Contiguous: Joining or touching in a continual, consecutive, unbroken order to a common edge or boundary.

Control Panel Device: A control panel device is a program used to control varying aspects of the Macintosh. They include the TechTool Protection control panel and the Sound control panel.

CPU: See Central Processing Unit.

CRT: CRT is an acronym for Cathode Ray Tube. It is the element that produces the image on most computer and television screens.

Device: A device is any piece of equipment that can be attached to a computer. These might include a monitor, disk drive, printer, etc. Devices are also known as peripherals.

DIMM: See Dual Inline Memory Module.

Directory: Another term for the volume structures.

Disk: A disk is a flat circular device for storing computer data. The data might be stored magnetically or optically. The most common disks are CD-ROM disks made of stiff, translucent plastic.

Disk Drive: A device for controlling and accessing data stored on a disk or disk stack.

Diskette: Also known as a floppy disk or Zip disk. It is a lower capacity, removable storage medium that holds data on a substrate with a magnetic coating.

Drive: A drive is a computer peripheral that stores data. It might use a tape cartridge, a disk, or other medium. A drive may be "read only" or "read/write."

Driver: A driver (or device driver) is software that lets a computer communicate with a device. When you purchase a new device, its driver is usually provided as part of the software that comes with it.

Dual Inline Memory Module: A DIMM, or Dual Inline Memory Module, is a memory unit used by the computer. It contains RAM chips mounted on a small printed circuit board that plugs into DIMM slots making for easy installation and removal.

Ethernet: A popular networking protocol originally developed at Xerox. Standard ethernet communicates at 10Mbps and fast ethernet communicates at 100Mbps.

Extension: An extension, at one time known as an INIT, is a piece of software that enhances the System. Extensions load after the System has booted but before the Finder has loaded. *TechTool Pro* installs the Protection Extension.

Extents File: This file in the volume structures contains the extent data for the volume. Extents are the separate components of a fragmented file.

File System: Every volume uses a file system to organize the information it stores. A file system keeps track of where files are located on the volume. The Macintosh typically uses either the HFS or HFS+ file system.

FireWire: FireWire is Apple's name for the high speed IEEE 1394 bus standard. It can handle data rates of up to 400Mbps and is commonly used to connect hard drives and video cameras to the Macintosh.

Firmware: This is software that has been permanently recorded into ROM (Read Only Memory). It is a cross between hardware and software.

GB: See Gigabyte.

Gigabyte: A Gigabyte consists of 1,024 Megabytes.

Hayes-Compatible Modem: Hayes-compatible modems are modems that adhere to the Hayes communications standards. Almost any analog modem you can purchase for the Macintosh will be Hayes-compatible.

Head: A mechanism that reads, writes, or erases data on a storage medium.

Head Crash: A Head Crash refers to contact between a read/write head and a floppy or a hard disk surface. This usually results in damage to the disk surface and loss of data.

HFS: HFS stands for Hierarchical Filing System and is also known as Macintosh OS Standard Format. It is a method of formatting storage devices for Macintosh computers.

HFS+: Macintosh OS Extended Format is a method of formatting storage devices attached to Macintosh computers. Compared to the earlier HFS it supports more files and increases the efficiency of storage on larger drives.

I/O: An acronym for input/output.

IDE/ATA: IDE stands for Integrated Device Electronics. These devices (sometimes called ATA devices) conform to the ATA (AT Attachment Standard) which specifies how peripherals communicate with the computer.

Initialize: Initialization is a process of preparing a storage medium to hold data. During initialization, the volume structures for a volume are created specifying locations for storing data. Initialization erases directory information. However; the data in files themselves may be left on the volume.

Kb: Kilobit or 1024 bits.

KB: Kilobyte or 1024 bytes.

Kbps: Kilobits per second.

KBps: Kilobytes per second.

LAN: See Local Area Network.

Local Area Network: A Local Area Network, or LAN, consists of a group of computers and peripherals in close proximity that have been set up so that they can communicate with one another. Macintosh computers usually connect via Ethernet or LocalTalk.

LocalTalk: A wiring protocol developed by Apple to network computers and peripherals. It transfers data at 275 Kbps.

Logic Board: The logic board is the main component of any computer system. It might even be called the brain of the computer since it contains all the parts necessary to perform the many calculations that computers perform. This is where the CPU, the memory, and the main components of the computer are located.

Low-Level Format: Low-level formatting removes and then recreates the markers that organize the data on a drive. All data on the drive is usually erased. Low-level formatting is usually followed by initializing.

Mandate: A term used to designate the “manufacture date” and “hours of use information” stored in the PRAM of some Macintosh computers. This information is no longer stored in the newer models.

Mb: See Megabit.

Mbps: Megabits per second.

MB: See Megabyte.

MBps: Megabytes per second.

MHz: See Megahertz.

Megabit: A unit of measure for storage capacity. One megabit is equivalent to 1,048,576 bits.

Megabyte: A unit of measure for storage capacity. One megabyte is equivalent to 1,048,576 bytes.

Megahertz: A measure of frequency—one million cycles per second.

Modem: Modem stands for Modulator/Demodulator. It is a device that converts between digital and analog signals so that your computer can send its digital data over the analog phone lines.

NuBus: NuBus is a communication protocol developed by Texas Instruments and is employed in many older Macintosh computers. It allows a universal expansion and interface method for inter-Macintosh compatibility. Apple has discontinued use of the NuBus format and now relies primarily on the PCI standard bus.

OS: OS stands for Operating System. This is the software that allows you to interact with your computer and that keeps track of files, peripherals, programs, networks, etc.

Parallel: Parallel, the converse of serial, is a method of transmitting simultaneous bits of information over a multi-paired connector. This is much faster than serial communication since multiple bits of data can be transmitted at once. The SCSI port is a parallel port.

Partition: Disks can be divided into subsections called partitions. The computer recognizes each partition as a separate unit (often called a volume.)

Parameter RAM: Also called PRAM. This is a dedicated chip that holds information that is vital to the Macintosh computer. A battery supplies power to the PRAM so that when the Macintosh is shut down it will retain this information. Information contained in this chip includes keyboard settings, mouse settings, and the startup device.

PCI: The standard bus on the newer Macintosh computers. It supersedes NuBus.

PRAM: See Parameter RAM.

PRAM Battery: The PRAM battery is a 3 to 4 1/2 volt battery that supplies the parameter RAM chip with power once the Macintosh has been turned off.

Protocol: A set of rules that dictate the operations of computers to allow them to communicate.

QuickDraw: QuickDraw is a group of programming routines located in the Macintosh ROM providing a consistent graphical-programming interface for the Macintosh.

RAM: See Random Access Memory.

Random Access Memory: RAM is an acronym for Random Access Memory. This is memory that stores the data and programs used by your computer. Its contents are lost when the computer is turned off. RAM generally comes in packages called DIMMs and SIMMs.

Read Only Memory: ROM is dedicated chips that permanently store information. In the Macintosh the chips contain operational routines that the computer employs. ROM does not lose its information when the power is turned off. The information is permanent and cannot be changed.

Refresh Rate: This is the rate at which an image is repeated on a display surface such as a monitor.

Resolution: A measurement of the sharpness of an image; either by the number of pixels or the number of lines and columns on the display screen.

RGB: RGB is a video format standing for Red, Green and Blue providing color images on a CRT. By combining different levels of the red, green, and blue signals almost any color can be displayed on a monitor.

ROM: See Read Only Memory.

Root Directory: The top level of a volume's directory. It may contain subdirectories (otherwise known as folders).

SCC: See Serial Communication Controller.

SCSI: See Small Computer System Interface.

SCSI Chip: The SCSI Chip allows the Macintosh to communicate with SCSI devices. Most Macintosh computers equipped with SCSI use the 8530 SCSI chip.

SCSI Conflict: A SCSI Conflict occurs when two or more SCSI devices share the same ID number on the same bus. This can keep the devices from working reliably or from working at all.

Sector: A Sector is a small portion of a disk drive's track and contains 512 bytes of data.

Serial: Serial is a communication format for sending information in consecutive bits of data, in contrast to parallel in which multiple bits of data are sent simultaneously. The advantage of using this format is that it requires less data lines, usually two, whereas parallel can require up to 50.

Serial Communication Controller: The Serial Communication Controller or SCC is an integrated circuit that supervises all serial processing on the Macintosh.

Small Computer System Interface: Also known as SCSI, this is a parallel interface standard that specifies how peripherals communicate with the computer. There are several varieties of SCSI. The transfer rate for standard SCSI built into SCSI-equipped Macs is 4MBps. The maximum rate for SCSI is 80MBps.

SIMM: See Single Inline Memory Module.

Single Inline Memory Module: A SIMM, or Single Inline Memory Module, is a memory unit used by the computer. It contains RAM chips mounted on a small printed circuit board that plugs into SIMM slots allowing for easy installation and removal.

Startup File: This file in the volume structures, if present, contains information used by the ROM to determine what program will boot the computer.

Termination: A technique of capping the end of a signal bus to prevent resonance from occurring within a signal. A SCSI bus requires a terminator at each end.

Trojan Horse: A Trojan Horse is a program that masquerades as a useful or desirable piece of software, but causes unintended effects.

USB: USB or Universal Serial Bus is a medium speed protocol for connecting devices to a computer. It has superseded ADB on Macintosh computers. USB is hot-swappable and has a maximum transfer rate of 12Mbps.

Versatile Interface Adapter: Versatile Interface Adapter or VIA is an integrated circuit used to control user input on the Macintosh. The VIA is attached to the ADB circuitry, as well as the NuBus, to control signal timing.

Virus: A Virus is a small self-replicating program that can invade your computer and cause problems with your system. Viruses attach to other programs; that is,

they are parasitic. If a virus enters your computer, it can cause strange behavior and ultimately crashes.

Volume: A volume refers to a logical storage unit seen by the computer as a single item. This may be a floppy disk, an entire hard drive, or a partition on a hard drive.

Volume Header: This portion of the volume structures contains important data about the volume as a whole. Included is the volume name, number of files and folders, and amount of free space.

Volume Structures: A collection of data structures on a volume that is used by the file system to organize the storage of data on the volume. They include the Volume Header and Catalog.

VRAM: VRAM, or Video RAM, is the memory that holds the information that is displayed on your computer's screen.

Worm: A Worm is a program that is similar to a virus. It is self-replicating, but not parasitic.