HD Tune Pro manual

version 5.70

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1. Introduction

HD Tune Pro is a hard disk / SSD utility which has the following functions:

- Benchmark: measures the low-level performance (read/write)
- File Benchmark: measures the file performance (read/write)
- Random Access: measures the random access performance (read/write)
- Extra Tests: includes several quick tests to show the most important performance parameters (read/write)
- Cache Test
- Info: shows detailed information
- Health: checks the health status by using SMART, data can be logged
- Error Scan: scans the surface for errors
- Erase: securely erases all data from the disk
- Disk Monitor: monitors disk access
- Folder View: shows disk space usage for each folder
- AAM: reduces noise or increases seek performance
- Temperature display
- S.M.A.R.T. Self-test
- check status of all connected drives in a simple overview

HD Tune Pro may also work with other storage devices such as memory cards, USB sticks, iPods, etc.

There are two modules. The first one is the main program **HD Tune Pro**.
The second is **HD Tune Pro Drive Status**. This module can be run separately from the main program.
The main function of HD Tune Pro Drive Status is to quickly check and monitor the status of all connected drives and to perform a quick S.M.A.R.T. Self-test.
To learn more about HD Tune Pro Drive Status please read the HD Tune Pro Drive Status manual.

2. Before you get started

WARNING!
Hard disks and other storage media can fail at any time without any prior warning.
Always make sure you have a backup of your important files especially if your hard disk is acting strangely.

Unit of storage capacity
There is a lot of confusion when it comes to showing the capacity of hard drives. Hard drive manufacturers use the SI notation where 1 KB equals 1000 bytes. Windows uses the binary notation where 1 KB equals to 1024 bytes.
Although generally HD Tune Pro uses the binary notation, for showing the hard drive capacity the SI notation is used. To differentiate with the binary notation, the first letter will be a non-capital letter.

Comparison tables

1 kB	1 000 bytes	0.98 KB
1 mB	1 000 000 bytes	0.95 MB
1 gB	1 000 000 000 bytes	0.93 GB
1 tB	1 000 000 000 000 bytes	0.91 TB

1 KB	1 024 bytes	1.02 kB
1 MB	1 048 576 bytes	1.05 mB
1 GB	1 073 741 824 bytes	1.07 gB
1 TB	1 099 511 627 776 bytes	1.10 tB

Short Stroke
Short stroking is a technique to maximize performance by only using a small part of the hard drive.
Hard drives are faster at the outer tracks because of the higher data density. A hard drive starts reading and writing at the outer tracks. Speed decreases when the read/write heads move towards the inner tracks.
By discarding the inner tracks the average speed will be higher. The seek times will also

improve (decrease) because the read/write heads don't have to move long distances.

It's important to note that short stroking will not make your hard drive faster. It will only instruct the operating system not to use the slow part of the drive.

The performance tests of HD Tune Pro include an option to specify the test capacity. This allows to test the performance when short stroking is used.

This option also allows for an easy comparison between drives with a different capacity.
By setting the short stroke capacity to a value which is equal or lower than the capacity of the smallest hard drive you will get a fair comparison.
For example: suppose you have a 120 GB hard drive and you're using 100 GB for the operating system and applications. If you want to install the same operating system and applications on a new, larger drive and want to see how it compares with the old hard drive you can set the stroke capacity to 100 GB and test both hard drives.

4 KB Alignment
For optimum performance write operations on SSD drives should be done on a 4 KB alignment which is the size of a memory page.
The Random Access and Extra Tests have an option to perform all read and write operations with a 4 KB alignment. Enabling this option will simulate the behaviour on Windows Vista and Windows 7 systems. Older Windows typically use unaligned partitions which could result in poor performance with certain SSDs. The Info tab shows the alignment for each partition on the disk.

3. System requirements

- Windows XP 32/64-bit , Windows Vista 32/64-bit, Windows 7 32/64-bit, Windows 2003 Server with administrator rights, Windows 8, Windows 10
- 10 MB of free hard disk space

4. Usage
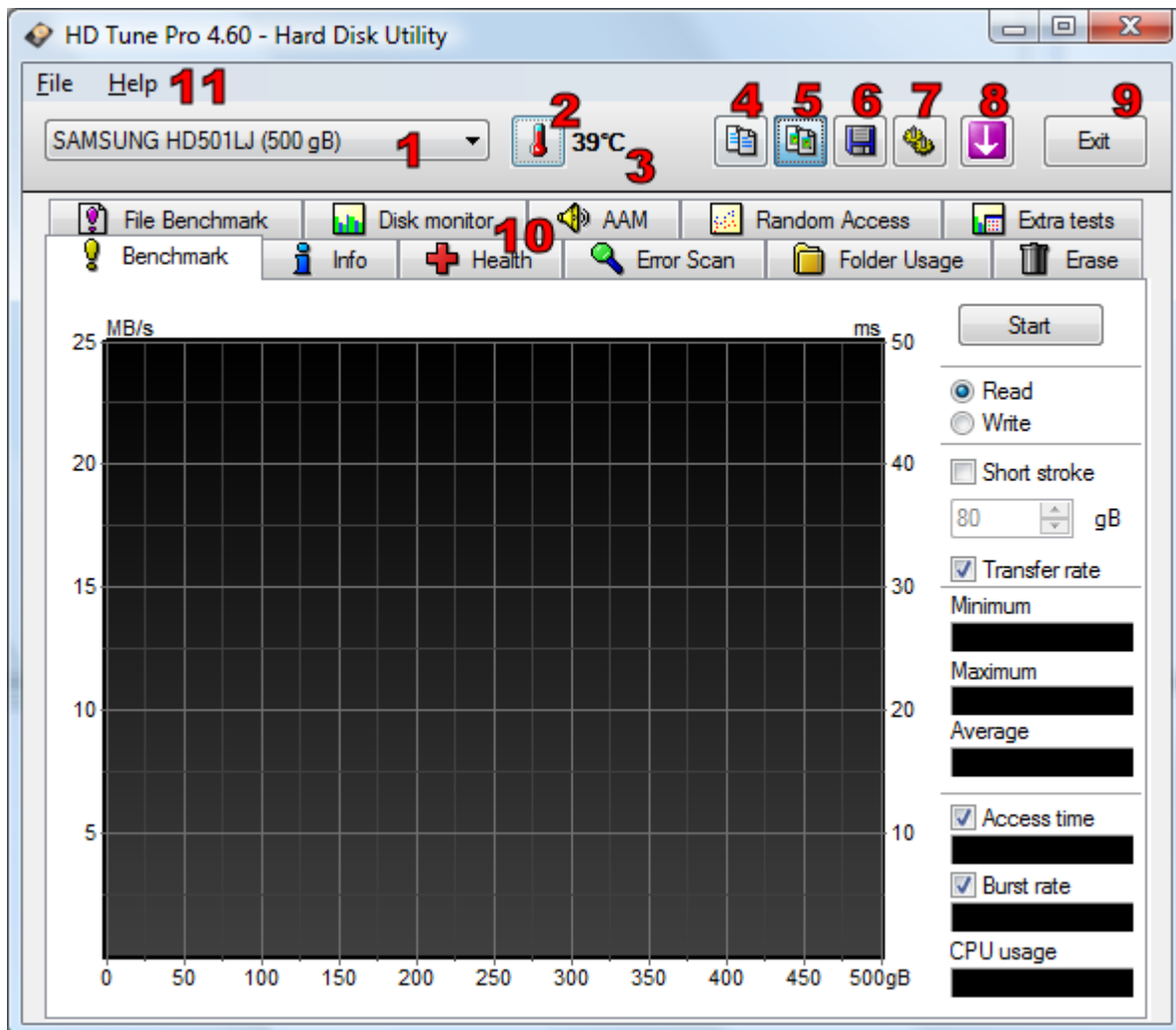
1. Select hard drive
2. Show temperature statistics
3. Current temperature display
4. Copy results or info to clipboard
5. Copy screenshot to clipboard
6. Save screenshot as png file
7. Options
8. Minimize to tray
9. Exit program
10. Select function
11. Menu

Available options:

Options — General options dialog box
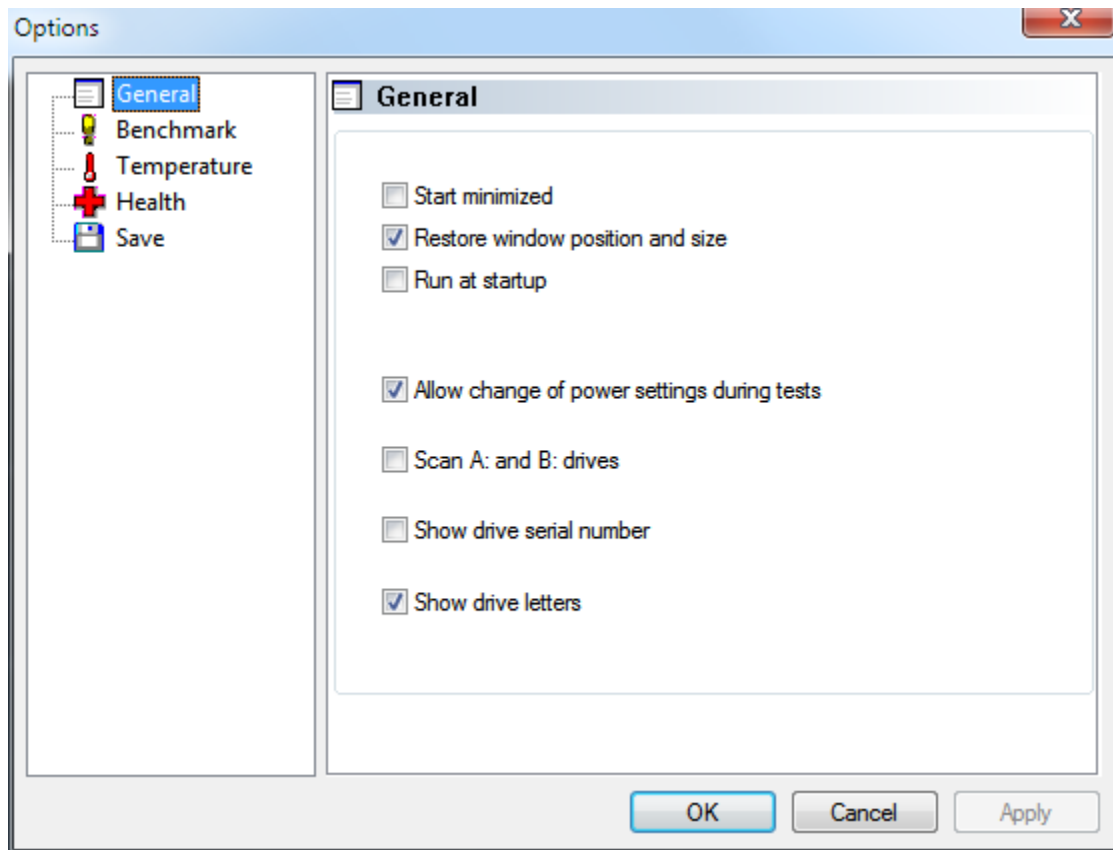
Start minimized: minimizes the program to the taskbar.
note: this function only works if the 'Show temperature in taskbar' option is enabled (available in temperature options).

Run at startup: automatically executes the program each times Windows starts.

Allow change of power settings during tests: certain processors reduce the performance in idle conditions. This may interfere with the test results. By enabling this option the power settings will be ignored during the tests.

Scan A: and B: drives: historically these drive letters were used for floppy drives. It is possible to assign these drive letters to hard drives. Enabling this option allows the program to detect these drives.
It's recommended to disable this option if these drive letters are not assigned because it will increase the time to start up the program.

Show drive serial number: by checking this option the serial number of the drive is shown under the drive selector. This may be convenient to differentiate identical drive models.

Show drive letters: by checking this option all drive letters which are assigned to the drive are shown under the drive selector.

5. Temperature statistics

The current temperature can be shown on the main screen next to the drive selector, in the task bar and on the health page. Detailed temperature statistics can be shown by pressing the temperature button next to the drive selector.
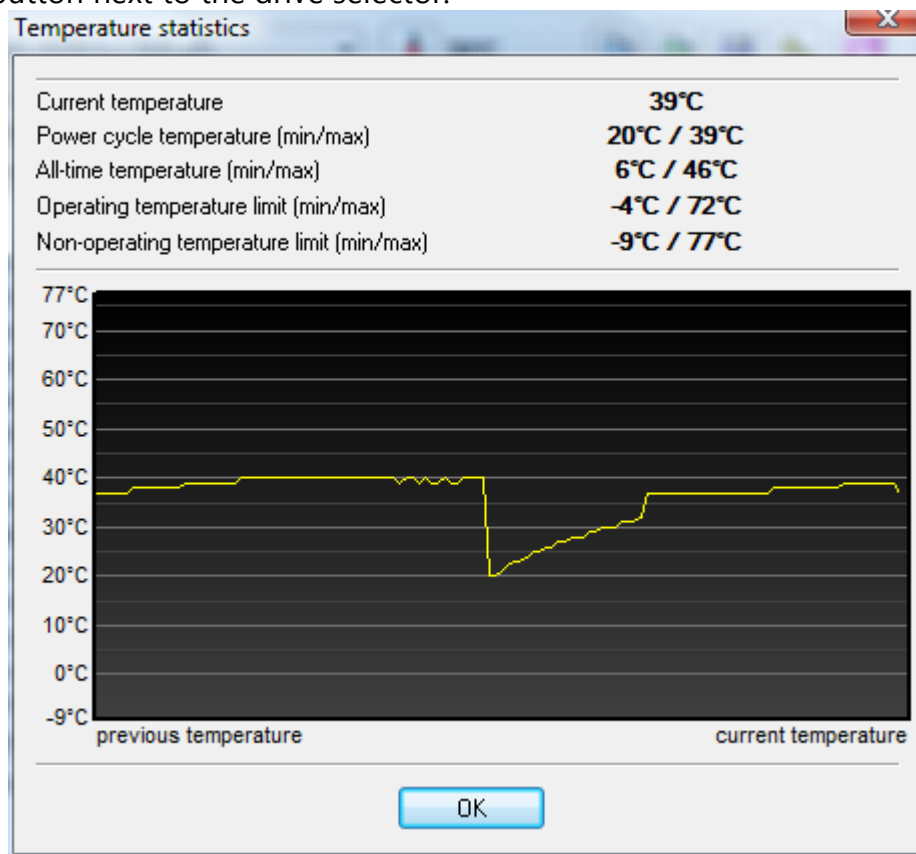
The graph shows the temperature progress per minute. The current temperature is shown at the right position.

Current temperature: current drive temperature

Power cycle temperature: lowest and highest temperatures measured since start up

All-time temperature: lowest and highest temperature ever measured with this drive

Operating temperature limit: minimum and maximum temperature allowed when the drive is active. Exceeding these limit may cause damage to the drive.

Non-operating temperature limit: absolute temperature limits. Exceeding these limit may cause damage to the drive.

Notes:

1. *not all drives can report temperature statistics*
2. *some drive cannot report minimum temperatures*

Available temperature options:
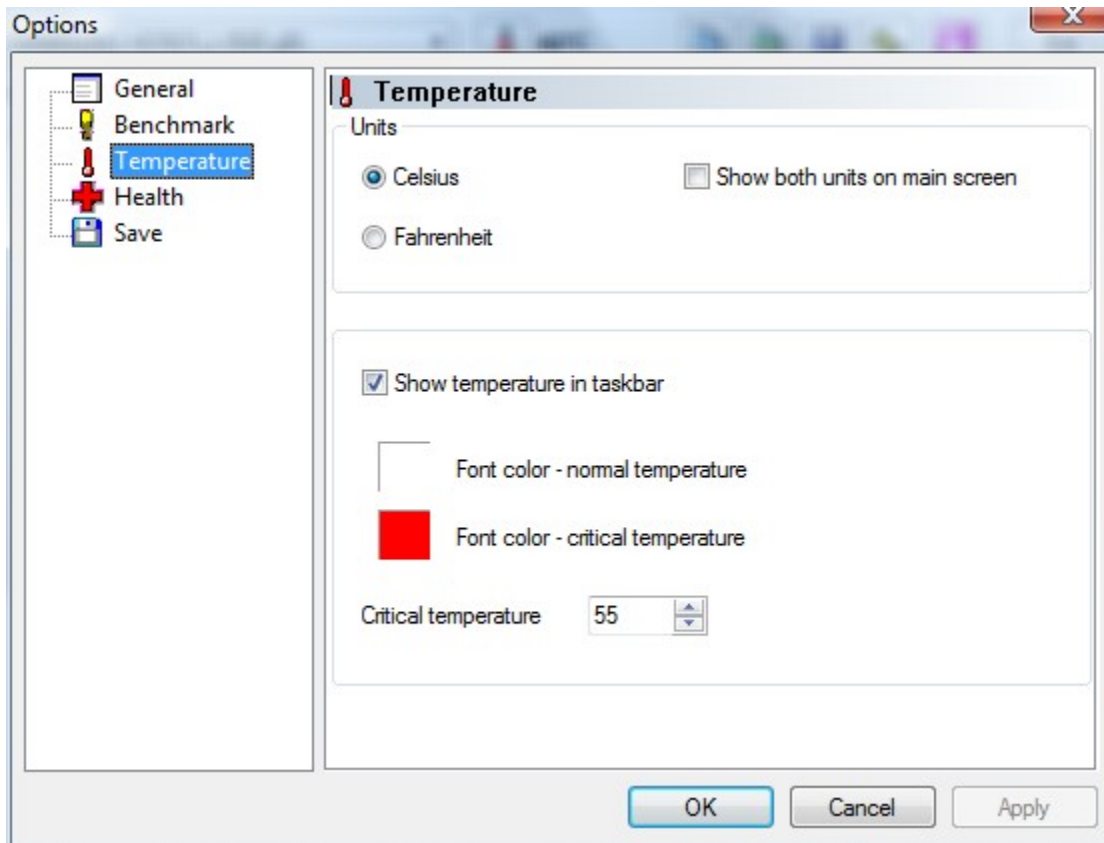
Units: select between Celsius and Fahrenheit.

Show both units on screen: temperature will be shown in both Celsius an Fahrenheit on the main screen.

Show temperature in taskbar: temperature will be shown on the taskbar. If the temperature exceeds the specified limit a warning message will show up here.

Font color - normal temperature: color of the temperature display when the temperature is below the critical value.

Font color - critical temperature: color of the temperature display when the temperature is equal to or higher than the critical value.

Critical temperature: a warning will show up if the temperature equals or exceeds this value.

6. Benchmark
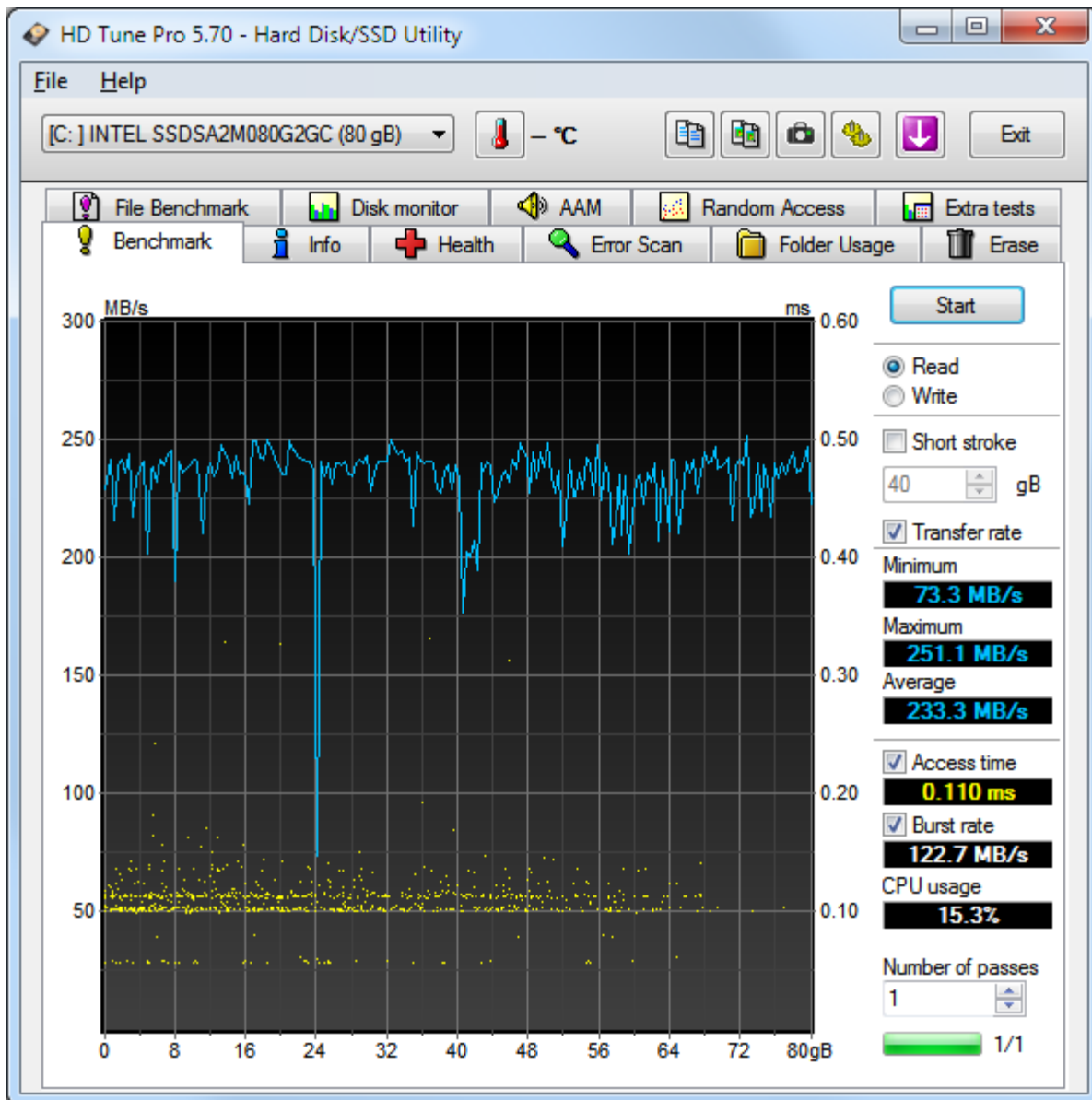
The benchmark function offers four different tests:

6.1. Transfer rate

The data transfer rate is measured across the entire disk surface (default) or across the selected capacity (short stroke option).

The X-axis shows the position in gigabytes (gB). The Y-axis shows the transfer speed in

megabytes per second (MB/s).

Both read and write transfer rate can be measured. To prevent accidental data loss, the write test can only be performed on a disk with no partitions.
To remove all partitions go to **Control Panel -> Administrative Tools -> Computer Management -> Disk Management**, right-click on the partitions on the hard disk you want to test and select delete partition.
A newly bought hard disk usually doesn't have any partitions yet so this step is not necessary to run the write test.

Note: the data density at the outer tracks of a hard drive is higher than at the inner tracks. Reading or writing at the outer tracks will be done at a higher speed because the rotation speed is constant.
A hard drive starts reading and writing at the outer tracks and moves to the inner tracks. This can be seen in the transfer rate graph where the speed is the highest at the start of the test and decreases towards the end of the test. This does not apply to SSDs and other storage media

Available options:
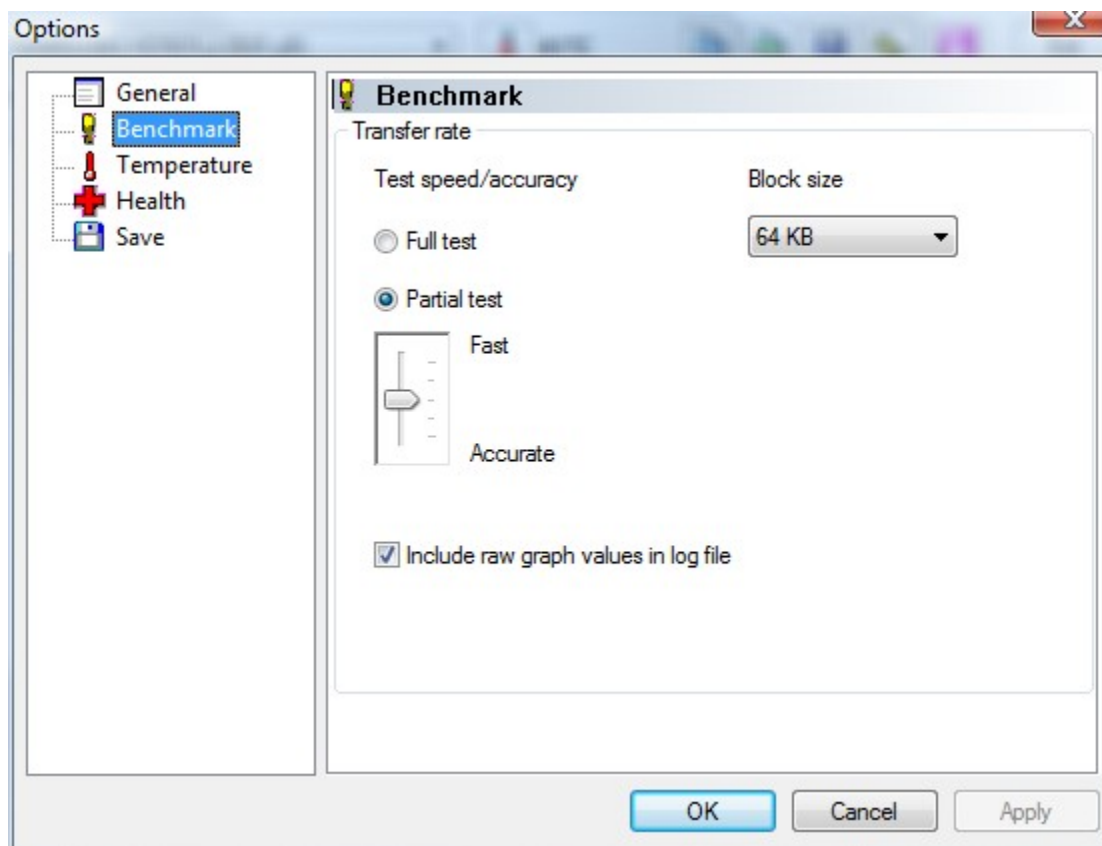
Test speed/accuracy: the full test will read or write every sector on the disk. This will give the most accurate results but the test time will be very long. By choosing the partial test the transfer speed is sampled across the disk surface. The test time and accuracy can be chosen by moving the slider.

Block size: block size which is used during the transfer rate test.

Lower values may give lower test results. The default value is 64 KB.

Note: *RAID configurations and SSDs may require a higher block size to achieve their maximum performance.*

Include raw graph values in log file: by enabling this option the graph values will be saved in the log file which can be imported in a spreadsheet.

6.2. Access time

The average access time is measured and displayed in milliseconds (ms). The measured access times are shown on the graph as the yellow dots.

6.3. Burst rate

The burst rate is the highest speed (in megabytes per second) at which data can be transferred from the drive interface (IDE, SATA, SCSI, USB,...) to the operating system.

6.4. CPU usage

The CPU usage shows how much CPU time (in %) the system needs to transfer data from the hard disk.

Multiple pass testing

You can set the number of passes from 1 (default) to 50000.

Warning! When performing write tests with SSDs it should be noted that the number of write cycles on these devices is limited therefore it's not recommended to run lengthy write tests on these devices.

Note: if you use multiple pass testing you probably want to disable the '*Ask for file name and location*' option (from the Save options screen) when you want to automatically save the results after each pass..

To avoid files being overwritten you can add the time format specifier (ie. %T) or the current pass (%P) to the file name.

Note: you may have to increase the window size to view the multi pass options.

7. File benchmark
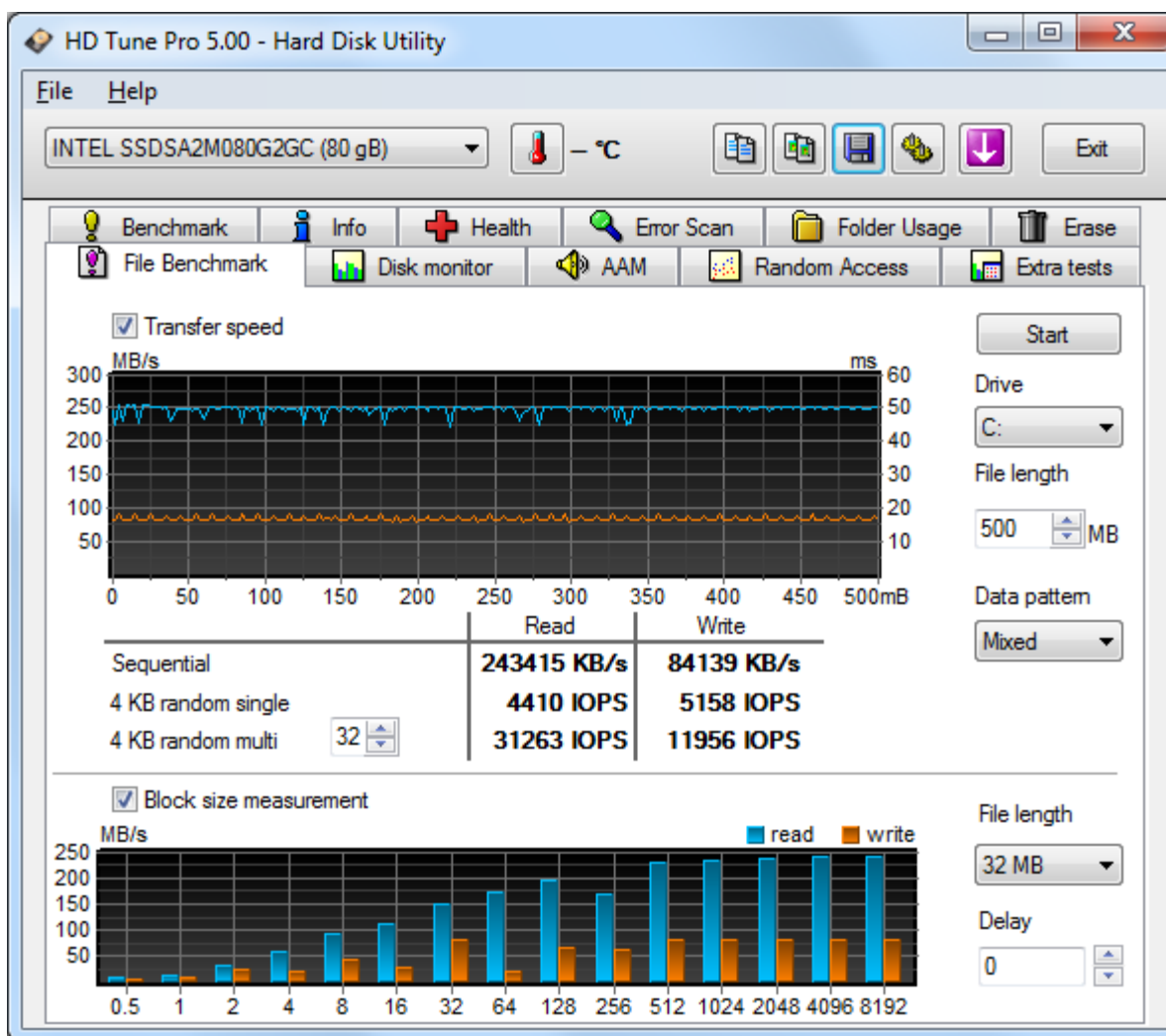
The file benchmark consists of two parts: the transfer speed test and block size test.

7.1. Transfer test

The transfer rate test measures three different parameters for both reading and writing:
Sequential: the sequential speed is measured and shown on the graph. Ideally the transfer speed line should be straight and smooth. When the test is completed the average transfer speed is shown.
4 KB random single: this test measures the performance of I/O operations of 4096 byte blocks. This is the most common I/O operation on a typical system. Especially the 4 KB write speed is an important indication of general system performance.

4 KB random multi: this test is similar to the 4 KB random single test except that multiple requests are sent simultaneously to the device. The number of operations can be specified and can be a value between 2 and 64.

The transfer rate test is performed on a file which is created on the selected partition.

A larger test file size will give more accurate results.

Warning! When performing write tests with SSDs it should be noted that the number of write cycles on these devices is limited therefore it's not recommended to run lengthy write tests on these devices.

The data pattern which will be used during the write process can be specified.
The choices are: zero, random and mixed which is a combination of zeroes and random data.
For most devices this option does not have any effect on the test results. However, certain SSDs use a compression technique which improves performance when compressible data is used.
For these devices the results will be highest when writing zeroes and lowest when writing random data.

7.2. Block size test

The file benchmark measures the performance for reading and writing files to the selected hard disk partition with different block sizes ranging from 0.5 KB to 8192 KB (x-axis).
The length of the test files can be set. For accurate results a large size is recommended. If the file length is too small the hard disk may be able to cache the entire file. In that case the cache speed will be measured instead of the hard disk throughput.

On some configurations it may be necessary to add a delay between the write and read test to make sure all data is written to the disk before the read test is executed.

This test is non-destructive but requires a partition with a drive letter associated.

8. Random access
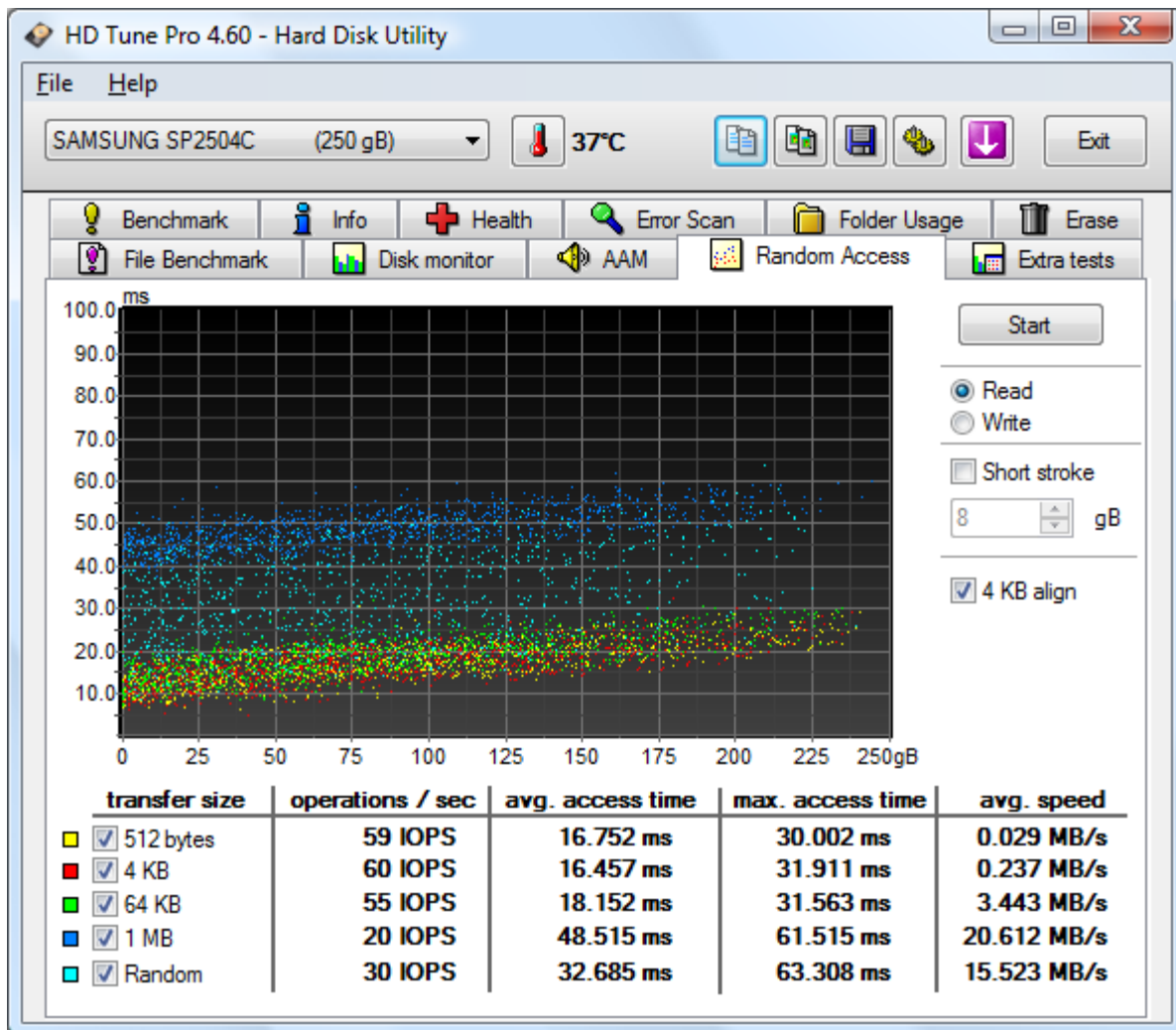
The Random Access test measures the performance of random read or write operations.
The amount of data which will be transferred varies from 512 bytes to 1 MB.
The random test uses transfer size between 512 bytes and 1 MB.
You can choose which tests will be performed by clicking on the check boxes next to the transfer size.

Results are shown in three different units:
Operations per seconds (IOPS): number of completed read or write requests per second.
Higher is better.
Avg. access time (in milliseconds or ms): average amount of time it takes to perform a single

read or write operation. Lower is better.

Max. access time (in milliseconds or ms): highest access time measured during the test. Lower is better.

Avg. speed (in megabytes per second or MB/s): average transfer speed for a completed read or write operation. Higher is better.

This test is a low level test and can only be performed on a drive with no partitions (see the benchmark topic for more information).

The random access performance can be measured on a partial section of the hard drive by setting the short stroke options.

9. Extra tests
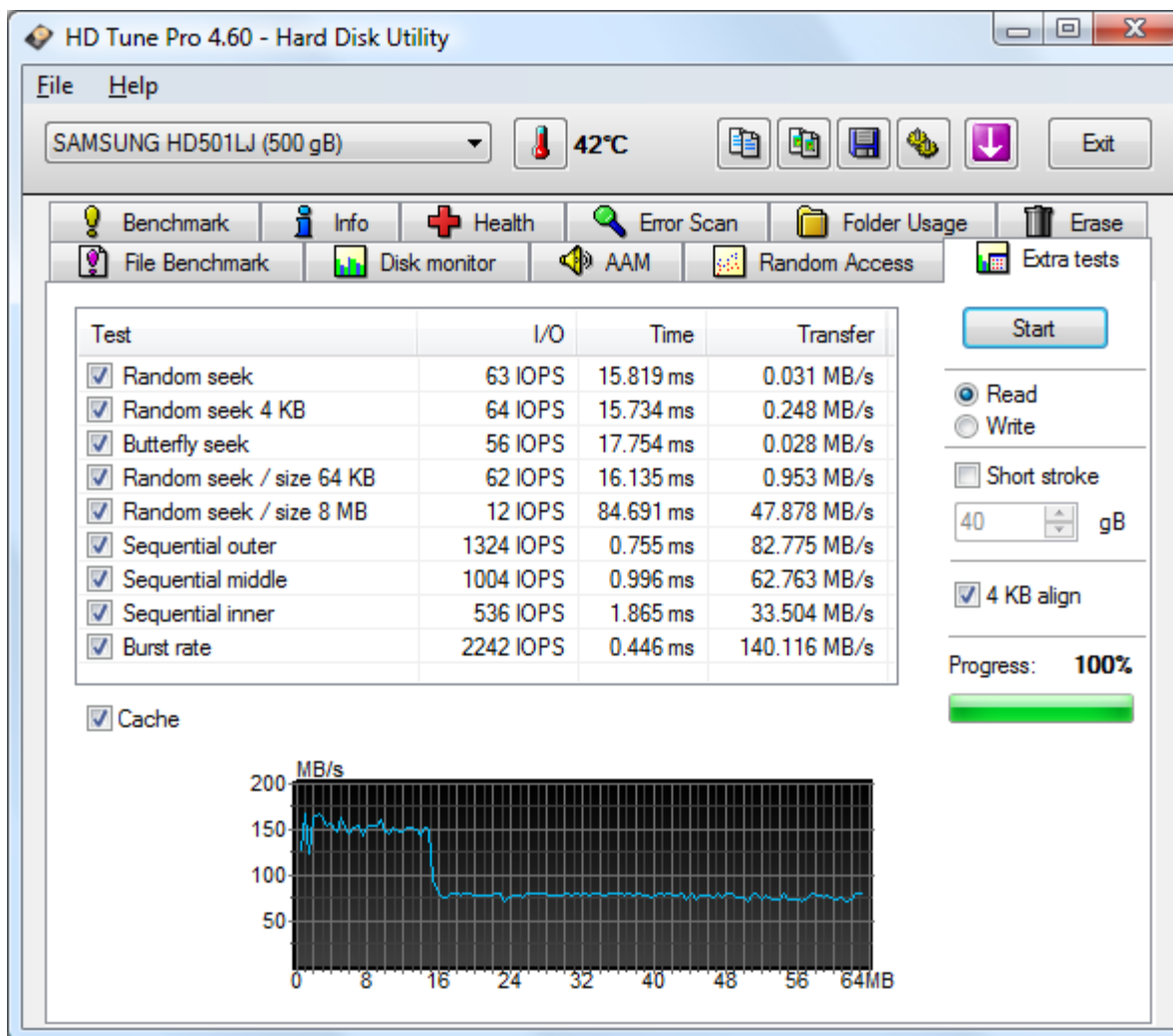
The extra test tab offers a variety of small tests which can be used to quickly determine the most important performance parameters of the hard drive.
Short stroke options are available for a partial test.

Explanation of the extra tests:
Random seek: performs random seek operations across the disk surface
Random seek 4 KB: performs random seek operations and reads 4 KB across the disk surface
Butterfly seek: performs seek operations moving from the outer tracks to the inner tracks and back
Random seek / size 64 KB: performs random read/write seek operations with a random block

size (max. 64 KB).

<u>Random seek / size 8 MB:</u> performs random read/write seek operations with a random block size (max. 8 MB)

<u>Sequential outer:</u> measures the transfer rate at the outer tracks

<u>Sequential middle:</u> measures the transfer rate at the center of the drive

<u>Sequential inner:</u> measures the transfer rate at the inner tracks

<u>Burst rate:</u> measures the highest possible transfer speed between the drive and the interface

<u>Cache test:</u> measures the transfer speed from the buffer of the drive and shows it graphically. Usually the buffer capacity of the drive can be determined by checking the position where the speed drops sharply. The screenshot shows a buffer capacity of 16 MB.

10.   Info
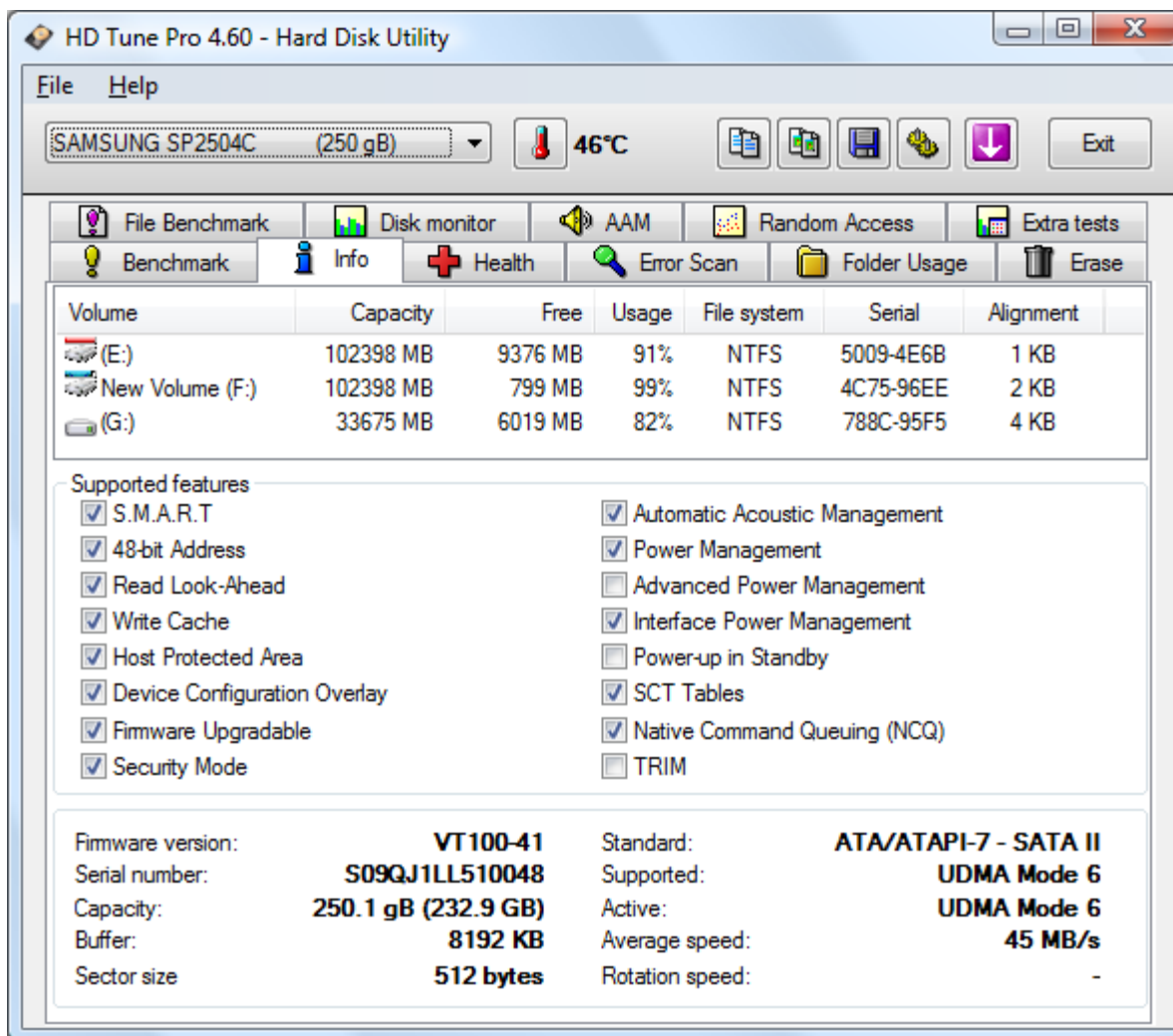
The first part of the screen shows detailed information about each partition on the hard disk.
The second part shows which features are supported.
The third part shows basic information:
Firmware version
Serial number
Capacity as it is marketed by the manufacturer; defining 1 KB as 1000 bytes. The capacity between braces is the capacity as shown by Windows defining 1 KB as 1024 bytes.
Buffer size: buffer capacity of the drive. Note: due to limitations of the (S)ATA specifications only buffer capacities below 32 MB are reported. To determine the actual usable buffer capacity the cache test from the extra tests tab can be used.
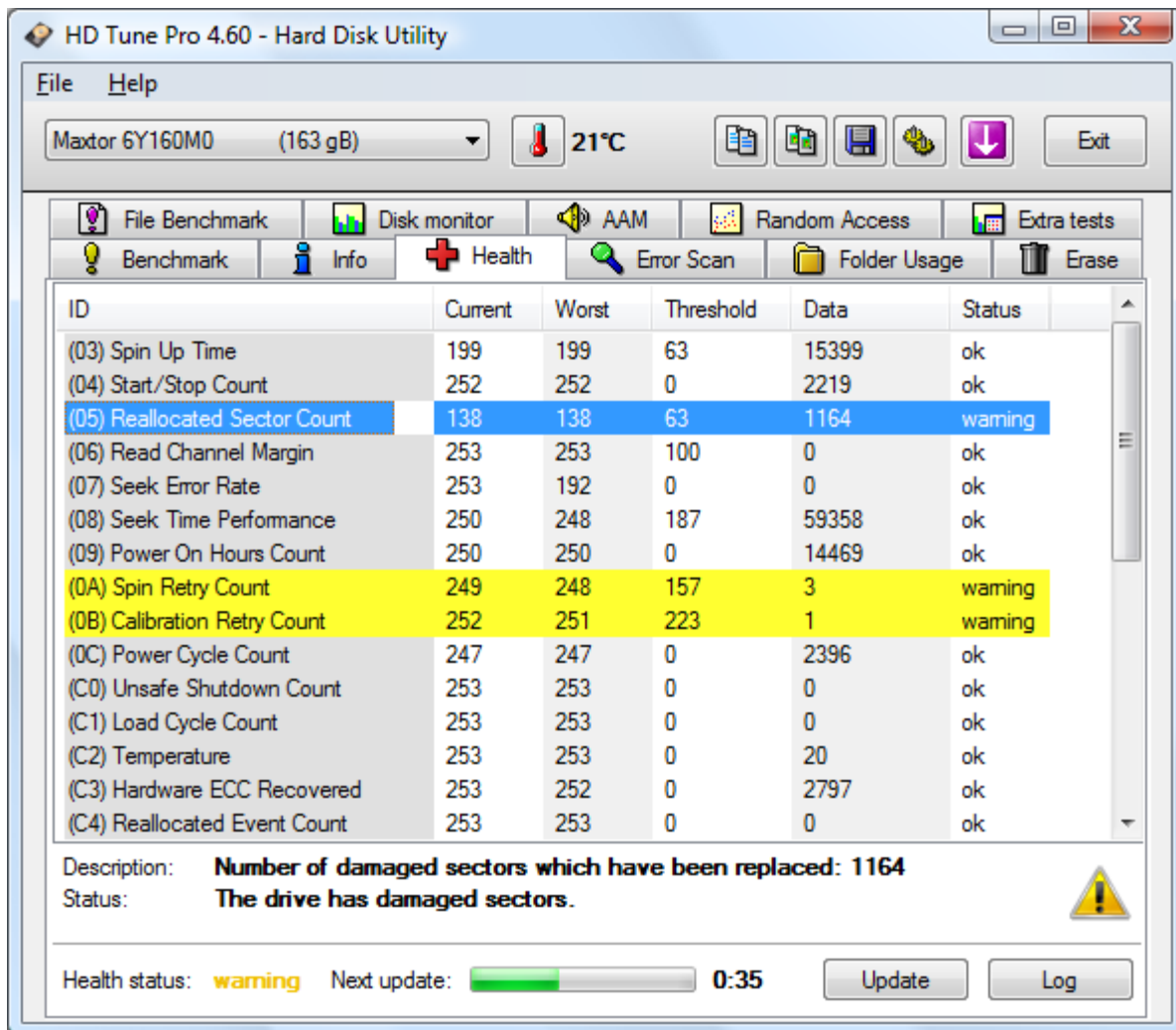
Interface standard
Maximum transfer mode and active transfer mode
Average speed: average read/write speed across the entire drive capacity.
Rotation speed: rotation speed in revolutions per minute (rpm)

11.   Health

This function uses S.M.A.R.T. (Self-Monitoring Analysis and Reporting Technology) to get information about the health of the hard disk.

The table shows the following parameters:
ID: parameter which is being measured
Current: current value
Worst: the worst value which has been recorded since the hard disk was first used
Threshold: the value of any of the parameters should never get below the threshold
Data: shows the usable data which belongs to the ID
Status: status of the parameter (OK, warning or failed)

Click on a list entry to get detailed information about the selected parameter as well as the status and possible reason for failure.

The progress bar shows when the next update of the status will occur. The status can be manually updated by pressing the update button.

Available options:
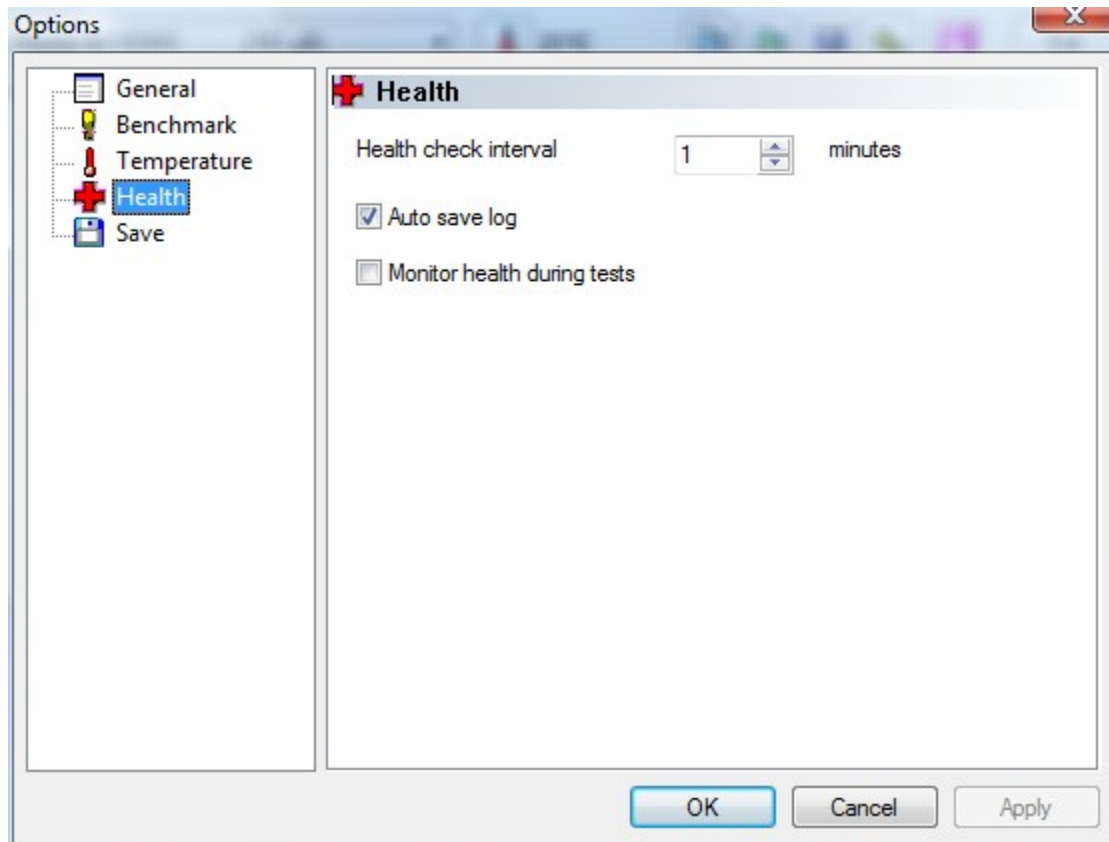
Health check interval: time in minutes between status updates.
Auto save log: saves the health status to a log file
Monitor health during test: enabling this option will update the health status during performance tests. This may cause lower results.

Log

By pressing the log button a new screen will pop up which shows a history of the S.M.A.R.T. status.
Note: *the 'Auto save log' option must be enabled for this function!*
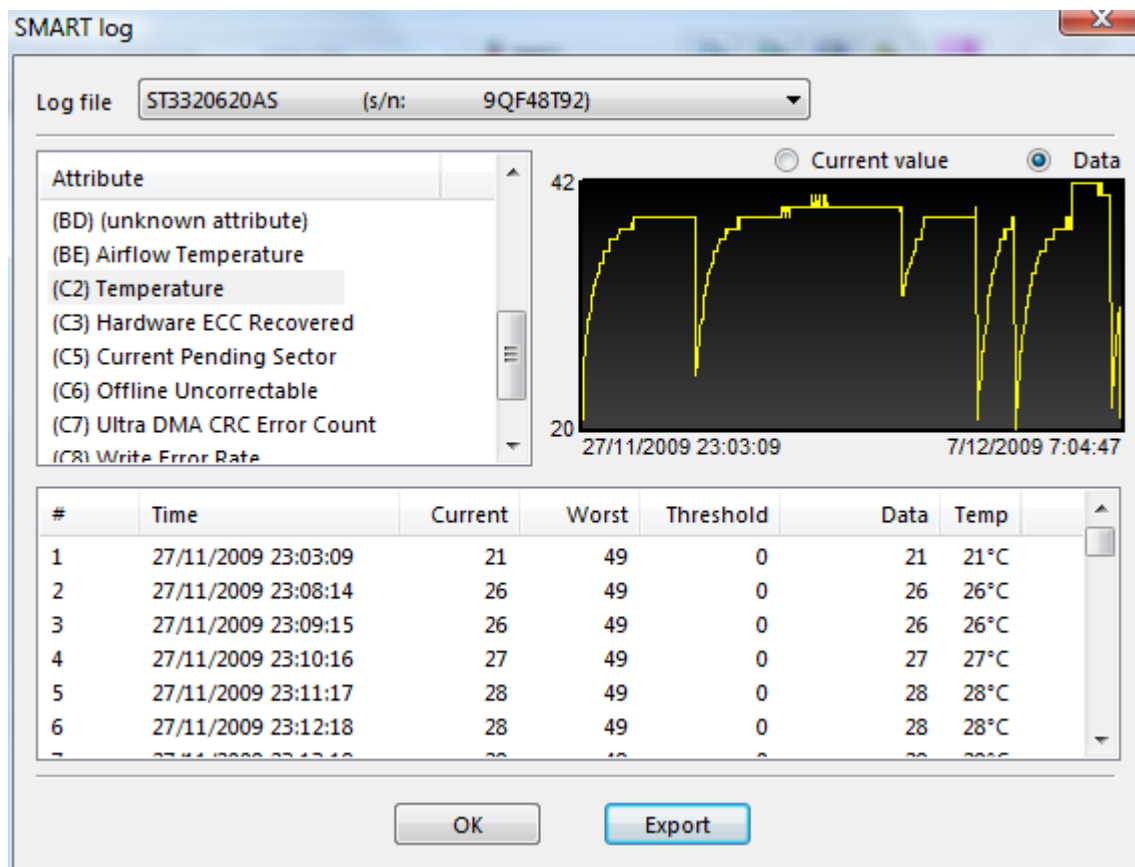
If you have multiple hard drives you can select the log file you want to inspect.
Select an attribute to view its history. This will be shown graphically and numerically.
You can choose between the current value or the data field which may be more useful.

The log data can be exported to a text file which can be opened by a spreadsheet for further analysis.

12.   Error scan
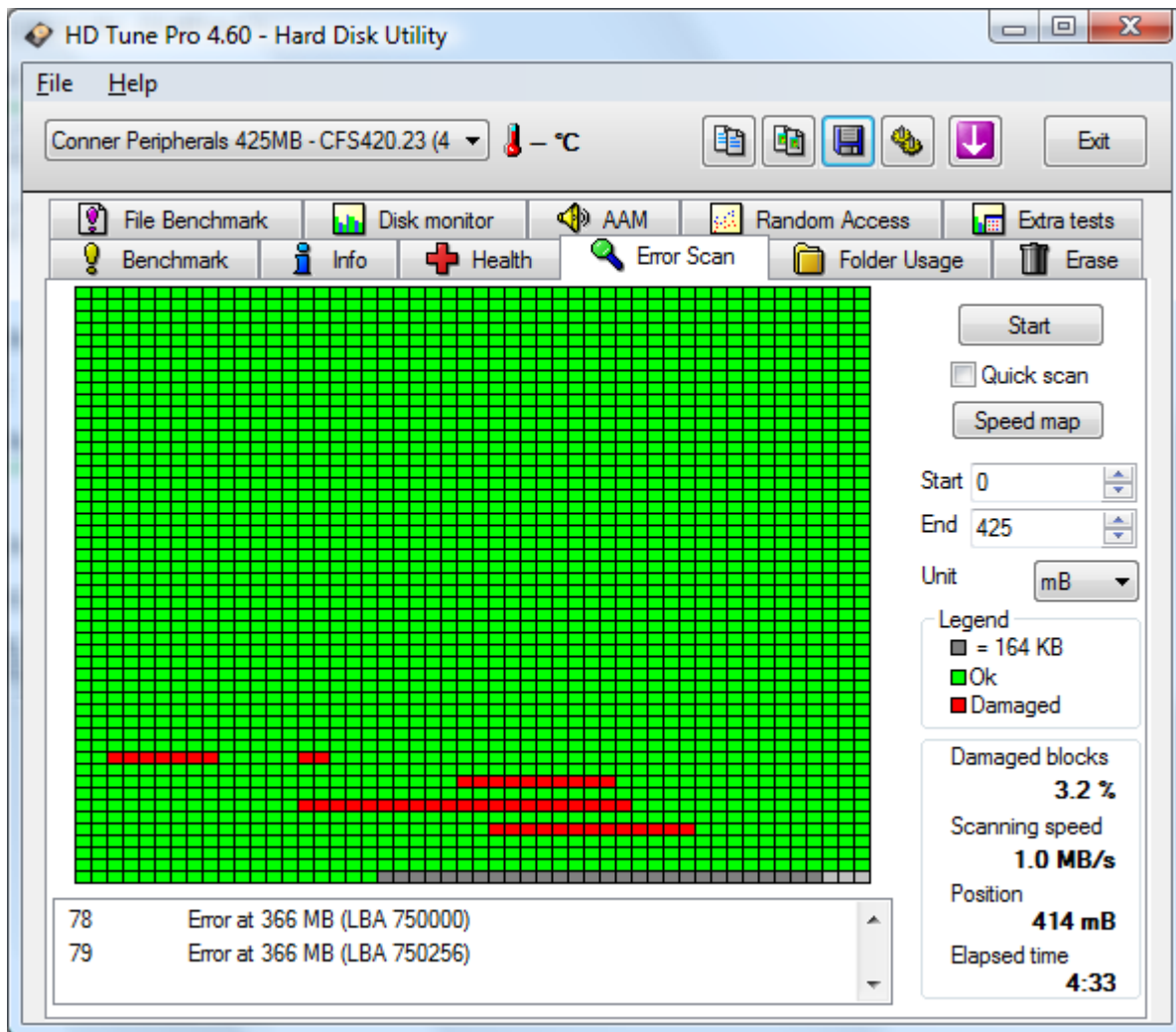
The Error Scan scans the entire disk surface for errors. Defects will show up as red blocks. The exact location of these defects are shown in the list below the graph.
This test only performs read operations and is nondestructive.
For a short test the quick scan option can be set. With this option enabled only certain parts across the disk surface will be tested.

By pressing the 'Speed map' button after the test has completed you can see the read performance across the disk.
The highest performance will be shown as green blocks, slower performance is shown in a yellow color and very slow performance is shown as red blocks.
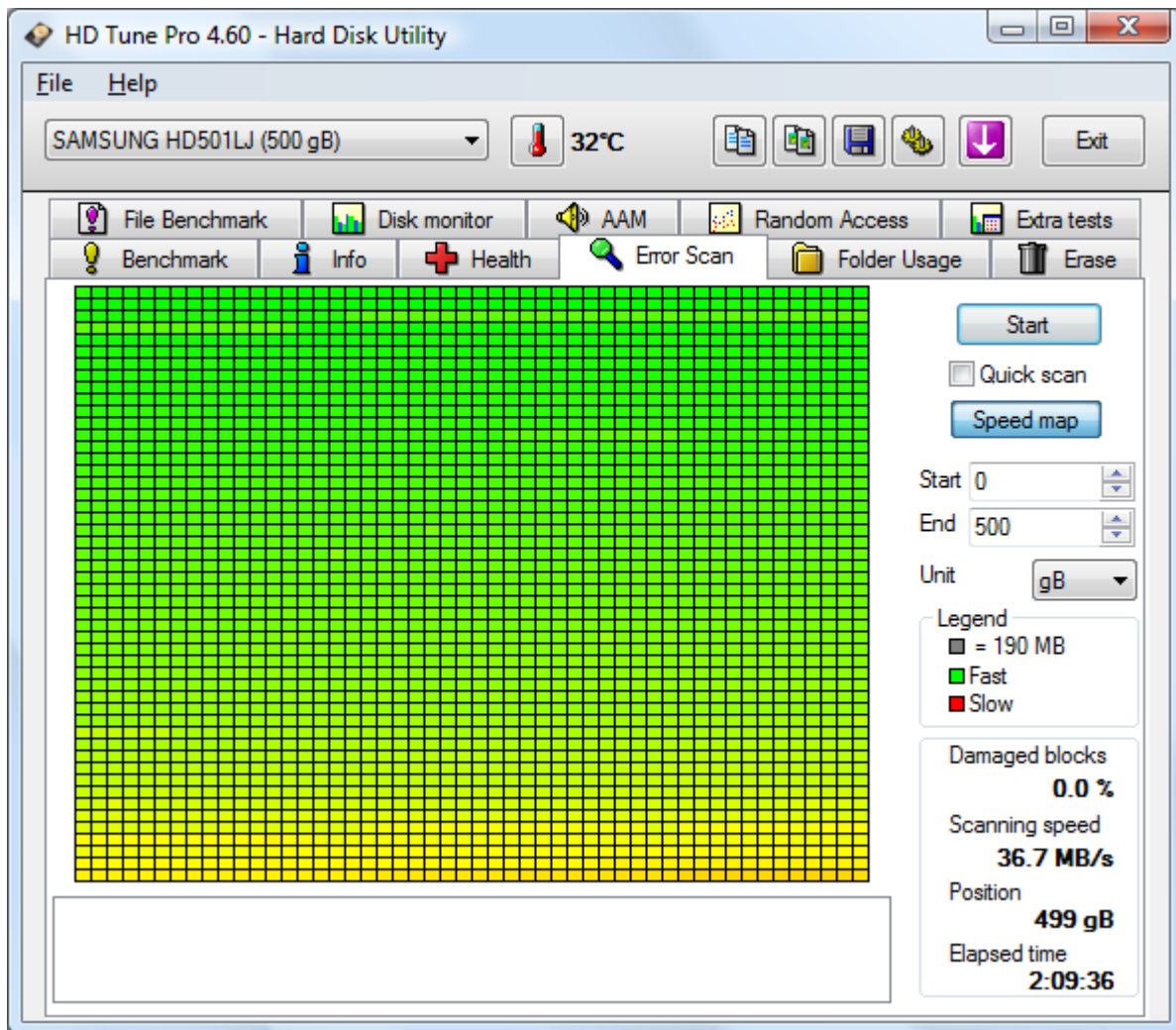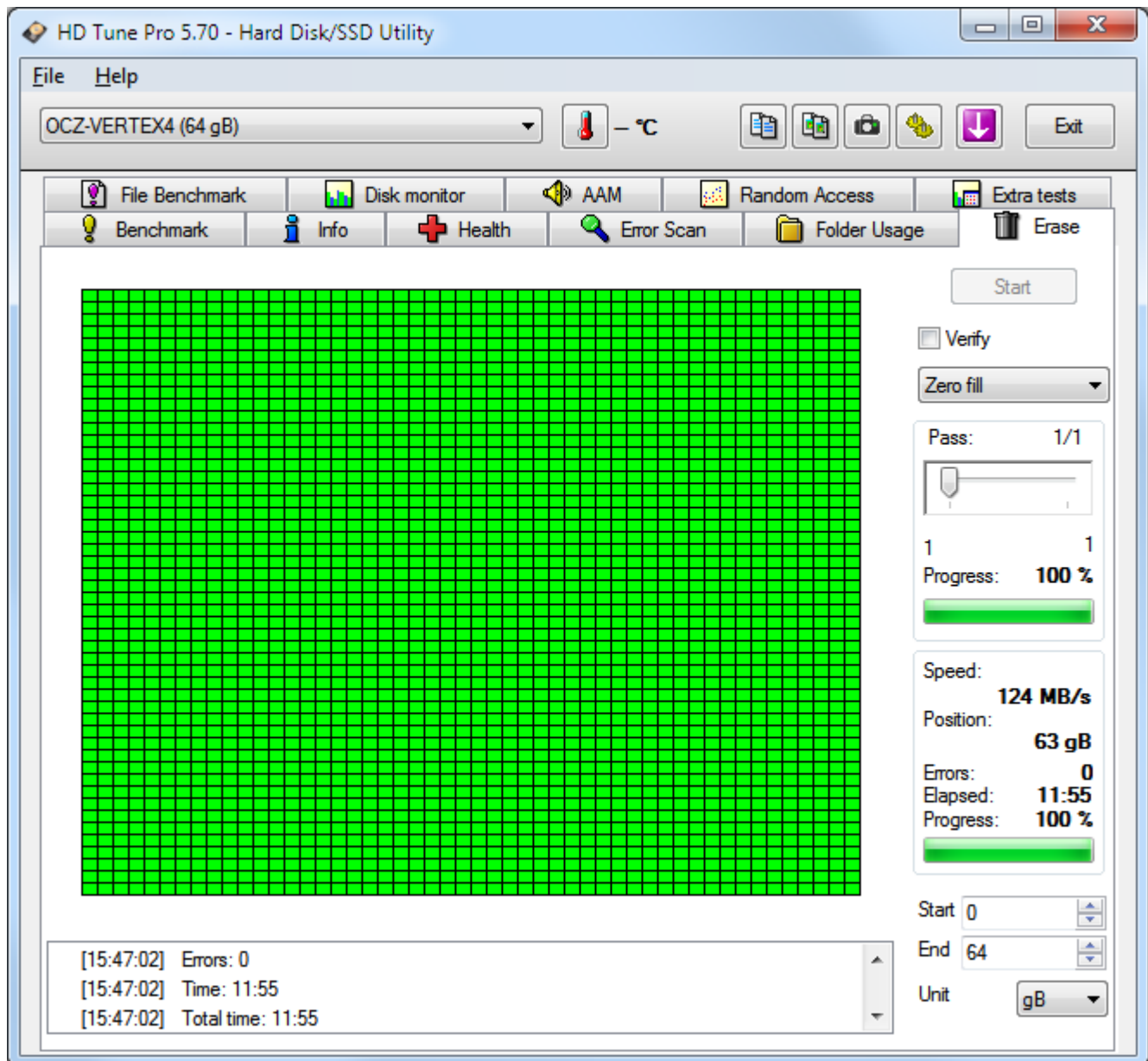
13.   Folder usage
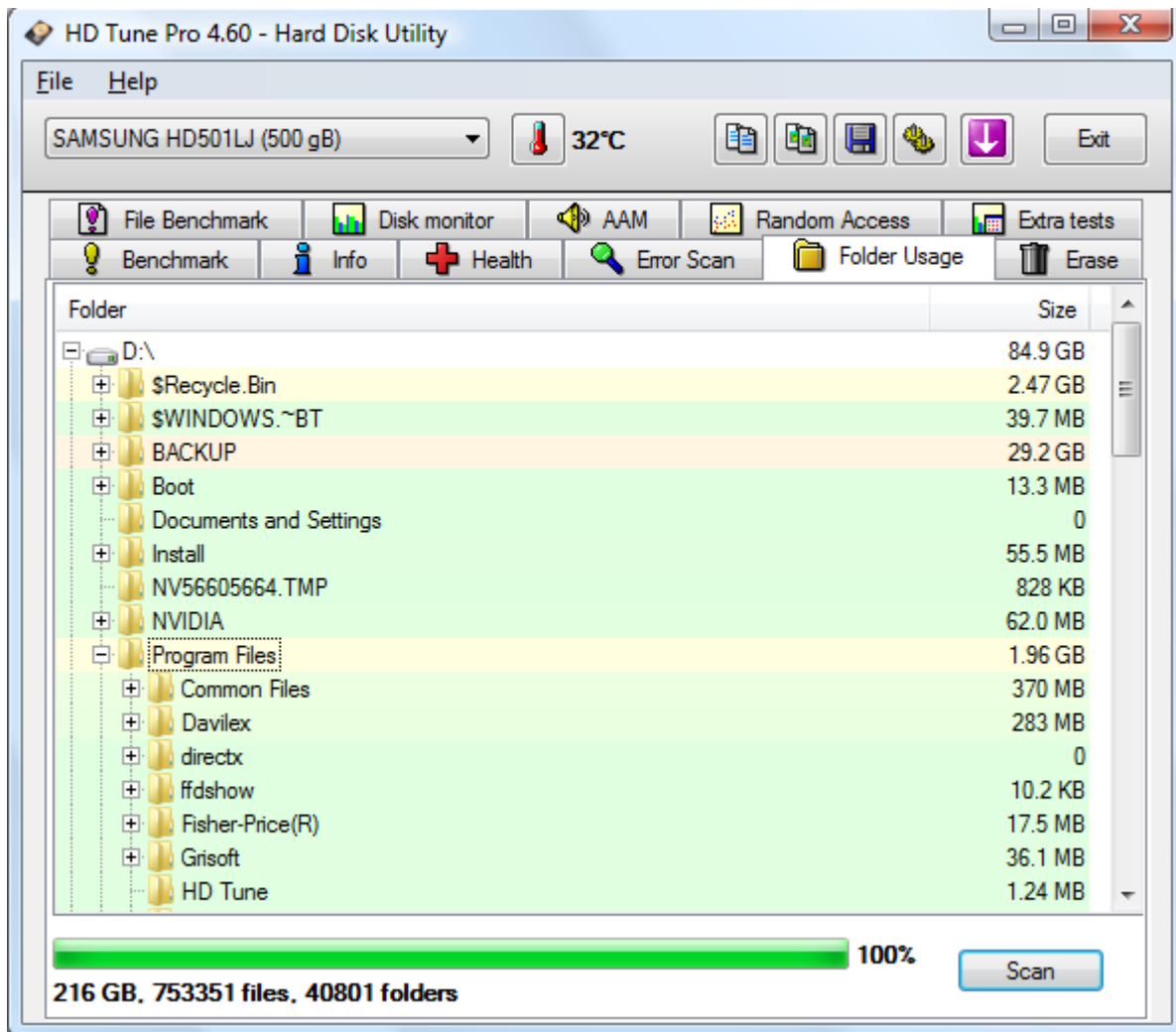
With this function you can easily see how much space each folder on the hard disk is using.
Each line in the folder list is colored according to the disk space.
Green = low disk space usage
Yellow = average disk space usage
Red = high disk space usage

14.   Erase

When files are deleted from a hard disk, the data is not actually erased. Only the references to those files are deleted.
By using recovery software it will be possible to recover many or all files after the files have been deleted or even after a full format. So if you sell, return or give away your hard disk someone may be able to recover sensitive data from the disk.

The erase function securely erases the disc by overwriting the entire contents of the disk with a specified pattern.

There are four different delete methods:
Zero fill (1 pass), random fill (1 pass), DoD 5220.22M (7 passes), Guttman (35 passes).
The zero and random fill should be sufficient for most purposes. For more securely deleting data you can use the other two methods.
Completely erasing the hard disk may take several hours. If you're using one of the multi-pass delete methods you can select at which pass the erasing should begin.
During the erase process write errors will be reported in a similar way as in the Error Scan function.

To prevent accidental data loss, the write test can only be performed on a disk with no partitions (see the benchmark topic for more information).

By clicking the verify option the erased disk will be read and the contents will be verified.
A green block shows the sector is readable and contains the expected data (ie. all 0's for the Zero Fill method).
A red block indicates the sector is either unreadable or the data does not match the expected data.

You can choose which area of the drive you want to test by changing the *start* and *end* values. This is especiallty convenient if you want to erase large drives.

Note: you may have to increase the window size to view the test area selection.

15.   Disk Monitor
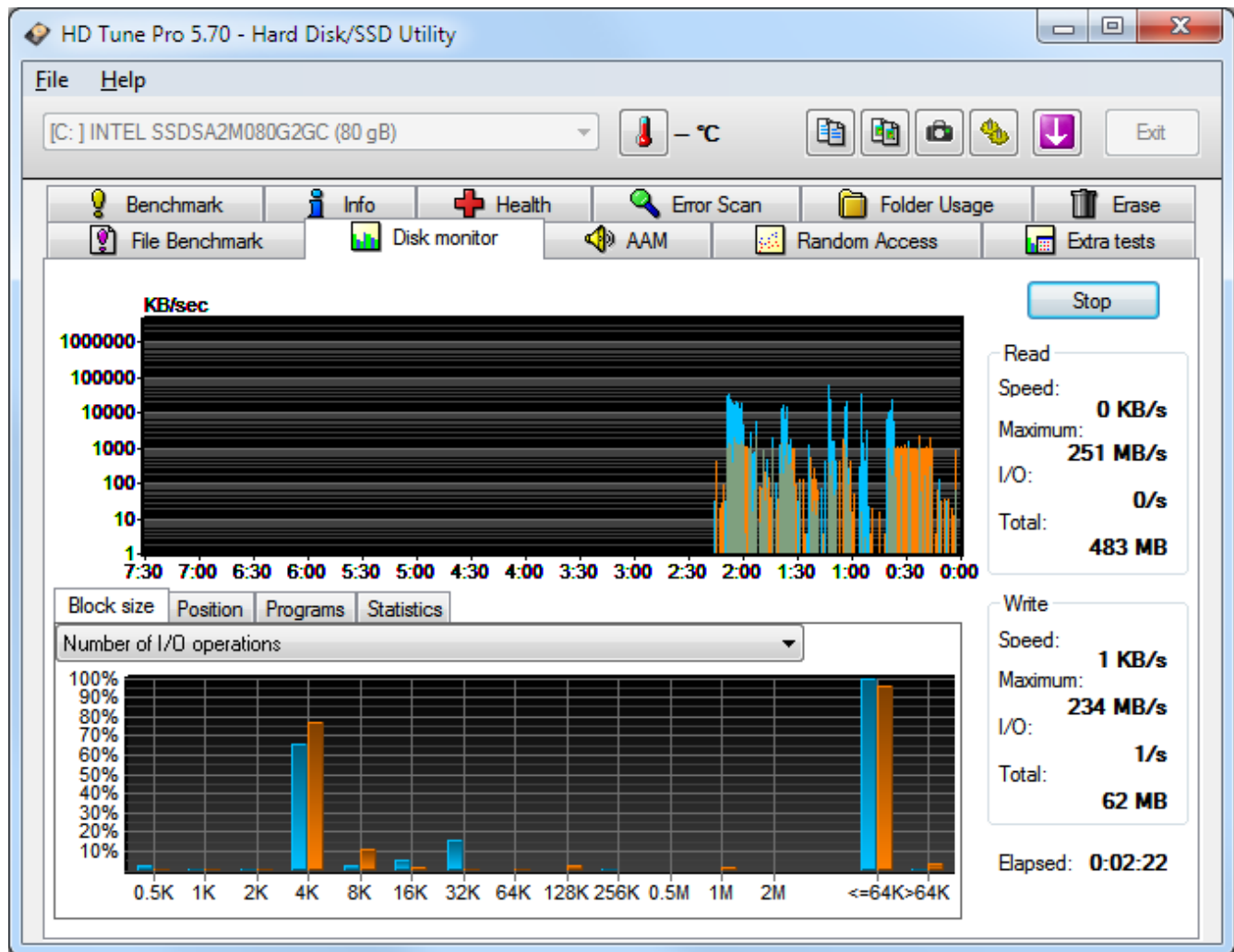
The Disk Monitor function monitors the disk activity from the selected disk.

The top graph shows the read and write transfer speed for each second.
On the bottom half of the screen, the disk activity can be analyzed in detail by selecting one
of the four options:

Block size

Number of I/O operations: shows the occurrences in % for each block size (512 bytes to 64 KB)
Maximum speed: shows the maximum speed in MB/s for each block size
Median speed: shows the most often occurred speed in MB/s for each block size
512 – 2MB performance: shows the frequency distribution of the performance for the selected block size
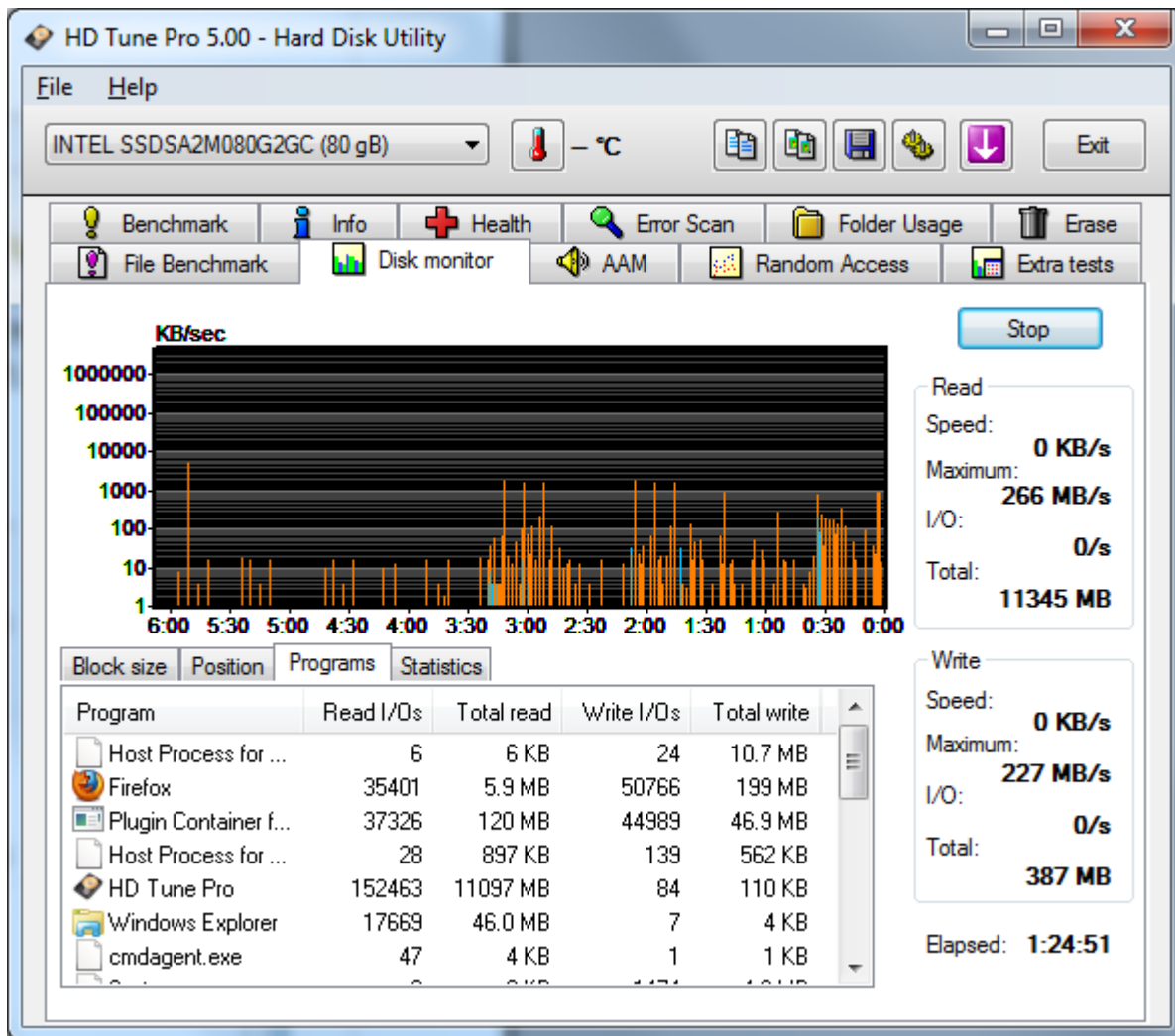
Position

This graph shows the frequency distribution of the positions (in %) on the disk where the I/O activity took place.
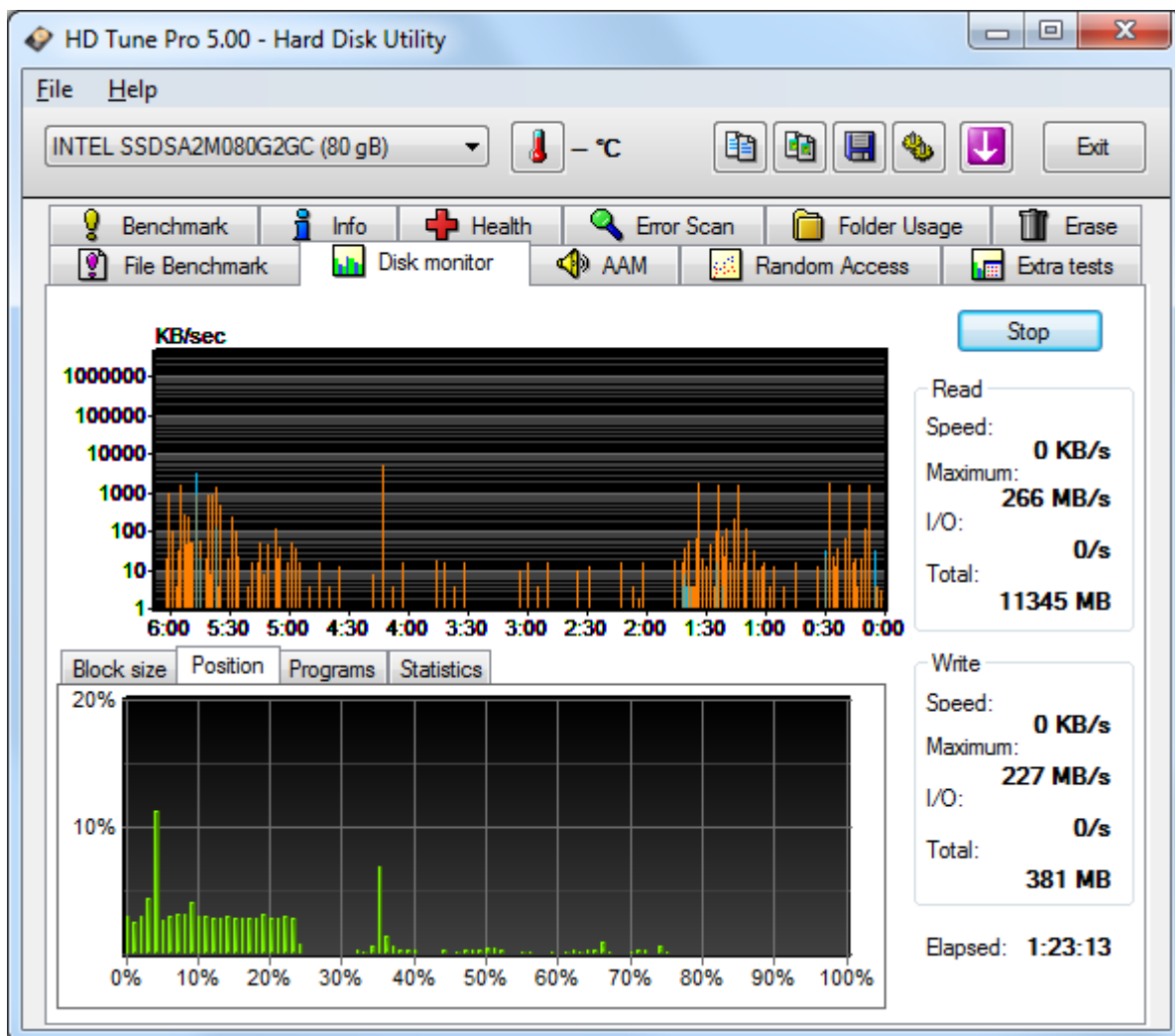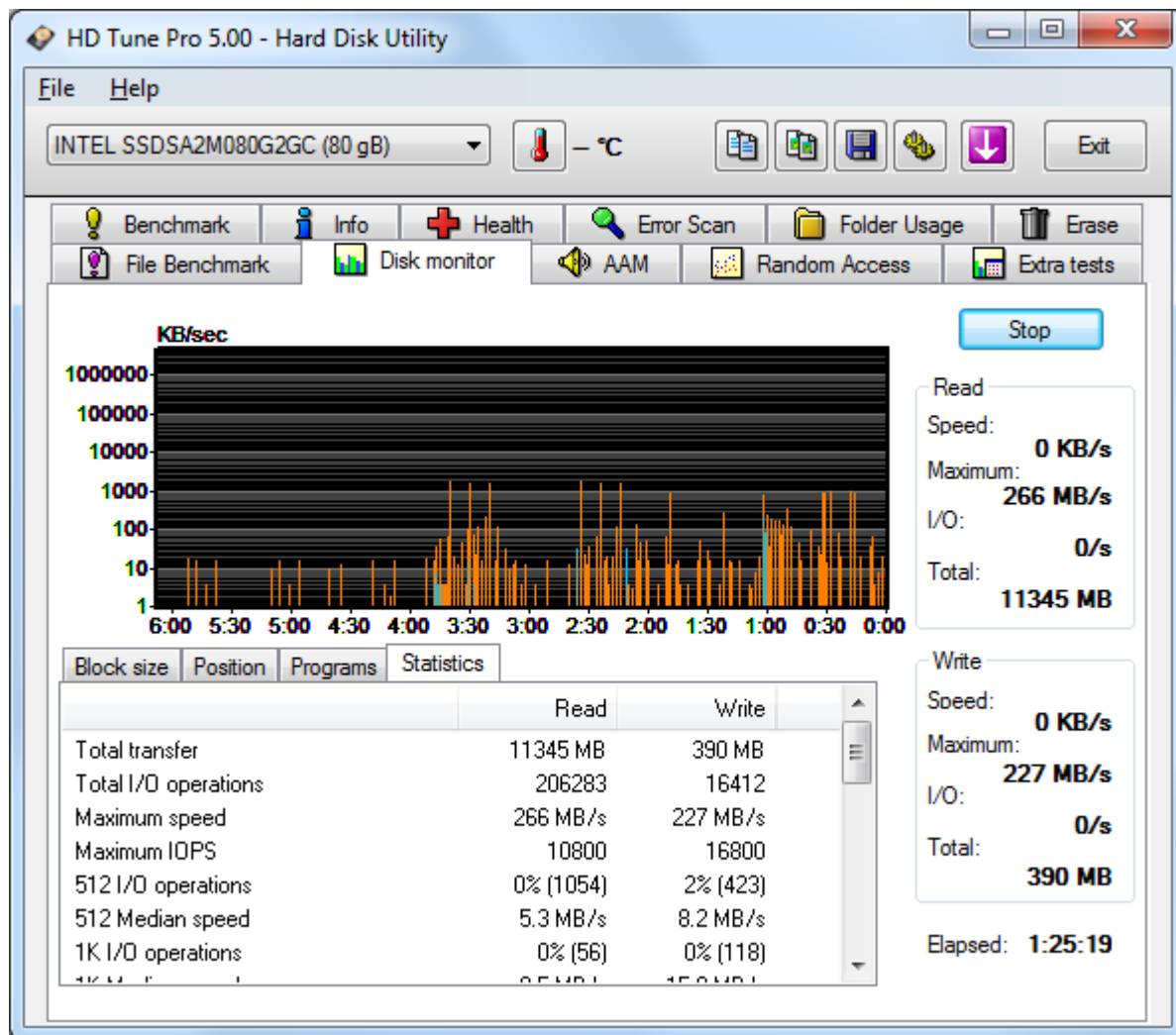
Programs

Shows a list of programs/processes which generate disk I/O activity. The number of read/write operations and total read/write size are shown for each process.
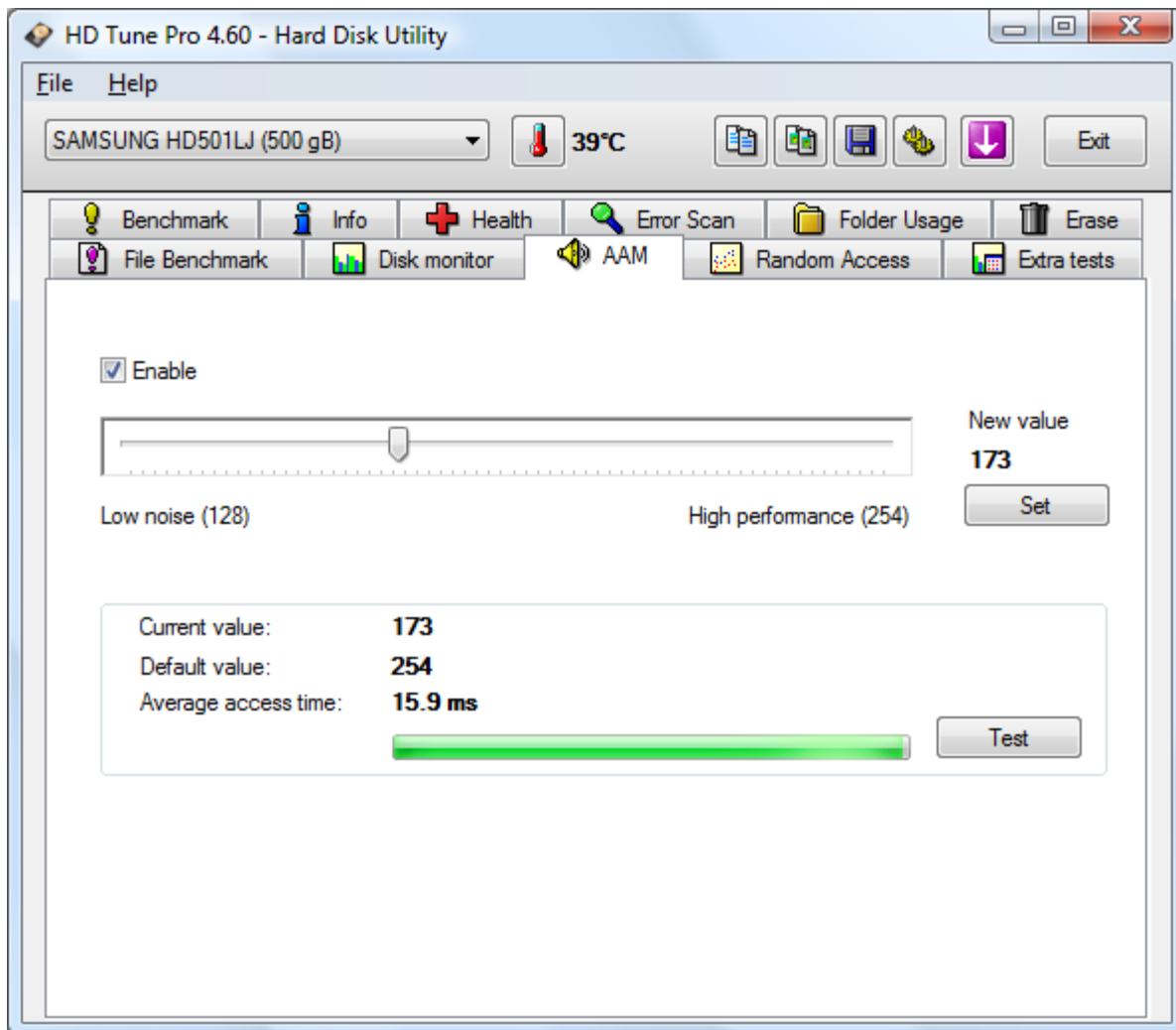
Statistics

Shows a list of the most important I/O statistics.

Note: the I/O transfers include cached operations. These cached operations usually exceed the maximum performance of the device.

16.   AAM

AAM or Automatic Acoustic Management allows you to reduce the seek noise or to increase the seek performance.
Possible values are between 128 and 254 where 254 gives you the highest performance but also more noise while a value of 128 gives you less noise but lower performance.
To change the AAM settings move the slider and press the Set button.

The effect of the new setting can be tested by pressing the Test button.

17.   Save options

The save options apply to the screenshot save function. To change the save settings go to the Options menu and click on the Save entry.
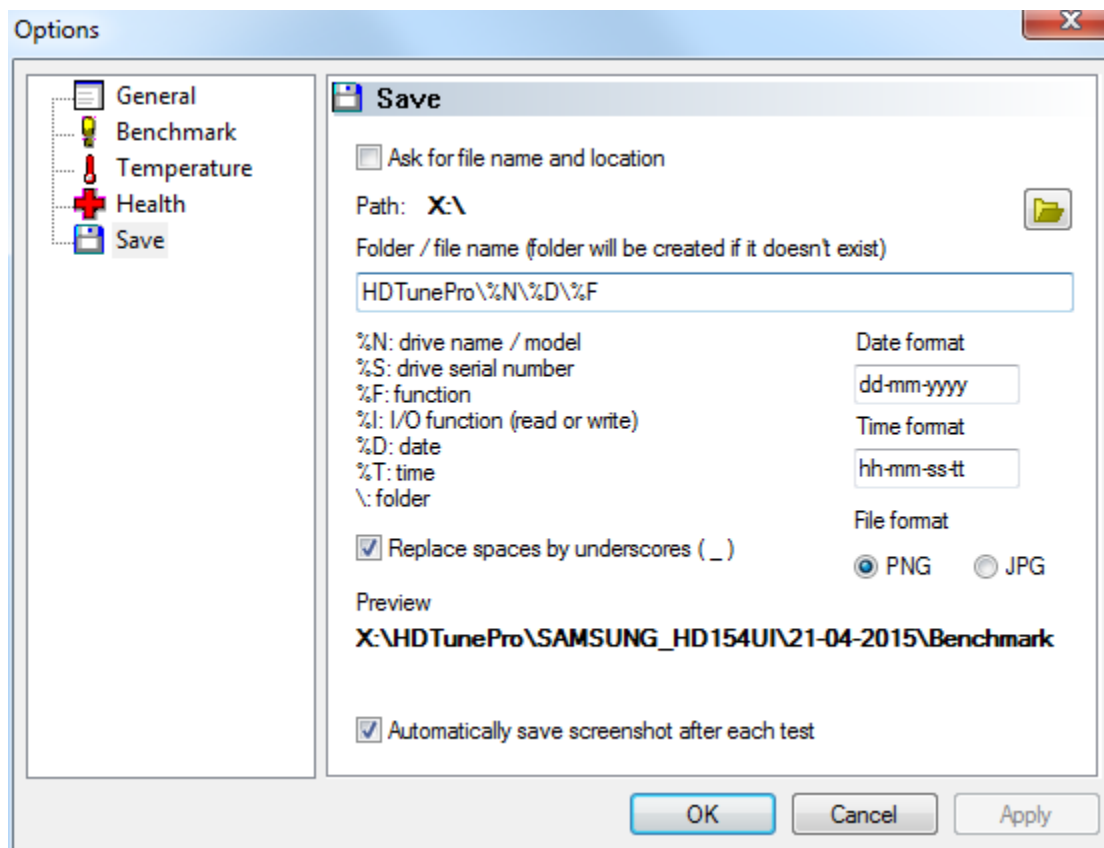
Ask for file name and location:
When this option is checked you can manually specify the destination folder and file name.
When this option is enabled the two options below are ignored.

Path: click on the folder button to select the destination folder.

Folder / file name:
Specify the filter to generate the folder and file name.
If the folder does not exist it will be created.

%N: drive name / model
%S: drive serial number
%F: function
%I: I/O function (read or write)
%D: date
%T: time
%P: current pass (used in Benchmark function)
\: folder

Date format:
The date format can be specified by using these format types:

d: day of the month without leading zero (eg. 7)
dd: day of the month with leading zero (eg. 07)
ddd: abbreviated day of the week (eg. sat)
dddd: day of the week (eg. saturday)
m: month without leading zero (eg. 3)
mm: month with leading zero (eg. 03)
y: last digit of the year (eg. 5)
yy: two last digits of the year (eg. 15)
yyyy: year (eg. 2015)
g: era (eg. A.D.)

examples:
d-m-yy: 7-3-15
dddd-dd-mm-yyyy: saturday-7-03-2015

Time format:
The time format can be specified by using these format types:

h: hours without leading zero, 12-hour clock (eg. 2)
hh: hours with leading zero, 12 hour clock (eg. 02)
H: hours without leading zero, 24-hour clock (eg. 14)
HH: hours with leading zero, 24 hour clock (eg. 14)
m: minutes without leading zero (eg. 4)
mm: minutes with leading zero (eg. 04)
s: seconds without leading zero (eg. 7)

ss: seconds with leading zero (eg. 07)
t: time marker, one character (eg. A or P)
tt: time marker, multicharacter (eg. AM or PM)

examples:
h-m-s tt: 5-20-8 PM
HH-mm-ss: 17-20-08

File format:

Choose between the png and jpeg file format.
For HD Tune Pro screenshots png is preferred because it delivers higher quality with a smaller file size. The jpeg format may be conveniemt if your system doesn't support png files.

Replace spaces with underscores: check this option to replace all spaces with underscores (_)

Automatically save screenshot after each test: when this option is checked a screenshot with test results is saved automatically saved to the specified folder.
This option applies to the following functions: Benchmark, File benchmark, Random Access, Extra Tests, Error Scan and Erase.

18.   Command line parameters

The following command line parameters can be used:

/DISK:x
Selects hard disk
x = disk number (0 = first disk)

/FUNCTION:x
Selects function
Possible values:
Benchmark, Info, Errorscan, Health, Folderusage, Erase, Filebenchmark, Diskmonitor, AAM,
Accesstest, Extratests.

/QUICKSCAN
Quick scan will be performed with the Error Scan function.
Used in combination with /FUNCTION:ErrorScan.

/LOG:x
Saves information or test results to the specified file
x = full path to file.

/START
Starts selected function automatically
Can be used for Benchmark, Error Scan, Disk Monitor and File Benchmark

/WRITE
Selects the write test. If omitted the read test will be executed.
Can be used for Benchmark, Access Test and Extra Tests.

/MINIMIZE
Minimizes the program

/QUIT
Quits the program after the specified task has been executed

/LIST
Shows a list of all available devices

/SAFE [+][-]x
Certain advanced detection functions will be disabled when specifying this option to
troubleshoot incompatibility issues with certain drivers.
/SAFE without extra parameters will disable all of these functions and will restore the windows
size to the default size.
For more information please contact support.

Parameters are not case sensitive.

Examples:
/DISK:1 /FUNCTION:benchmark /START /LOG:c:\benchmark.txt
This command line performs the benchmark functions on the second disk and saves the
results to the file c:\benchmark.txt

/FUNCTION:info /LOG:c:\info.txt /QUIT
This command line saves the information from the Info tab to the file c:\info.txt and then exits
the program.
No disk is specified so the information will be gathered from the first disk.

19.   Contact information

Support and sales questions: support@hdtune.com

For the latest information and program updates please visit http://www.hdtune.com