

PC-3000 Disk Analyzer

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1. Functionality

PC-3000 Disk Analyzer is a program designed for testing of disk drives connected using standard means. It allows to:

- ◆ Perform logical scanning using the commands for reading or verification.
- ◆ Detect the read/write speed for various sectors of a drive in order to estimate its performance.
- ◆ Write ranges of logical addresses to disk in order to test the recording functionality or erase data.
- ◆ View identification data of disk drives.
- ◆ View complete identification data of IDE (PATA/SATA) drives.
- ◆ View S.M.A.R.T. data including logs.
- ◆ Save defects revealed while scanning in PC-3000 format for their subsequent reassignment using the tools of these suites.
- ◆ Copy the data to another disk drive sector by sector.

2. System requirements

PC-3000 Disk Analyzer can be used with any relatively recent Windows NT based OS, such as Windows 2000, Windows XP, Windows Vista or Windows 7, as well as their server counterparts – Windows Server 2003 and Windows Server 2008/R2.

The program has no specific requirements for the PC hardware as they are determined by the host operating system.

Generally the requirements of Windows 2000 may be used as those of the earliest NT-based OS supported:

- ◆ a P6 (Pentium Pro) type or similar CPU running at 233 MHz or faster;
- ◆ 128 Mb RAM;
- ◆ motherboard that supports USB 1.1 or faster (for testing of USB drives).

3. Interface

PC-3000 Disk Analyzer starts with a dialog prompting to choose one of the disk drives available in the system; the list may contain hard disk drives and Flash devices. The program will also recognize connected CD/DVD if they contain an inserted disc.

The startup dialog also displays the following information:

- ◆ type of the bus used to connect a device (USB, SATA, IDE);
- ◆ device type (Disk, CD-ROM);
- ◆ device identifier;
- ◆ number of LBA sectors;
- ◆ size of LBA sectors (bytes);
- ◆ volume corresponding to the connected device.

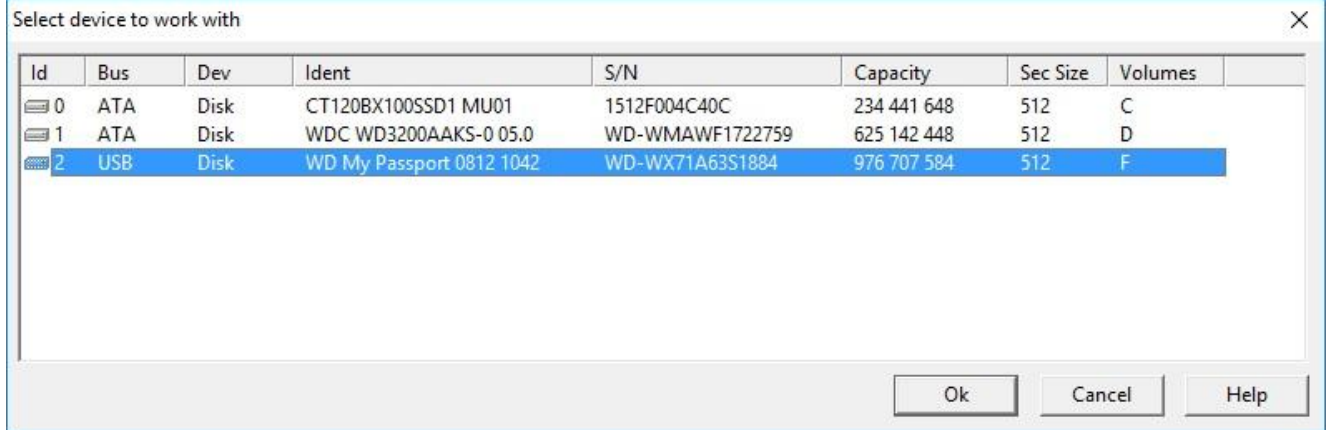


Figure 3.1. Startup dialog

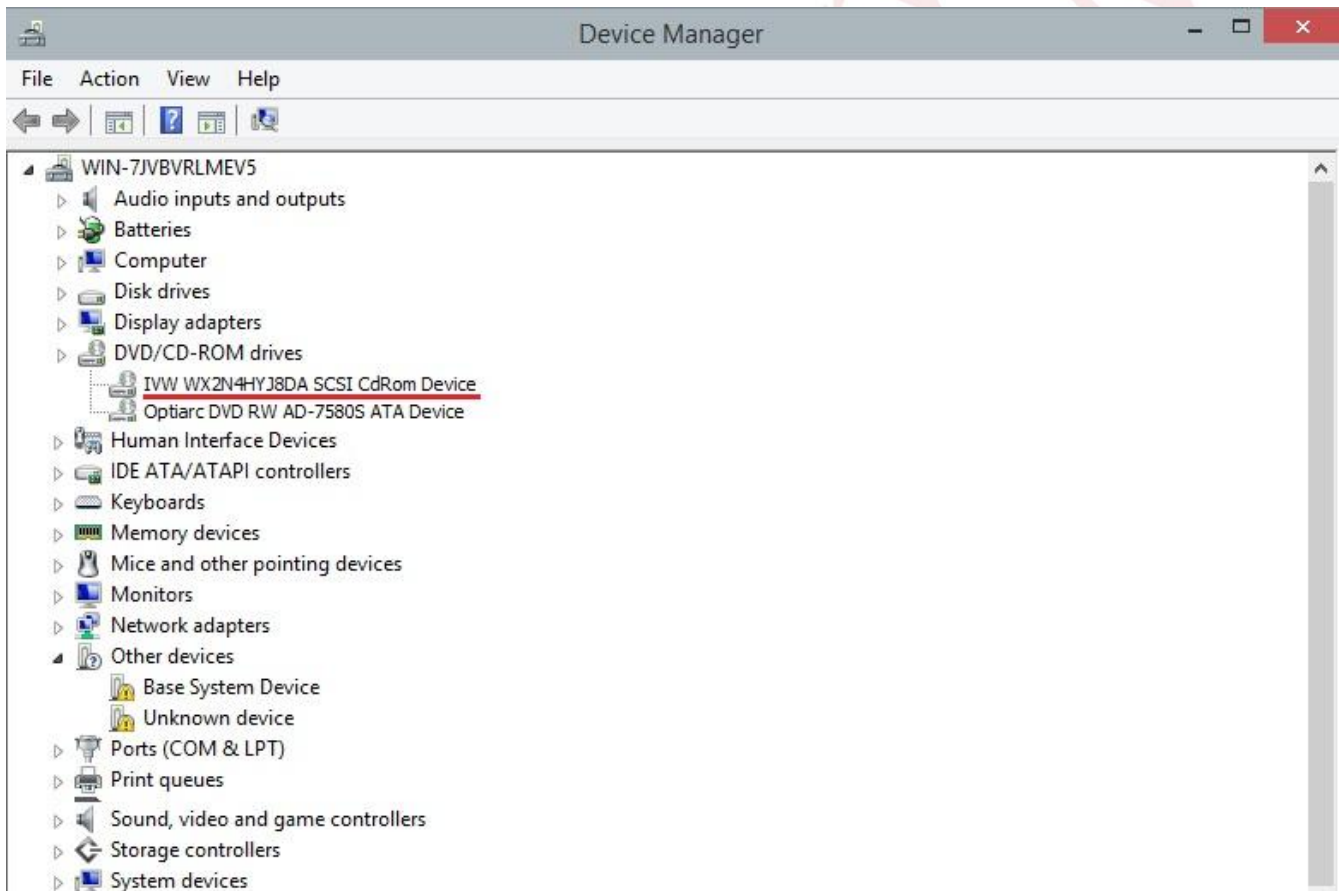


Figure 3.2. Device Manager with available disk drives and DVD/CD-ROM drives

Please keep in mind that although Windows Device Manager recognizes virtual drives (underlined in red) created in programs like Daemon Tools, Alcohol 120 or Nero, PC-3000 Disk Analyzer will not detect them, of course.

4. Main window

The interface is plain and intuitively understandable. PC-3000 users are certain to notice the resemblance between the main window of PC-3000 Disk Analyzer and PC-3000 UDMA/Portable/SCSI utilities.

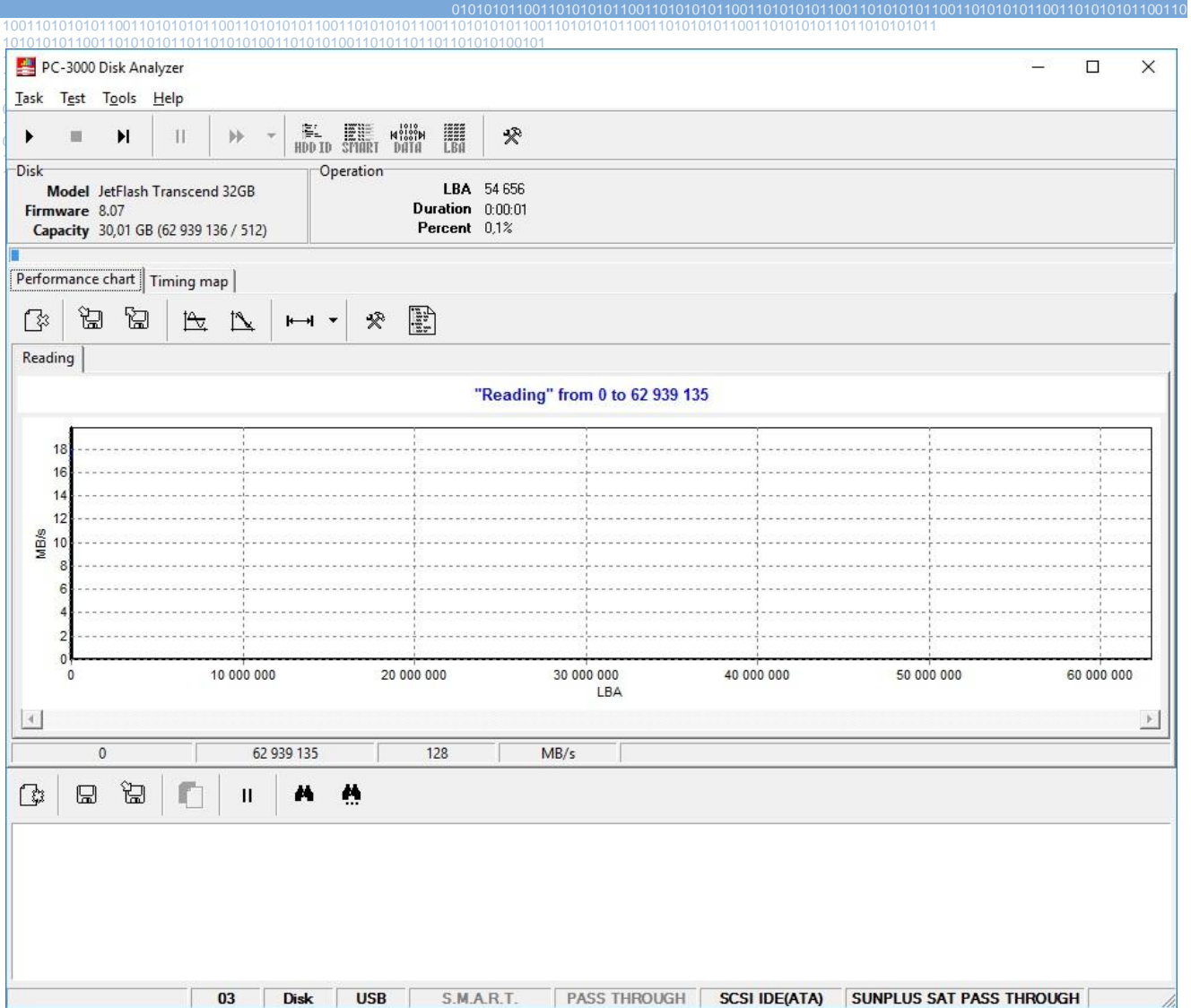


Figure 4.1. Main window

The main window of the program provides access to the following tabs:

- ◆ Task - (implemented incompletely yet, acts as an exit command in version 1.02).
- ◆ Test - initiates the read/write/verify test cycle for the selected drive.
- ◆ Tools - allows to start the 'Sector edit' or 'Defect list edit' tools, 'View S.M.A.R.T.', view 'Drive ID' or open the program 'Options'.
- ◆ Help - allows to open the 'PC-3000 Disk Analyzer help' or its 'About' dialog.

The test control toolbar below allows to start, pause, resume or complete the current operation.



Figure 4.2. Test control toolbar

Next to the test control toolbar there is another toolbar duplicating the tools from the corresponding menu tab.



Figure 4.3. Toolbar

The following section contains the panes of brief information about the drive being tested and current results of the test:

Disk	Operation
Model JetFlash Transcend 32GB	LBA 54 656
Firmware 8.07	Duration 0:00:01
Capacity 30,01 GB (62 939 136 / 512)	Percent 0,1%

Figure 4.4. Disk and Operation panes

The progress indicator for the current test is displayed below the Disk and Operation panes. It is integrated with the 'Performance chart' and 'Timing map' tabs (which may also contain additional toolbars).



Figure 4.5.

Bottom line of the main window displays the parameters of the selected drive:

- ◆ current operation;
- ◆ number of the device (2);
- ◆ device type (Disk);
- ◆ the interface used to connect the device (USB);
- ◆ S.M.A.R.T. availability (grayed out if the feature is not supported);
- ◆ IDE PASS THROUGH IOCTL availability;
- ◆ SCSI ATA Translation availability.

03	Disk	USB	S.M.A.R.T.	PASS THROUGH	SCSI IDE(ATA)	SUNPLUS SAT PASS THROUGH
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Figure 4.6. Information line

The options tab allows you to modify the colors of various menus, graphs and charts, etc. It can be opened from the corresponding tab ('Tools -> Options') or by clicking its icon in the main window:



Figure 4.7. The Tools icon

4.1. The Test tab

The tab allows to start a verification, writing or reading test.

When a reading or verification test is selected, you can specify its parameters in a step-by-step sequence:

- ◆ Step 1: during this step you can define the range of sectors, which will be tested.
- ◆ Step 2: the program will prompt you to choose one of three available tests (in this case, reading or verification).
- ◆ Step 3: once you select the LBA-based sector reading test, the program will offer to copy data sector-by-sector from the drive being tested to another drive.
- ◆ Step 4: PC-3000 Disc Analyzer will display an offer to select its next step in case of an error:
 1. Terminate process.
 2. Skip the addresses where the error has been encountered.
 3. Save the defects as a defect list file (.lba) for further analysis in PC-3000 UDMA or PC-3000 Portable.

Step 5: before the test begins, you can also define the delay values, which will be used to determine the sector reading rate ("Without delay", "With delay" or "With slowing down").

PC-3000 Disk Analyzer measures the execution time of each command. The program uses two thresholds to estimate drive access during command execution and rate it accordingly.

Without delay means that the command execution time was below the minimum delay threshold.

With delay means that the command execution time was above the minimum delay threshold but below the maximum delay threshold.

With slowing down means that the command execution time exceeded the maximum delay threshold.

With error - *an error was encountered during command execution.*

Please keep in mind also that the verification test is only applicable to HDD because Flash-based drives do not support it.

Then the program actually starts the test, during which you can monitor the reading/verification performance in the selected LBA range. While the test is in progress, you can also navigate to the 'Timing map' and check the number of sectors read without errors, with a delay, with a slowdown or with an error. The graph in the 'Performance chart' tab can be helpful in case of a slowdown or delay as it allows to find the range of suspicious LBA sectors for further rescanning.

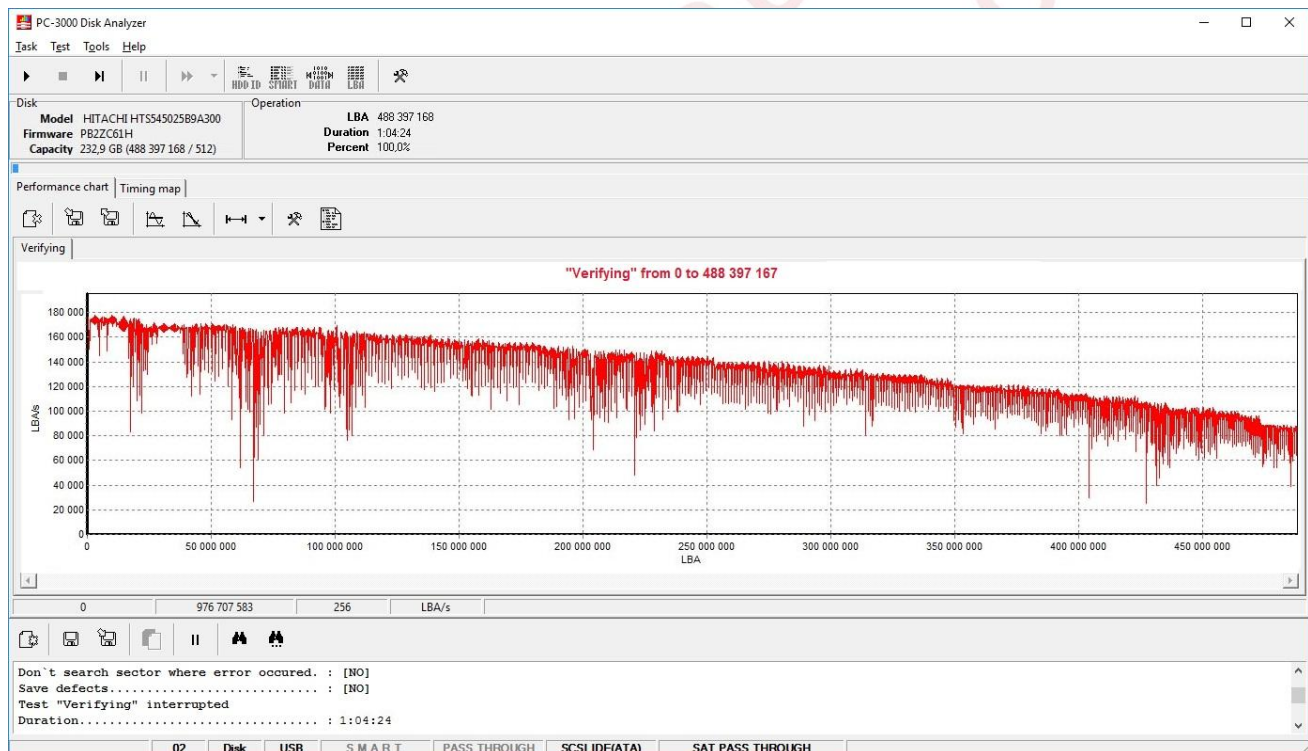


Figure 4.8. LBA-based reading performance graph for a HDD

Once reading/verification completes, the information pane in the lower part of the program window displays the time spent scanning and the number of found errors with indication of affected sectors. Information pane also displays the initial settings of the reading/verification cycle (including the applied parameters and the range of scanned LBA).



Figure 4.9. Information pane

Problems on HDD surface are always accompanied with a drop in reading/writing performance in the range of addresses corresponding to the affected area. While running a test, PC-3000 Disk Analyzer constantly measures the performance of the drive reflecting the results in the performance chart and timing map. Relative changes (decrease) in the performance become obvious immediately.

Please note that the graph reflects performance of the program and not just the drive being tested. Consequently, the graph shape may be affected by all kinds of events in the operating system. Thus, when the progress slows down, for example, because the operating system starts some process, the program's performance also decreases and the graph reflects that at once. Besides, such "additional" speed drops can be caused by OS attempts to access a drive resulting in slower performance as shown in the graph.

The issue requires special attention from the users of laptops running Windows Vista or Windows 7. These operating systems feature a lot of mechanisms extending battery life; as a result, the OS may deliberately switch a drive to slower operation if a laptop is in maximum power saving mode or if it enters the sleep mode. In that case the activity of the drive being tested will be minimized, and the graph will reflect that: the range of sectors read in the sleep mode will be recognized by the program as sectors read "with slowing down" or even "with error".

If you notice a considerable performance decrease, stop scanning, identify the range of sectors where performance drop is noticeable and start the reading cycle again having configured it specifically for the range of sectors demonstrating problems.

A sample situation:

While a 500 Gb Western Digital HDD was being tested, the laptop running PC-3000 Disk Analyser was accidentally switched to sleep mode. Upon test completion the following graph was produced:

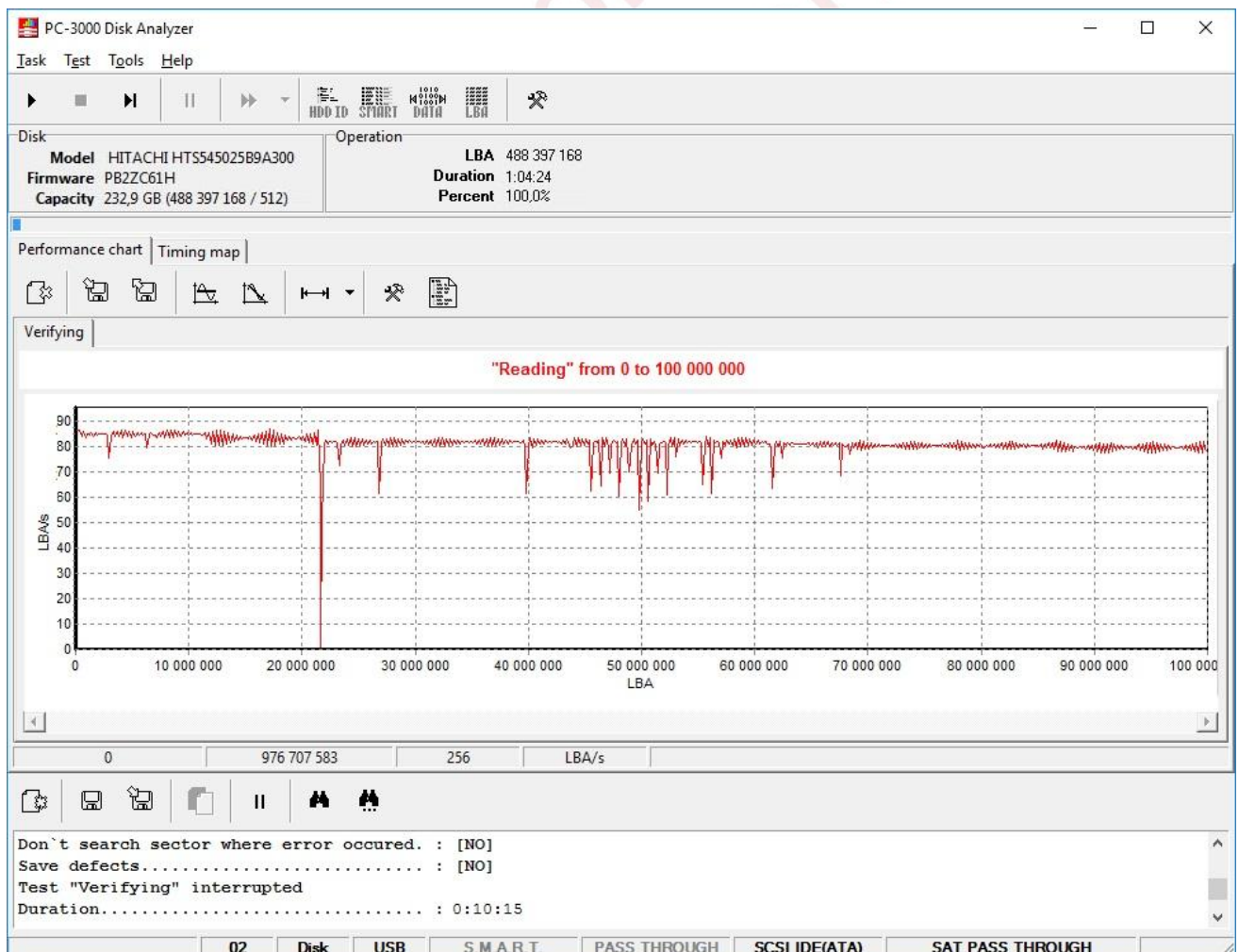


Figure 4.10. Reading test graph

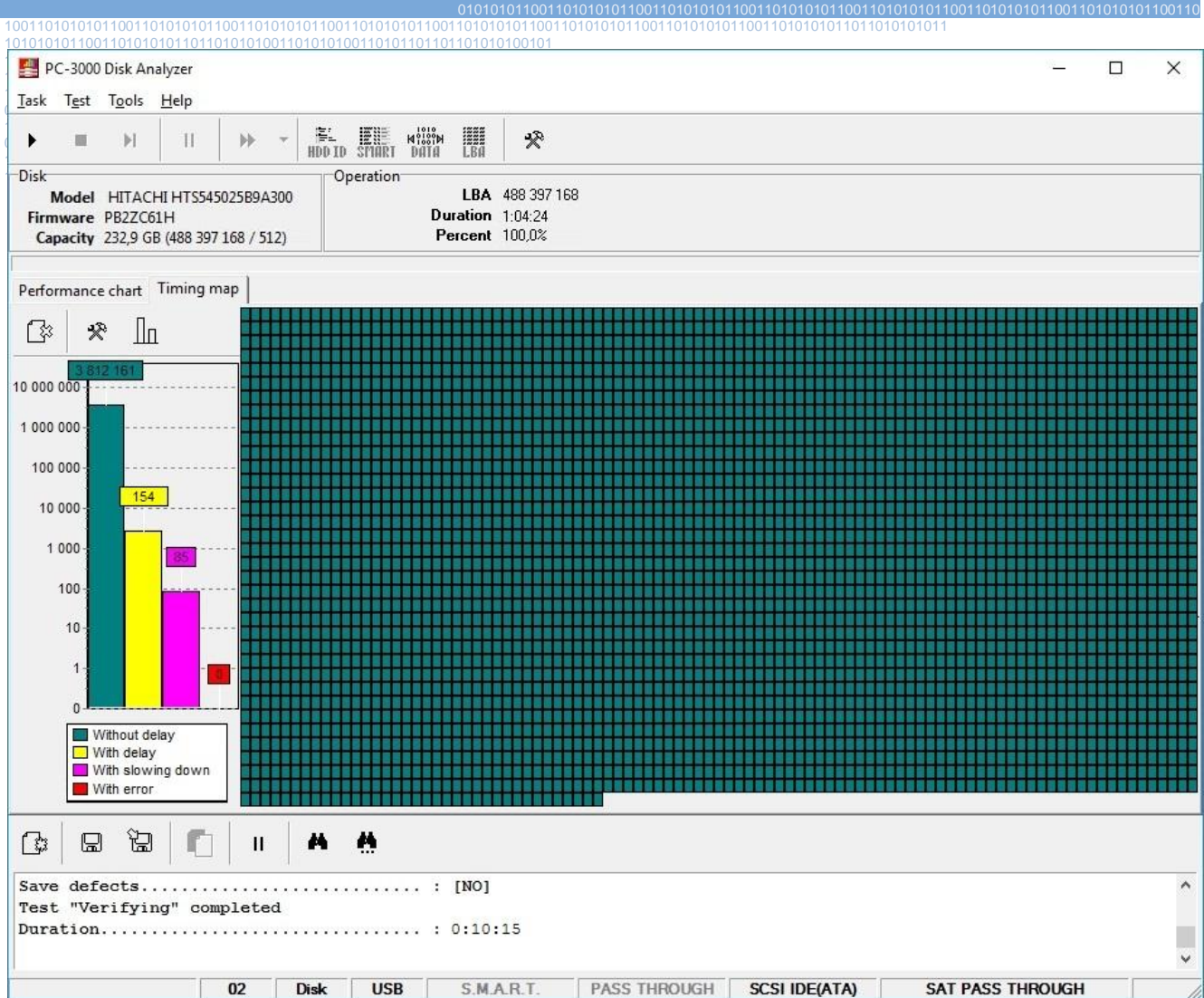


Figure 4.11. Reading test timing map

1. Obviously, performance decreased sharply within a small range at approximately 22 000 000 LBA, the program revealed several dozens of sectors with delays and slowdowns.
2. Moreover, delays are noticeable in a larger range approximately from LBA 44 000 000 to 58 000 000.

A repeated reading test of the suspicious sectors reveals that the delays have been caused by OS activity. The first occasion reflected HDD slowing down due to OS switch to sleep mode.



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Performance graph of retested subjects

The second occurrence was caused by internal Windows routines trying to access the HDD.

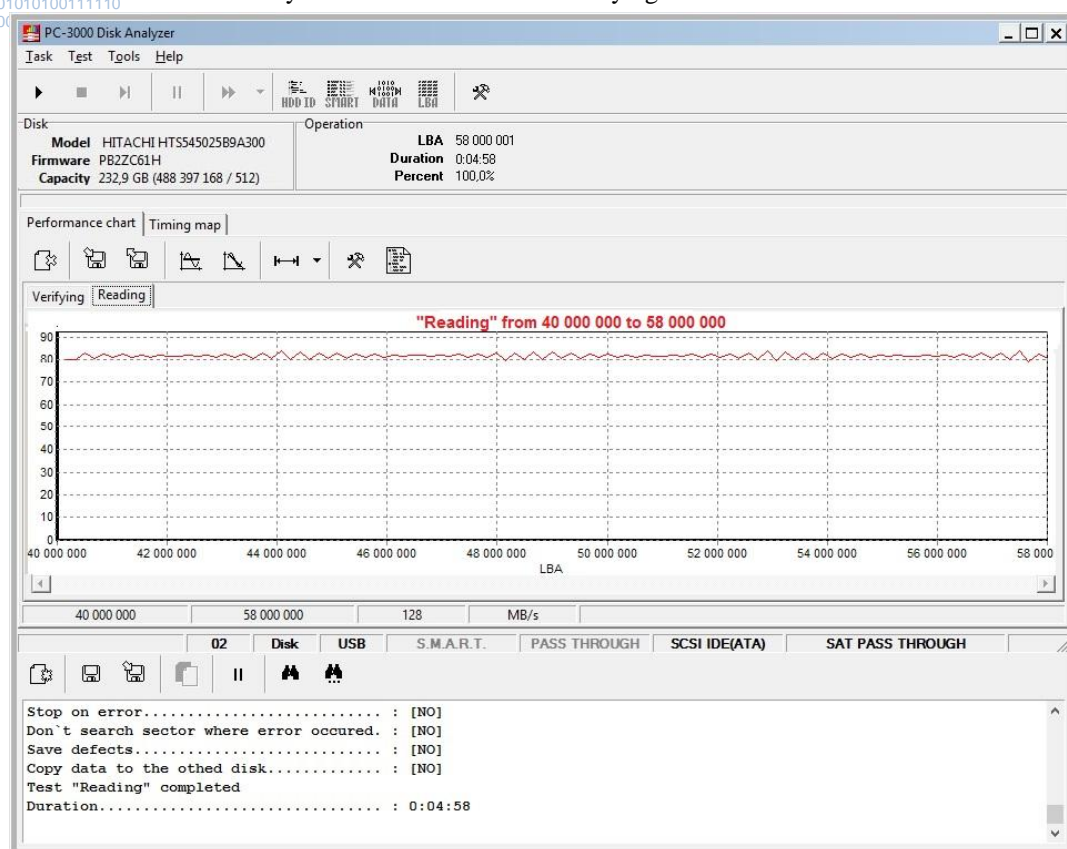


Figure 4.14. Performance graph of retested suspicious sectors

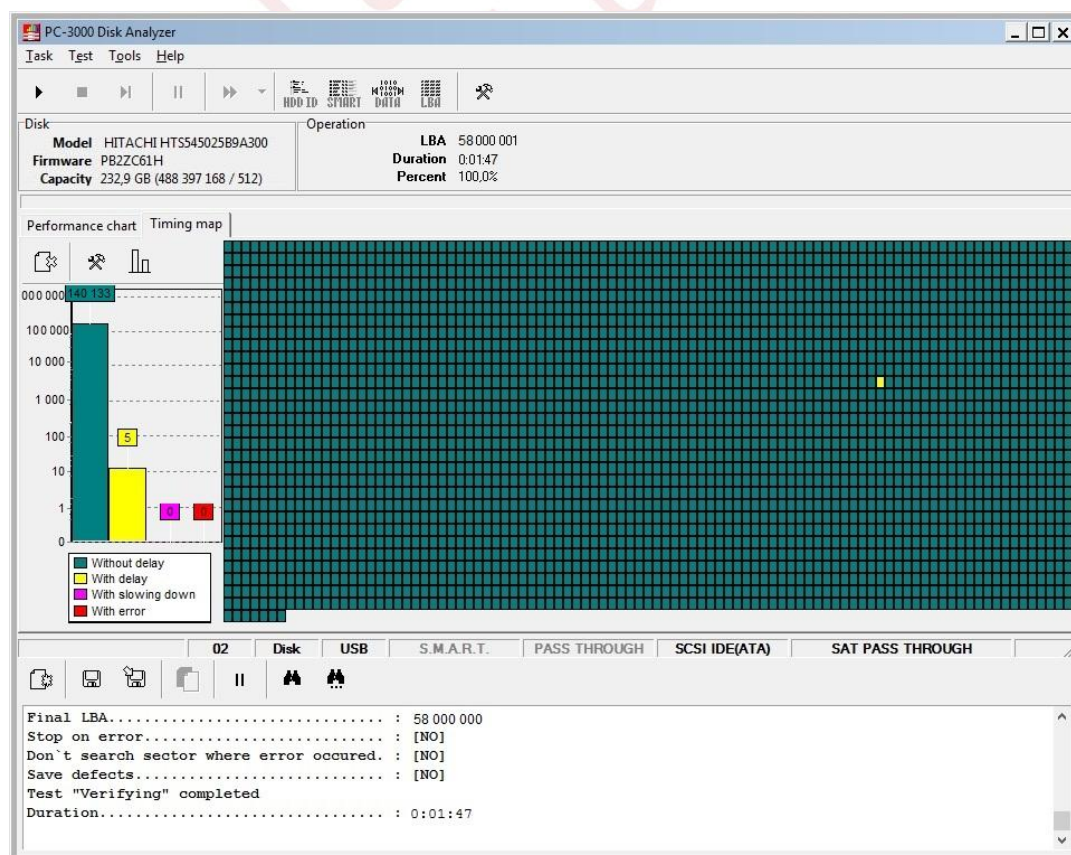


Figure 4.15. Performance graph of retested suspicious sectors

4.2. The Tools tab

4.2.1. Viewing the HDD identification data

HDD identification data (HDD ID) represent the response returned by a drive after the ID reading command (0xEC). HDD ID format and field values are described in the ATA Specification.

To view HDD ID, you need to invoke the command with the corresponding toolbar button or select the 'Tools -> Drive ID' command from the menu.

HDD ID contains parameters in binary and text format. The program displays them using different icons depending on the parameter type and status:

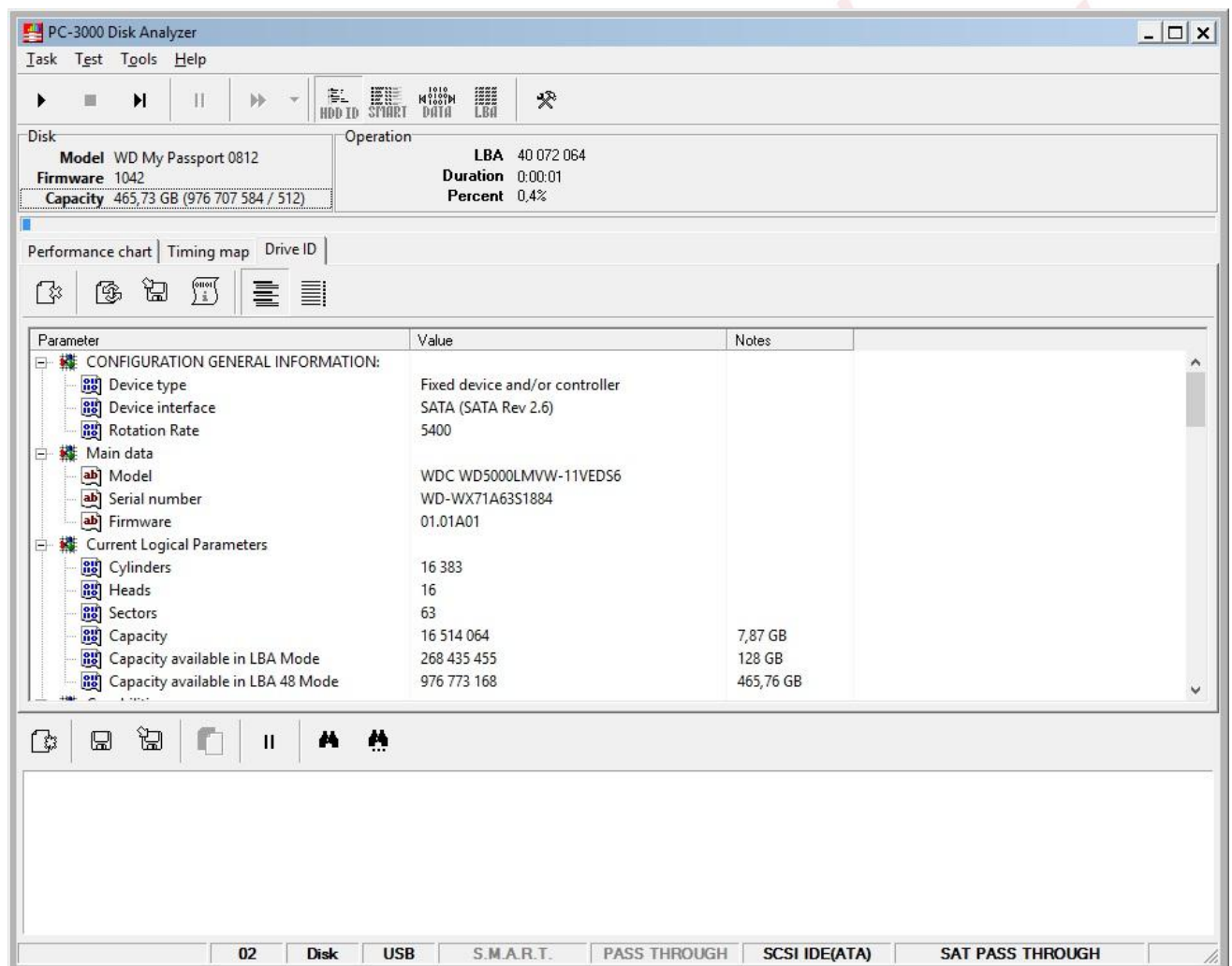


Figure 4.16. HDD ID viewing

HDD ID viewing is only available if the method used to connect the HDD allows reading of its ID.

4.2.2. View S.M.A.R.T.

S.M.A.R.T. (Self-Monitoring Analysis and Reporting Technology) is a drive self-testing technology developed by HDD manufacturers to ensure higher reliability of data storage. S.M.A.R.T. means that a drive internally monitors its operability thus being able to warn the user in advance about its pre-fail condition. Moreover, ATA Specification provides for some additional functionality of the S.M.A.R.T. subsystem, such as logging of HDD errors and execution of Offline diagnostics code (including logging of the results).

To view HDD S.M.A.R.T., you need to invoke the command with the corresponding toolbar button or select the 'Tools -> View S.M.A.R.T.' command from the menu.

Reviewing the S.M.A.R.T. values (in the Attributes tab) allows you to recognize a degrading HDD at once without long testing. Typically, a HDD with surface problems has "Reallocated Sector Count" above the threshold or close to it.

S.M.A.R.T. error log (in the Summary Error Log tab) is also quite useful for drive analysis without testing of its entire surface. If the error log contains records with RegError UNC, IDNF values, they are a clear indication of problems with the surface. You can run then a partial test of disk area around the LBA value of the corresponding log record.

Please keep in mind that the presence of records in the error logs does not always mean that the HDD has started to degrade. Some HDD keep in the log records generated during factory testing.

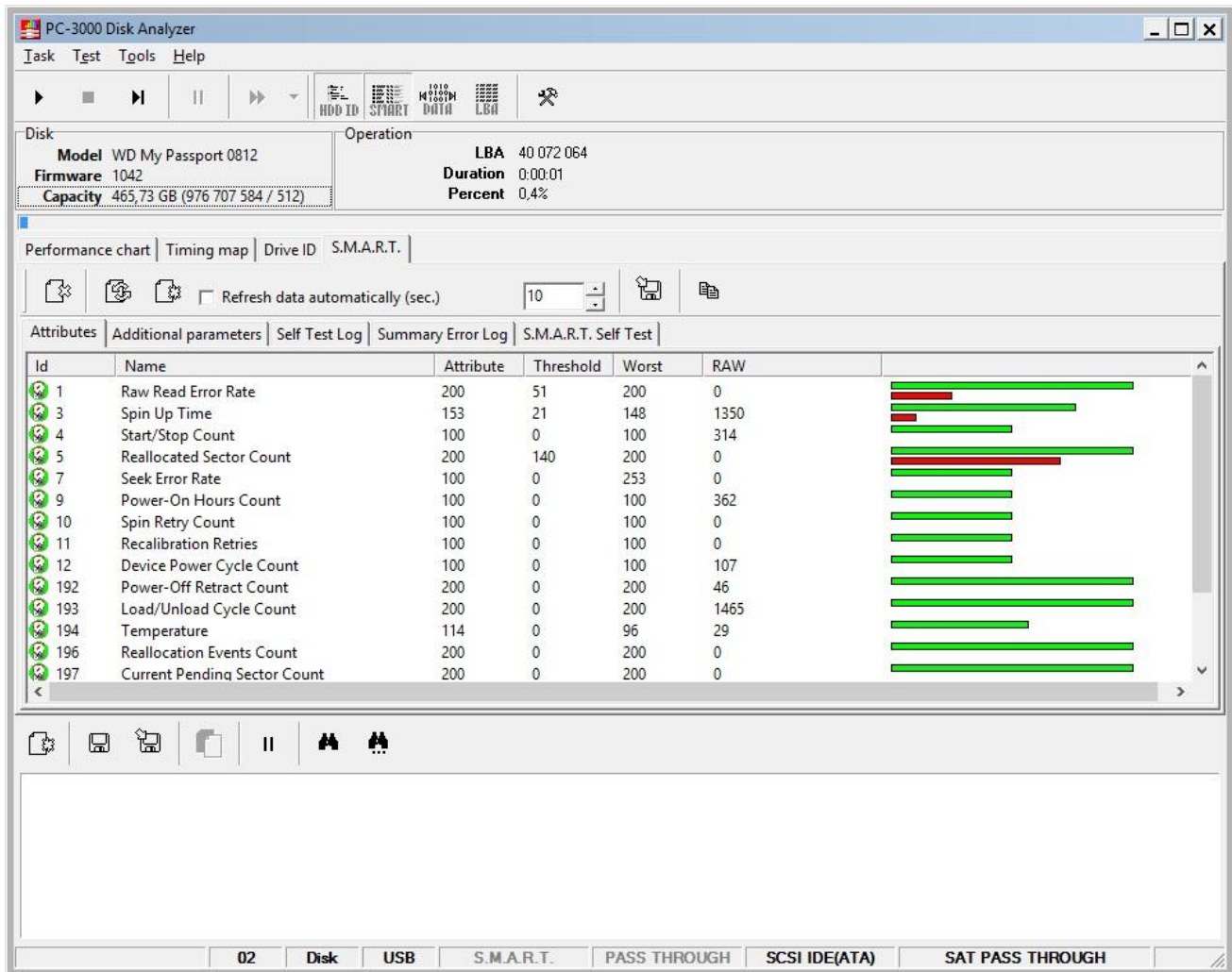


Figure 4.17. S.M.A.R.T. viewing

4.2.3. Sector editor

This mode allows viewing and editing of arbitrary data sectors on disk. It is a binary editor used as a standard component in ACE products and enhanced with drive navigation functionality.

To use the sector editor, you need to invoke the mode with the corresponding toolbar button or select the 'Tools -> Sector edit' command from the menu.

Please use the sector editing feature with caution. Otherwise you risk making the data on disk inaccessible for the operating system.

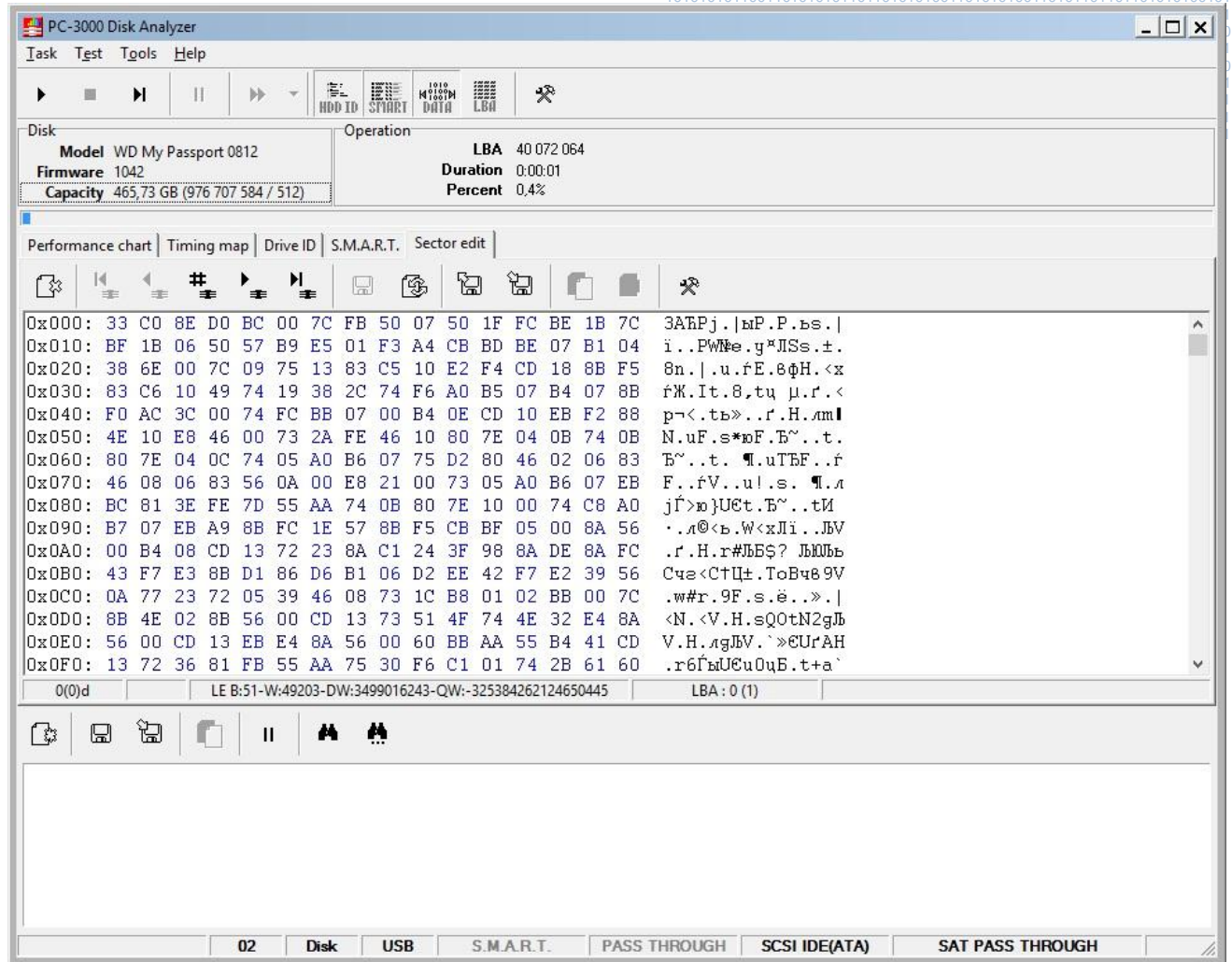


Figure 4.18. Sector editor

4.2.4. Defect list editor

A defect list is a universal format used in all the PC-3000 products for storage of defects revealed by testing or hidden in G- and P-List.

Defects found by PC-3000 Disk Analyzer while scanning can be reassigned later using specialized utilities of PC-3000 suites.

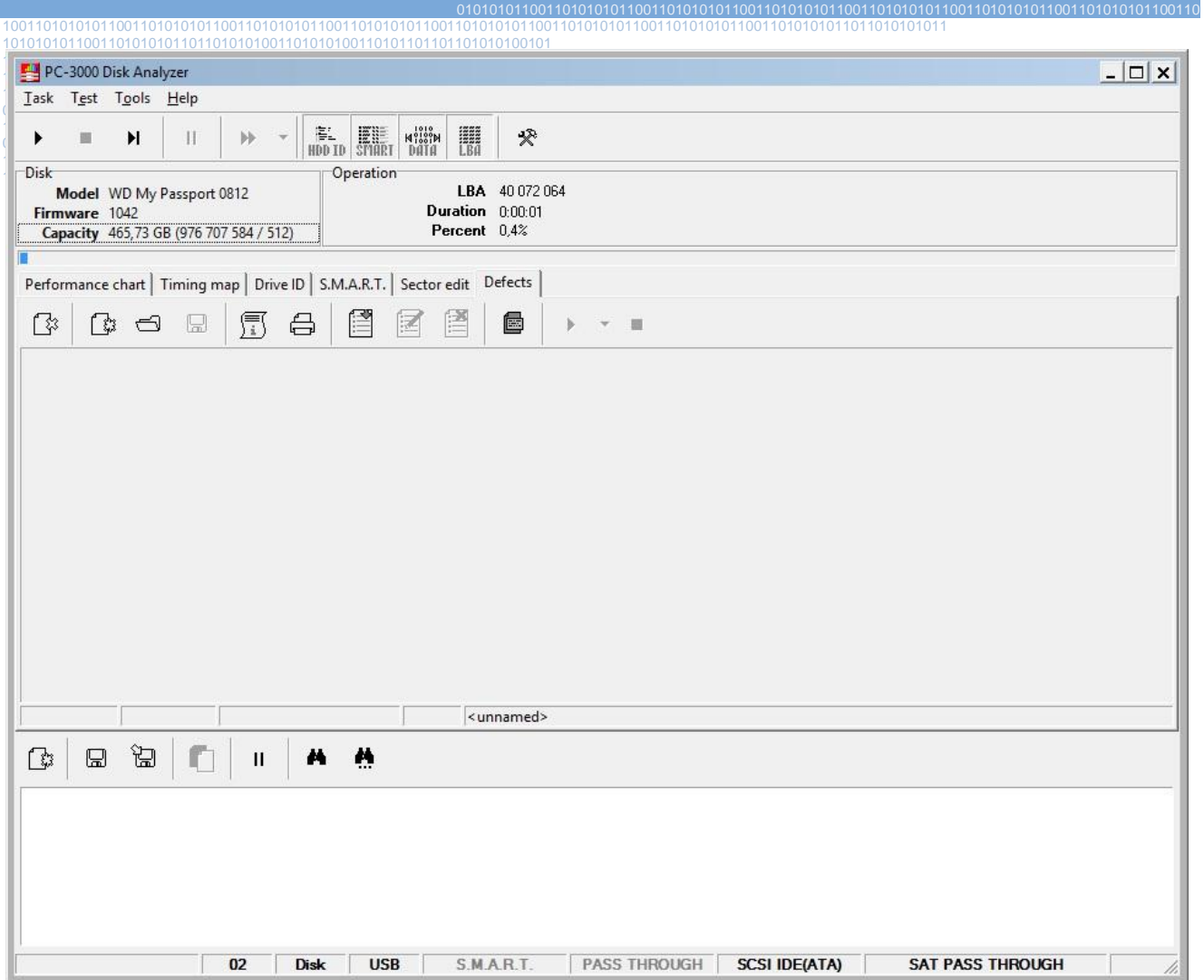


Figure 4.19. Defect list editor

4.3. The Help tab

This menu allows to open the 'About' dialog.

5. Potential issues

You may encounter certain issues while using PC-3000 Disk Analyzer. The main of them are as follows:

1. When the program starts for the first time in Windows Vista Windows 7, the startup dialog with an offer to choose the device for testing may contain an empty list of connected drives. Such behaviour is caused by some peculiarities in the operating system, in particular, its UAC (User Account Control) security settings; therefore, PC-3000 Disk Analyzer should be started using administrator credentials or after lowering the security level in the Control Panel.
2. When viewing of S.M.A.R.T. is selected, some values in the displayed list of drive attributes may appear invalid. For example, the reading of internal HDD temperature sensor or spin-up time may be incorrect. This discrepancy is caused by S.M.A.R.T. specifics because the program retrieves service data of the device and attempts to convert them into meaningful information about the drive's parameters. Consequently, some data may be erroneously decrypted by the program.