QuickBench™

**Disk benchmark utility which provides more than
70 different built-in disk performance measurements and a
powerful, highly customizable self-directed test.**

User's Guide

intech

Document Revision: 4.0.1

License Agreement
For One Computer

READ THE FOLLOWING SOFTWARE LICENSE AGREEMENT ("LICENSE") CAREFULLY, BEFORE YOU USE THE ACCOMPANYING SOFTWARE. BY INSTALLING OR USING THE SOFTWARE OR ANY OF THE MATERIALS ENCLOSED, YOU ARE AGREEING TO BE BOUND BY THE TERMS OF THIS LICENSE. IF YOU DO NOT WISH TO AGREE TO THE TERMS OF THIS LICENSE, (IF APPLICABLE) PROMPTLY RETURN THE UNUSED SOFTWARE TO THE PLACE WHERE YOU OBTAINED IT FOR A REFUND.

1. License. The software and documentation accompanying this License, known as the SpeedTools™ Utilities (Software), whether on disk, in read-only memory, or contained on any other media and the related documentation are licensed to you by Intech Software Corporation (Intech) and its Licensor(s). You own the disk on which the Software is recorded, but Intech retains title to the Software and related documentation. This license allows you to use the Software on a single computer and make one copy of the Software retained by you for backup purposes only. You may transfer your license rights of the Software and related documentation, the Software backup copy which you may have made, and a copy of this license to another person, provided the other person agrees to accept the terms of this license after reading its complete text and conditions.

2. Restrictions. You may not, in whole or part, copy, photocopy, reproduce, translate, reverse compile, disassemble, reverse engineer, reduce to any electronic or machine-readable form, or otherwise reduce to a human perceivable form (except for a backup copy, as stated in paragraph 1), the Software or related documentation without the prior written consent of Intech. You may not change, rent, lease, loan, distribute or create derivative works based upon the Software in any form, in whole or in part. This prohibition includes transmission of the Software over a network from one computer to another. THIS SOFTWARE IS NOT INTENDED FOR USE IN THE OPERATION OF NUCLEAR FACILITIES, AIRCRAFT NAVIGATION, COMMUNICATION SYSTEMS, OR AIR TRAFFIC CONTROL MACHINES IN WHICH CASE THE FAILURE OF THE SOFTWARE COULD LEAD TO DEATH, PERSONAL INJURY, OR SEVERE PHYSICAL OR ENVIRONMENTAL DAMAGE. Your rights under this License will terminate automatically without notice if you fail to comply with any term(s) of this License.

3. Service or Support. By using the Software and agreeing to this license, you understand and agree that Intech may not offer you any technical support regarding use of the Software or related products. Intech reserves the right to revise the Software and documentation without obligation to notify any person or organization of any such changes or revisions.

4. Warranty Disclaimer. By using the Software and agreeing to this license, you expressly acknowledge and agree that use of the Software is at your sole risk. The Software and related documentation are provided "AS IS" and without warranty of any kind. INTECH EXPRESSLY DISCLAIMS ALL WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. INTECH DOES NOT WARRANT THAT THE FUNCTIONS CONTAINED IN THE SOFTWARE WILL MEET YOUR REQUIREMENTS, OR THAT THE OPERATION OF THE SOFTWARE WILL BE UNINTERRUPTED OR ERROR-FREE, OR THAT DEFECTS IN THE SOFTWARE OR RELATED DOCUMENTATION WILL BE CORRECTED. NO ORAL OR WRITTEN STATEMENTS OR INFORMATION OR ADVICE PROVIDED BY A INTECH REPRESENTATIVE SHALL ESTABLISH A WARRANTY OR EXPAND THE SCOPE OR TERMS OF THIS WARRANTY. IF THE SOFTWARE IS DEFECTIVE, YOU WILL BE RESPONSIBLE FOR THE COST OF ALL NECESSARY SERVICING, REPAIRS, OR CORRECTIONS. Some jurisdictions do not allow for exclusion of implied warranties, so the above exclusion may not apply to you. The

Software may not work properly with modified versions of your computers operating system, certain resident software applications, or hardware that is not 100% compatible with that provided by the computers manufacturer.

5. Limited Warranty Regarding Media. Intech warrants that the diskette(s) on which the Software are recorded shall be free from defects in materials and workmanship under normal use for a period of ninety (90) days from the date of your purchase of the Software, as established by your receipt. Intech's entire liability, as well as your sole and exclusive remedy, will be replacement of the diskette(s) which are defective. The diskette(s) must be returned to Intech with a copy of your receipt. This warranty does not include diskette(s) damaged by accident, abuse, or misapplication. ANY IMPLIED WARRANTIES ON THE DISKETTE(S) ARE LIMITED TO A PERIOD OF NINETY (90) DAYS FROM THE DATE OF DELIVERY TO YOU. THIS LIMITATION INCLUDES IMPLIED WARRANTIES SUCH AS THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

6. Limitation on Liability. IN NO EVENT WILL INTECH BE LIABLE TO YOU FOR DIRECT, INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES ARISING FROM YOUR USE OR INABILITY TO USE THE SOFTWARE OR RELATED DOCUMENTATION, EVEN IF INTECH HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. INTECH SHALL HAVE NO LIABILITY FOR ANY HARDWARE, SOFTWARE OR DATA STORED OR USED IN CONJUNCTION WITH THE SOFTWARE, INCLUDING THE COSTS OF REPAIRING, REPLACING, OR RECOVERING SUCH HARDWARE, SOFTWARE OR DATA. Under no circumstances shall Intech's total liability to you for all damages, losses, and causes of action (whether in contract, tort (including negligence) or otherwise) exceed the amount paid by you to obtain the Software and related documentation.

7. Severability. Should a court of competent jurisdiction declare this license agreement, or any portion of this license agreement, to be unenforceable, that portion shall be enforced to the maximum extent possible so as to effectuate the intent of the parties, and the remainder of the agreement shall continue in full force and effect.

8. Complete Agreement. This license constitutes the entire agreement among the parties regarding the use of the Software and related documentation. This license agreement replaces and supersedes any prior understandings or agreements, whether oral or written. No contemporaneous understandings or agreements were entered into in conjunction with this license agreement. No change to this licensing agreement will be effective against Intech unless it is in writing and signed by an authorized representative of Intech Software Corporation.
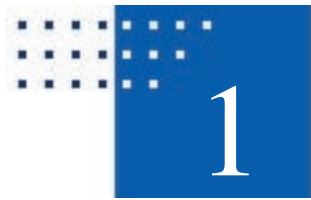
Table of Contents

1 Guide Introduction

About This Guide

The instructions and explanations in this guide assume that you understand how to operate your Macintosh computer. You should, for example, know how to choose, select, launch, and drag by using your mouse. In addition, you should also understand how the desktop, windows, dialog boxes, buttons and file/folders work within the Macintosh environment. For more information about these items, please refer to your Macintosh User's Guide.

Conventions Used In This Guide

Note: This symbol calls your attention to important information about the adjacent text. A note will always appear in standard print.

Warning: This symbol calls your attention to procedures in the adjacent text which can cause harm to you, your data or computer system. A warning will always appear in bold print.

User Registration

Please take a moment to register your copy of the SpeedTools™ software on-line via the Intech Software World Wide Web page at http://www.SpeedTools.com.

Technical Information

If you received this software with the purchase of a drive subsystem and you require technical support, Intech as made special arrangements with your drive manufacturer to support this software directly via their technical support department. For customers who have purchased this software product as stand-alone, Intech provides technical information and other late-breaking information via its web site at http://www.SpeedTools.com.

2 Using QuickBench

About QuickBench

The QuickBench application is a simple yet very powerful disk drive performance evaluation tool (a.k.a. Benchmarker) which has four main components: a "Standard" test suite which measures relatively small random and sequential read and write speeds; a "Large" and "Extended" test suite which measure two larger test size sets, and, lastly, a "Custom" test. The Custom Test allows you to design your own test according to your personal requirements. QuickBench is extremely safe since all tests are performed by reading and writing to temporary test files exclusively.

Note: QuickBench always presents byte sizes in powers of two. For example, a Kilobyte is considered to be 1024 (2^10) Bytes, NOT 1000 (10^3) Bytes. A Megabyte is considered to be 1024 Kilobytes, NOT 1000 Kilobytes, etc. Intech realizes that this is no longer the preferred nomenclature according to the U.S. National Institute of Standards and Technology. However, our rational to use this labeling system is simple: as long as Apple, Inc. continues to use this nomenclature, so will Intech. Intech believes this strategy is the least confusing to our customers.

Important Changes to QuickBench Version 4 - Please Read!

QuickBench version 4.0, released March, 2007, is the first revision since the very first version (1.0 for classic MacOS released April, 2000) to actually change existing benchmarking algorithms. All previous updates prior to 4.0 simply added new testing functions or options. As a result, QuickBench 4 results are not directly comparable to any previous version. By contrast, the results from all previous versions are directly comparable to one another, even between MacOS classic (OS 9.2.2 and earlier) and MacOS X versions of QuickBench.

Intech decided with version 4 to modify the original testing routines for one major reason: improve the test measurement consistency. We've improved both consistency of results between test sizes within an individual test, as well as consistency between test sizes from the different tests. We believe these changes were mandated by the amazing improvements in the sizes and sophistication of hard disk drive caches along with the corresponding improvements in bus interface speeds during the 7 years which have elapsed since the testing algorithms for QuickBench 1.0 were first developed.

One of the more important consequences of these changes is a corresponding increase in the test file sizes and time required for testing. The Standard test now requires 153 MB of free space (up from 20 MB). The Large test now requires 198 MB and the Extended requires 594 MB of free space, up from 20 MB and 200 MB, respectively.

Additionally, Intech made two more important changes separate and apart from new features: the 1K and 2K transfer sizes have been dropped from the Standard test and the Custom Test now performs streaming reads and writes only. We felt these changes reflect a more "real world" perspective and help keep QuickBench's interface as simple as possible.

Global Test Options: Asynchronous I/O and Cache Settings
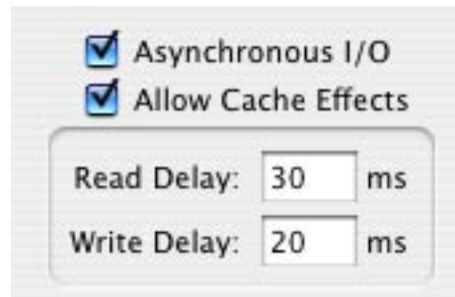

Figure 1. The Global Test Options

In the group box at the top of the main window containing the test volume information and the "Start" and "Cancel" buttons are two new check boxes: "Asynchronous I/O" and "Allow Cache Effects."

Asynchronous I/O - QuickBench uses standard file system calls to perform read and write speed measurements. Broadly speaking, there are two different modes in which these routines can be executed: synchronously and asynchronously. It is beyond the scope of this guide to explain the details of these concepts, but it is worth noting that some improvement in write speeds can sometimes be achieved by transferring data asynchronously, especially on faster devices.

Allow Cache Effects - Running a test with this box checked will result in a very short pause (delineated in milliseconds) between each transfer size being tested. A millisecond is a thousandth of a second.

Note that in the Standard Tests, these pauses will occur after every 1 MB of data transferred. Also, this setting is ignored during random testing.

Setting Read and Write Delay Values - When the "Allow Cache Effects" feature is enabled, these short pauses can have a dramatic, positive effect on measured drive speeds. Furthermore, optimizing these pause values can significantly improve measured peak performance. It is recommended to begin changing these values using 5 millisecond increments.

Read Ahead Delay - This setting controls how much time is provided to the drive between read requests allow the drive to anticipate the next read request and pre-fill its cache during

the pause. If the drive actually performs read ahead caching, some or all of the data will be ready to transfer directly from the cache when the next read request actually occurs, significantly improving performance.

Write Cache Delay - This setting controls how much time is provided to the drive between write requests. This allows the drive to commit data it may have stored in its write cache to the physical storage medium. This, in turn, frees the drive's write cache to be fully available for the next actual write request.

Only values between 1 and 1000 milliseconds are allowed for the read and write delays.

Per Test Option: Test Cycles

Test Cycles - A "Test Cycles" setting is available in every test mode. A new test cycle repeats the exact same test for as many cycles as are specified and calculates the simple mean average for each result. After 5 cycles, the low score for each transfer size is discarded. This helps compensate for, but does not fully prevent, occasional random system activity from interfering with the testing. See "Testing Tips" at the end of this document for a discussion on this and other issues affecting benchmark testing.

Since there is often a great degree of variance in speeds for any given single read or write, the addition of multiple test cycles can greatly assist in accurately and repeatability quantifying a drive's performance at a given task. This, in turn, sheds a much more consistent light on the comparison of the relative merits of one drive vs. another.

Test cycles are averaged by QuickBench on-the-fly, so each successive test cycle provides an increasingly accurate and repeatable picture of a drive's capabilities. In general, to increase the accuracy and repeatability of the test results choose a larger number of test cycles. But, of course, the more cycles chosen, the longer the test will take to complete.
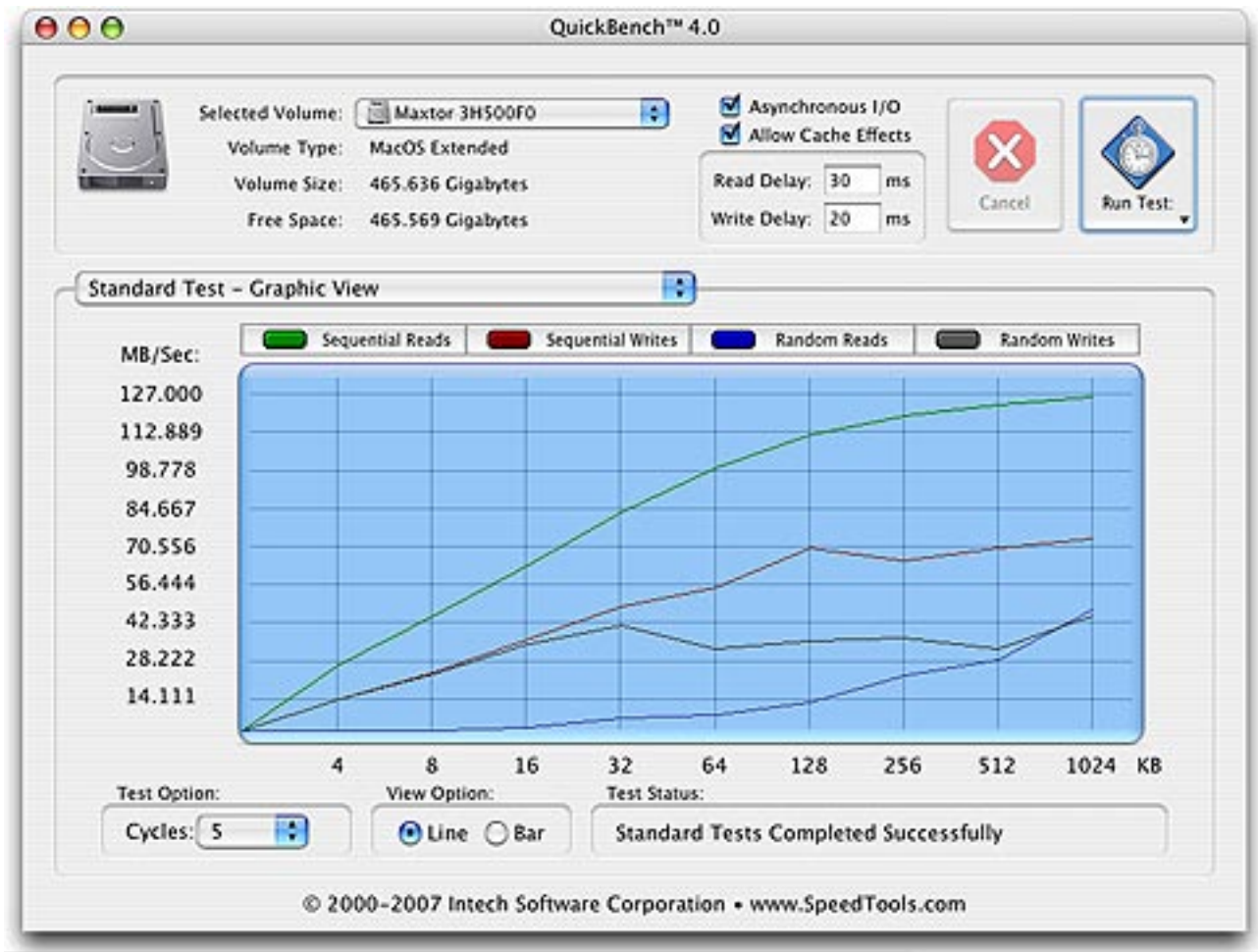
The Standard Test Suite

Figure 1. **The QuickBench Standard Test (Graphical View)**

The Standard Test suite measures nine different data transfer sizes under four different scenarios for up to 100 cycles: Sequential Reads, Sequential Writes, Random Reads and Random Writes. The test results reflect the following influences: the drive's internal media transfer rate, seek time and cache efficiency, the efficiency of the various drivers controlling the drive and, lastly, the speed of the bus interface connecting your drive to your Macintosh. QuickBench makes every attempt to limit the influence of the MacOS file system cache because, in our view, the MacOS's cache makes it too difficult to determine the drive's true performance.

The Standard Test suite can be run while displaying the results in either a graphical representation or a sortable numeric representation (which shows measured speeds with much greater precision). Note that the graphical and numeric views perform exactly the same tests, but just display the results differently. In graphical mode, one test option, "Test Cycles," and one view option, "Line vs. Bar" chart, are available. In numeric mode, only the "Test Cycles" option applies. The "Test Cycles" option applies to both the graphical and numeric modes.
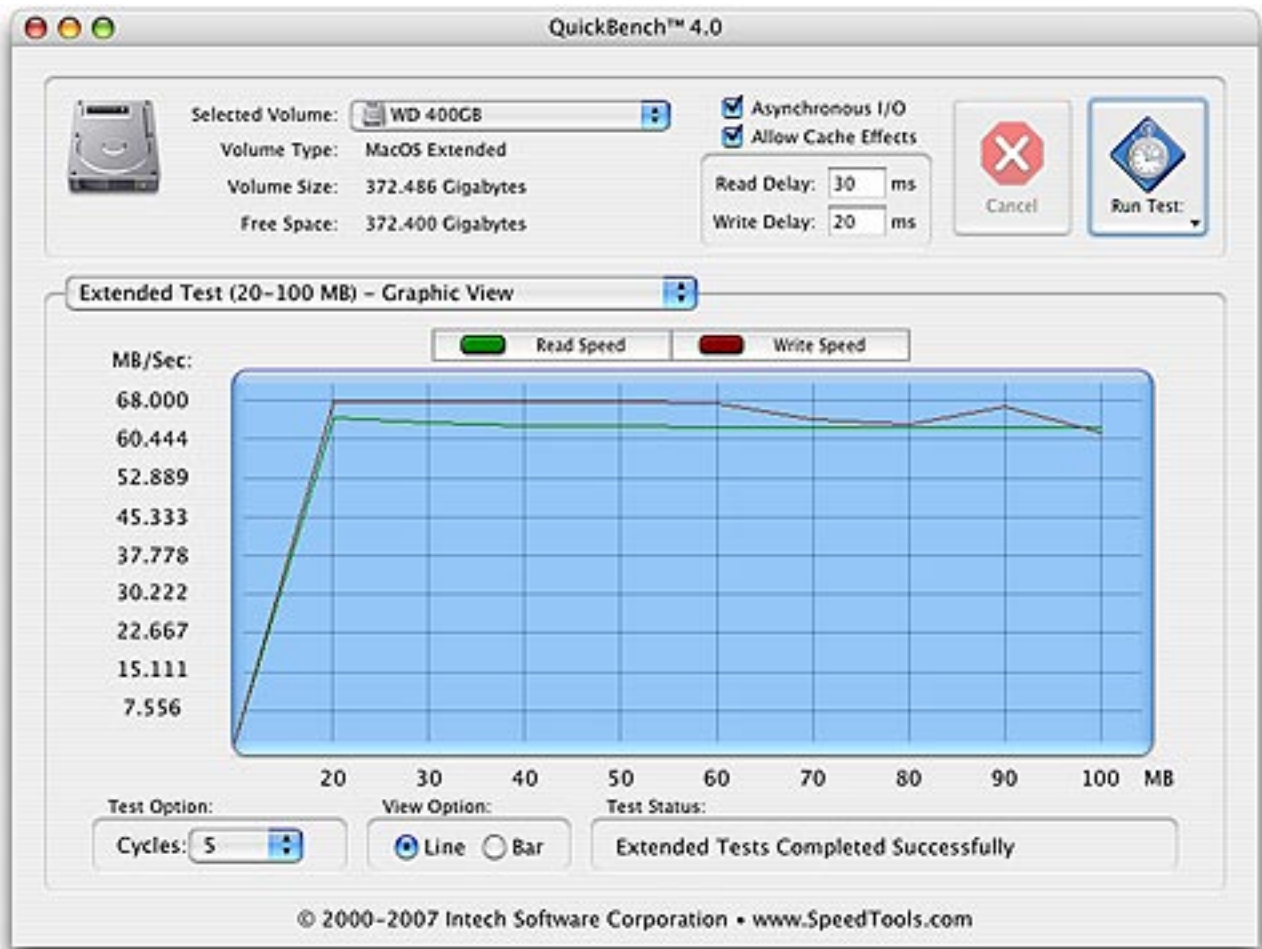
Large & Extended Tests

Figure 2. The QuickBench Extended Test (Graphical View)

The Large & Extended Tests are provided to measure the drive's ability to sustain large amounts of data transferred to and from your Macintosh. The Large test measures transfer sizes from 2 through 10 MB in size. The Extended test measures 20 through 100 MB transfers. Note that, as opposed to the Standard Tests, both the Large and Extended tests are not a series of sequential reads and writes averaged together. Each transfer size test consists of only a single read or write of the test transfer size. However, each transfer size is tested sequentially relative to the previous transfer size so that the same area of the disk is not accessed more than once within a single read or write test set. This helps prevent drives with very large caches from receiving an unfair advantage.
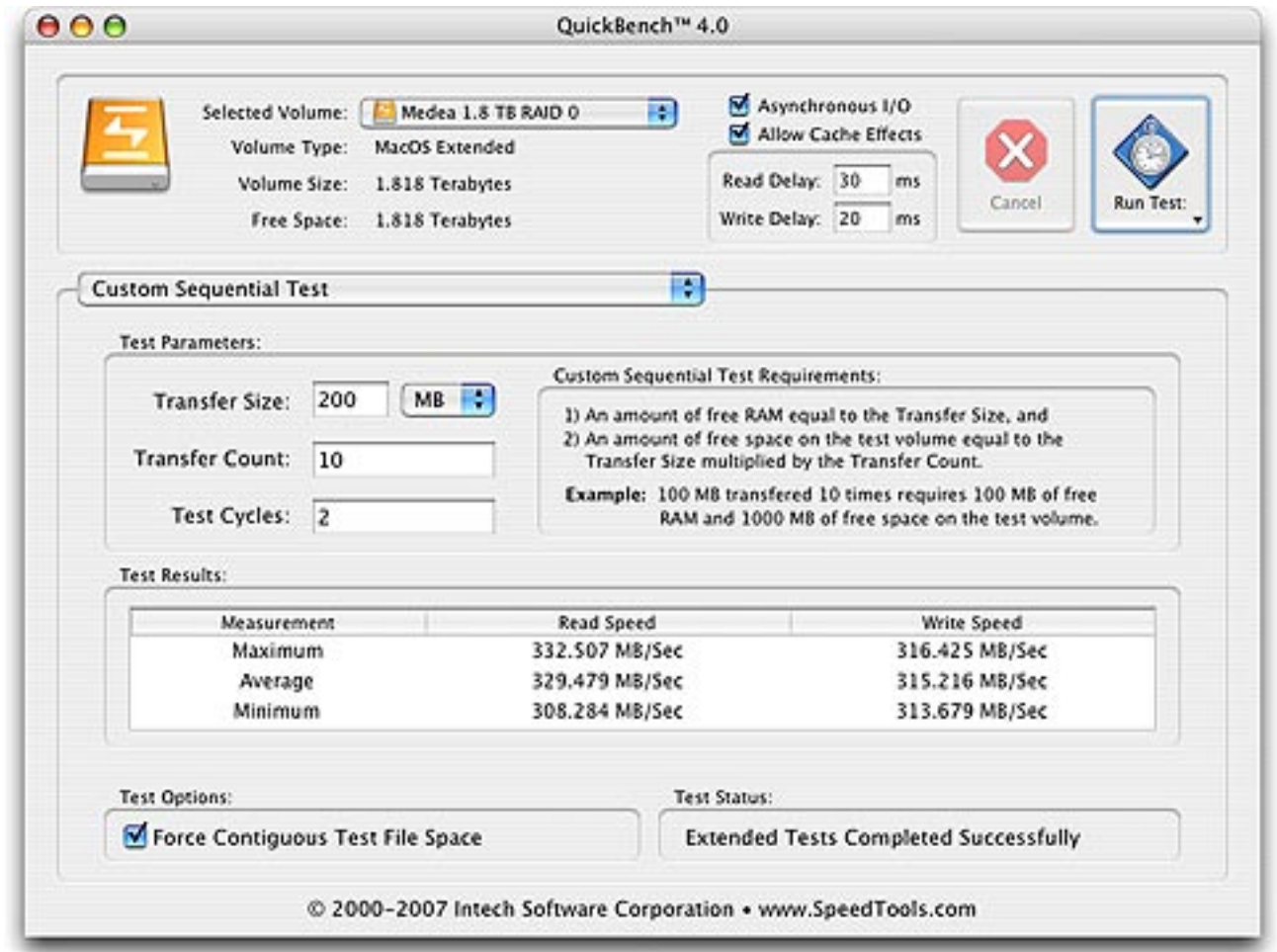
Custom Test

Figure 3. **Custom Test**

The Custom Test section of QuickBench provides a nearly unlimited range of sequential read/write tests which can be performed. There are three test parameters which must be chosen and one test option available. The three test parameters are Transfer Size, Transfer Count, and Test Cycles.

Transfer Size

The transfer size is the amount of data to be read from and written to the drive for each request. The popup menu allows the size you type in to be delimited as Kilobytes or Megabytes. Valid values range from one Kilobyte to 1024 Megabytes and is further limited by the amount of available physical RAM installed on your computer. For example, if you have 512 MB of RAM in your computer you will not be able to use a Transfer Size above 512 MB. In fact, the amount of actual memory available for data transfers will likely be far less than 512 MB.

Transfer Count

The transfer count is the number of sequential reads or writes which will be performed with the chosen transfer size for each test cycle.

> **Note:** When using the Custom Test, you will need to be mindful of the amount of free space available on the test volume. The size of the test file which needs to be created is equal to the Transfer Size multiplied by the Transfer Count. For example, a Transfer Size of 10 Megabytes and a Transfer Count of 100 will require 1000 Megabytes of free space on the test volume.

Test Cycles

Test cycles are explained on Page 2 of this guide, but notice in the Custom Test that test cycles, like the other two parameters, are to be typed in instead of selecting a pre-defined value from a menu. Valid values for the number of cycles to be performed are 1 to 1,000,000 (one million).

Test Option: "Allocate Contiguous Space Only for Test File"

A file is considered contiguous when all of the blocks allocated for the file are arranged on the volume in a single location. A file is considered fragmented when it is arranged in two or more separate locations on the volume. Checking the "Allocate Contiguous Space Only for Test File" box will force QuickBench to only allocate a contiguous test file. If there is not enough contiguous free space on the test volume, the test will NOT be performed. Note that if you do not check this box, QuickBench will still try to allocate a contiguous test file, but failing that allocation, QuickBench will attempt a new allocation allowing the test file to occupy multiple fragments.

Saving Test Results

Test results can be saved into either a word processor friendly file or a spreadsheet friendly file. The spreadsheet friendly file is specifically designed to facilitate the creation of quick and easy graphical charts. To save any and all test results into a file, go to the File menu and select one of the two data format options. (If you are running MacOS 10.3 or higher, you also will be able to toggle file output formats from the Save File window.)

The word processor friendly file is formatted with spaces and designed to be viewed by any word processing application. For best viewing, choose a monospaced font, such as Monaco. The spreadsheet friendly file is formatted with tabs between the data which should be assigned to columns and carriage returns for data to be displayed in rows.

QuickBench Benchmarking Tips

1) Quit all other non-essential programs. Due to the way MacOS X splits processor time evenly among all running applications and other processes, it is strongly recommended that you close all unnecessary applications when using QuickBench. Competition for processor time can significantly affect test results, especially during heavy CPU usage. Additionally, many applications and other processes generate disk access which also can adversely affect reliability of the QuickBench tests.

2) Fresh Format - If possible, you should re-format a volume prior to being tested. Because QuickBench testing is file-based, other files on the test volume can effect the accuracy of QuickBench with respect to other otherwise identical test configurations. Formatting as HFS Extended without journaling is highly recommended since this is the native file system of MacOS X, and journaling generates additional, unaccounted for disk access during testing.

3) Smoother is better - Test with at least 5 cycles, if possible, especially in the Standard Tests and the Large Tests. If your test results look similar to a saw blade (i.e. up, then down, then up again etc.), try increasing the cycle count until the pattern flattens out. If you are testing with cache effects enabled, you may need to adjust the delay time up or down to smooth out the results.

4) Re-test if necessary - sometimes an unrelated process will generate disk access on the disk you are testing right in the middle of a QuickBench test set. This will produce a clear anomalous result which shows up as an unexplained drop in performance at some arbitrary point in the test. If this happens, please ignore it and retest. If it happens repeatedly, you may need to track down which process is generating the I/O and terminate it before testing.

5) Do not put QuickBench into the background during testing - strictly speaking, this should have no effect on test results. But we assume that if you put QuickBench into the background, you did so in order to do something else. It is this "something else" action which may adversely affect QuickBench's results.

6) Maximum accuracy - MacOS X regularly reads and writes data to the boot volume at fairly random intervals. When accesses occur during a QuickBench test set, it may adversely affect the test results. This is true even if you are testing a different volume which belongs to the same drive as the boot volume. For optimum results, do not test a drive which shares a data bus (channel) with the boot drive (such as a master/slave ATA pair) since only one drive will be able to send/receive data over the bus at one time which could then induce a bottleneck.

System Requirements

- MacOS X 10.2 or later

- Read and Write permission to the root directory of the test volume.