

Advanced SMART Technology for SSDs in Embedded Applications

C.C Wu

VP of innodisk Flash BU

- iSMART Tool
 - Alert System
 - Wear-Leveling
 - Data Log
- Data log experience



iSMART Ver 3.1.0

innodisk

Disk Info | Status | Performance / Alert | System Info

Disk No. 1 2 [] [] [] [] [] [] [] [] °C °F

Temperature °C Health 99.7% Model Name mSATA SSD

Drive Letter Disk2: Capacity 29.82GB

Firmware 121227 Serial Number 20130118AAAA00000018 Power On Count 48


Transfer Mode SATA/600 Interface Serial ATA Power On Hours 130

Standard ATA9 Feature SMART LBA48 NCQ TRIM SECURITY T.SENSOR WPROTECT

W.Protect ATA Security Quick Erase Low Power

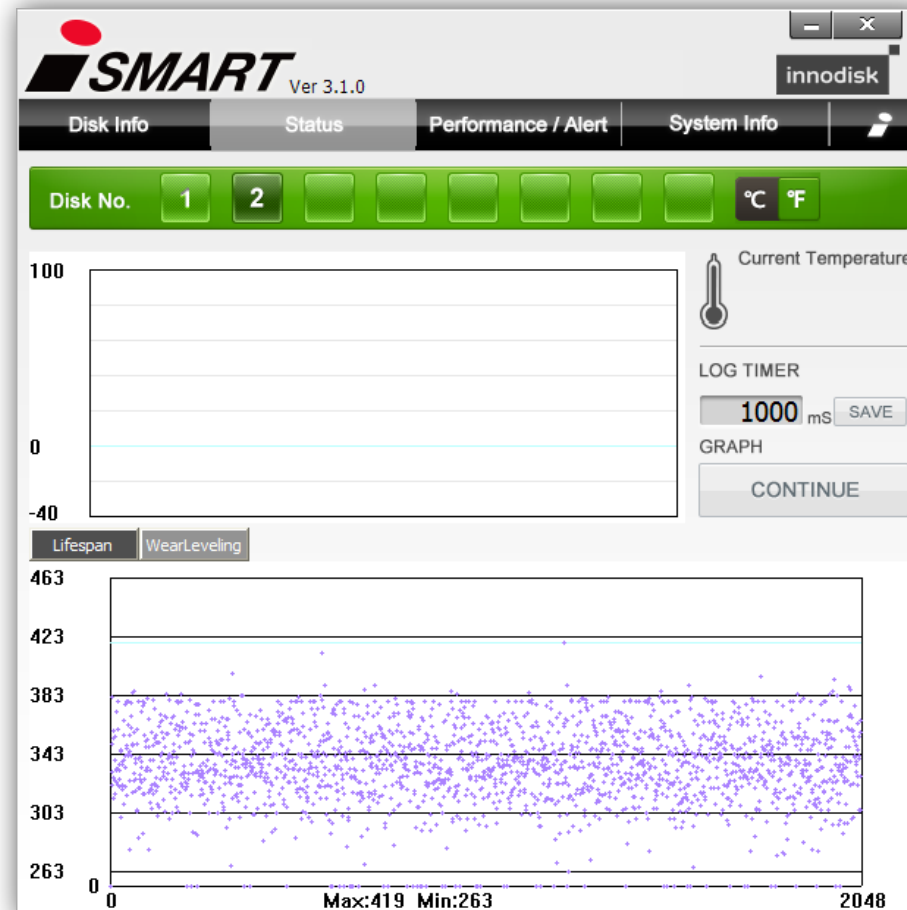
ID	Attribute Name	Item Value	Raw Values
09	Power On Hours	130	0000000082000000000000
0C	Power Cycle Count	48	0000000030000000000000
AA	Bad Block Count	Tot:252 Lat:59	030064640000FC003B0000
AD	Erase Count	Max:419 Ave:341	120064645501A301000000
EC	Unstable Power Count	0	0200646400000000000000
EB	Later Bad Block	Lat:59 Rea:0 Wri:0 Era:59	020064003B000000000003B
01			0000000000000000000000
02			0000000000000000000000
03			0000000000000000000000
07			0000000000000000000000
08			0000000000000000000000

- Temperature
- Health
- Lifespan
- Free capacity

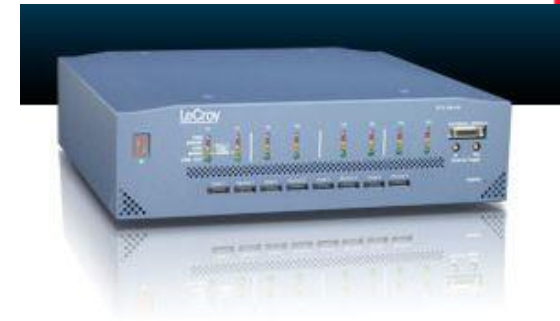


The screenshot shows the SMART Ver 3.1.0 web interface. At the top, there are navigation tabs for 'Disk Info', 'Status', 'Performance / Alert', and 'System Info'. Below the tabs is a 'Disk No.' row with buttons for disks 1 through 8, and temperature units '°C' and '°F'. The 'Performance Test' section displays 'READ' speed at 429.0 MB/s and 'WRITE' speed at 152.3 MB/s, each with a green progress bar. A 'TEST STOP' button is located to the right. The 'Alert for Device' section includes 'ALERT SETTINGS' with five categories: 'Temperature Under' (10 °C), 'Temperature Over' (70 °C), 'Health Under' (10 %), 'Lifespan Under' (3 Month), and 'Capacity Under' (1024 MB). Below these are input fields for 'Host' (host.innodisk.com), 'Port' (25), 'SMTPS/SSL' (checkbox), 'To' (mail@innodisk.com), 'ID' (mailID), 'From' (mail@innodisk.com), and 'Password' (mailPassword). At the bottom, there is a 'MAIL ALERT' checkbox, 'SAVE', 'TEST MAIL', and 'RefreshTimer' (600 s) with a 'SET' button.

- Erase count of each block



How to capture data



- SATA analyzer can get data, but it cost \$10,000
- innodisk provide free solution
- Easy to use. Don't need any driver
- Innodisk iSMART tool includes data log function



SMART Ver 3.1.0 innodisk

Disk Info Status Performance / Alert System Info

Disk No. 1 2

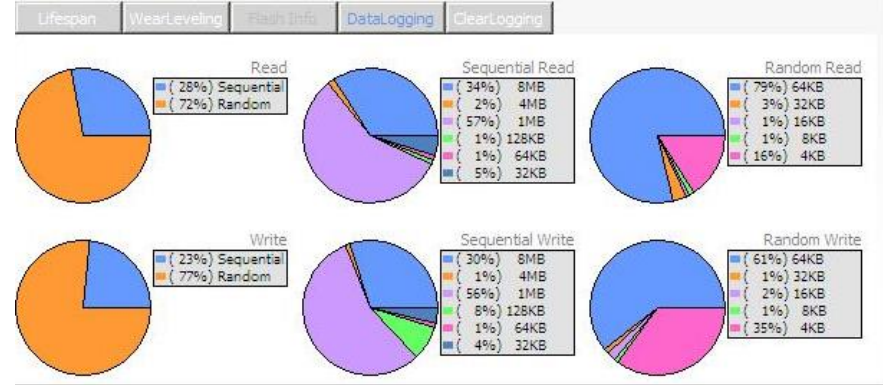
Temperature °C Health 99.7% Model Name mSATA SSD Drive Letter Disk2: Capacity 29.82GB

Firmware 121227 Serial Number 20130118AAA00000018 Power On Count 48

Transfer Mode SATA/600 Interface Serial ATA Power On Hours 130

Standard ATA9 Feature SMART LBA48 NCQ TRIM SECURITY T.SB006 WP/PROTECT

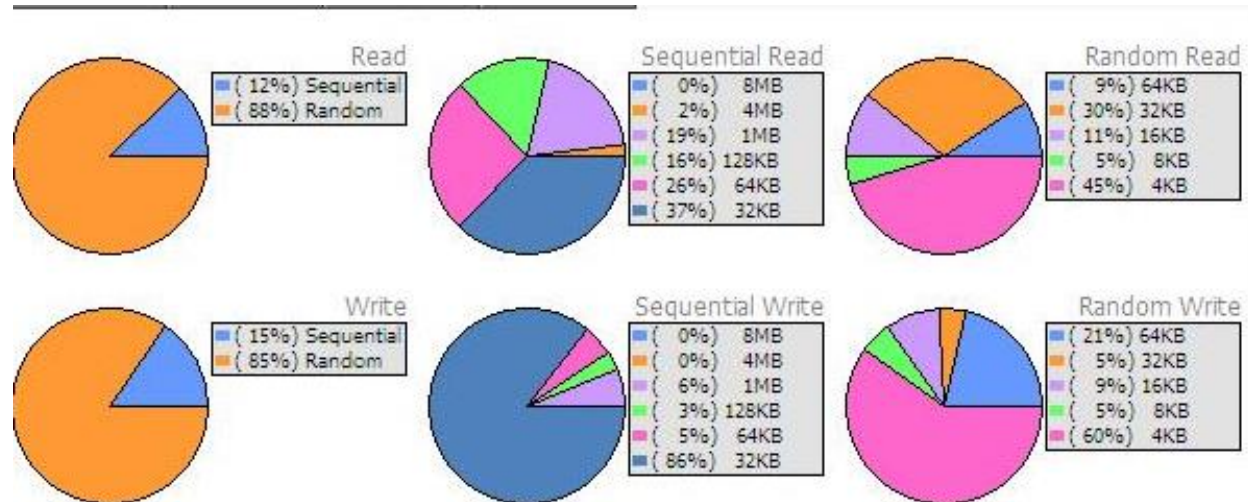
ID	Attribute Name	Item Value	Raw Values
09	Power On Hours	130	0000000082000000000000
0C	Power Cycle Count	48	0000000030000000000000
AA	Bad Block Count	Tot:252 Lat:59	030064640000FC03B00000
AD	Erase Count	Max:419 Ave:341	120064645501A301000000
EC	Unstable Power Count	0	0200646400000000000000
EB	Later Bad Block	Lat:59 Rea:0 Wri:0 Era:59	020064003B0000000000003B
01			0000000000000000000000
02			0000000000000000000000
03			0000000000000000000000
07			0000000000000000000000
08			0000000000000000000000



- Firmware can make a record for host read/write behavior
- Separate to sequential and random part
- 4K/ 8K/ 16K/ 32K/ 128K/ 1M/ 4M and 8MB unit
- This technology can help engineer to understand operation system and application behavior

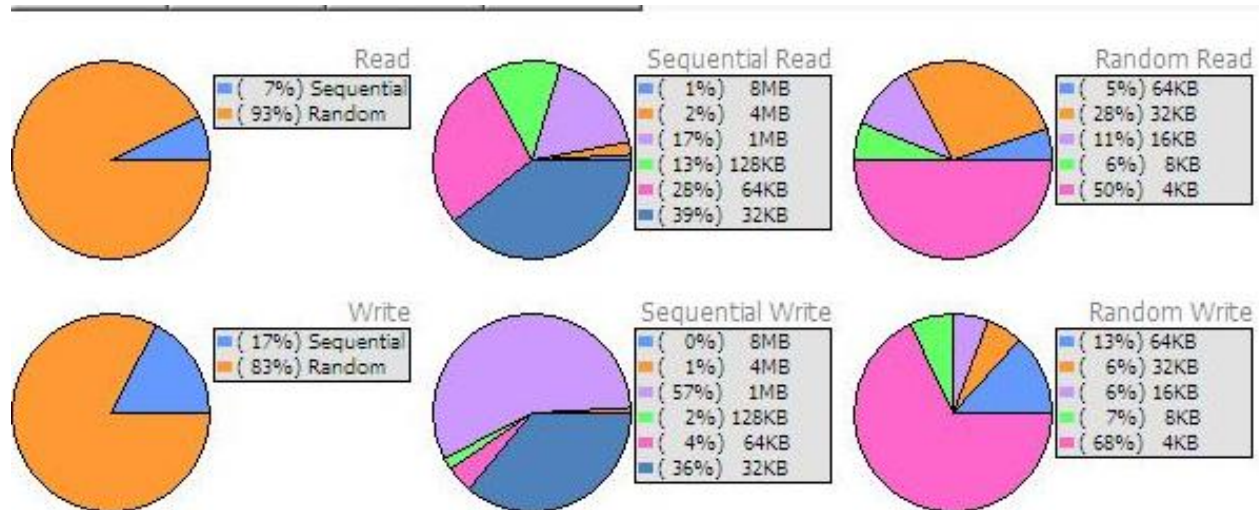
Window XP installation

- Analyze write behavior
- 15% Sequential write command
 - 86% is 32KB
- 85% is Random write command
 - 60% is 4KB



Window 7 installation

- Analyze write behavior
- 17% Sequential write command
 - 57% is 1MB
- 83% is Random write command
 - 68% is 4KB



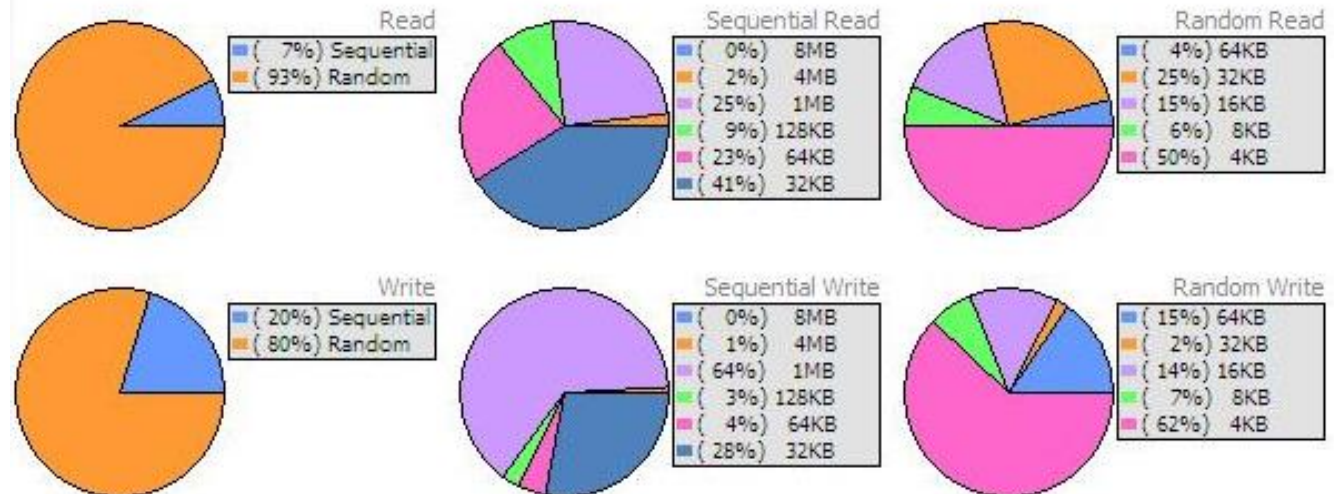
Ubuntu Installation

- Analyze write behavior
- 26% Sequential write command
 - 37% is 1MB
- 74% is Random write command
 - 64% is 4KB



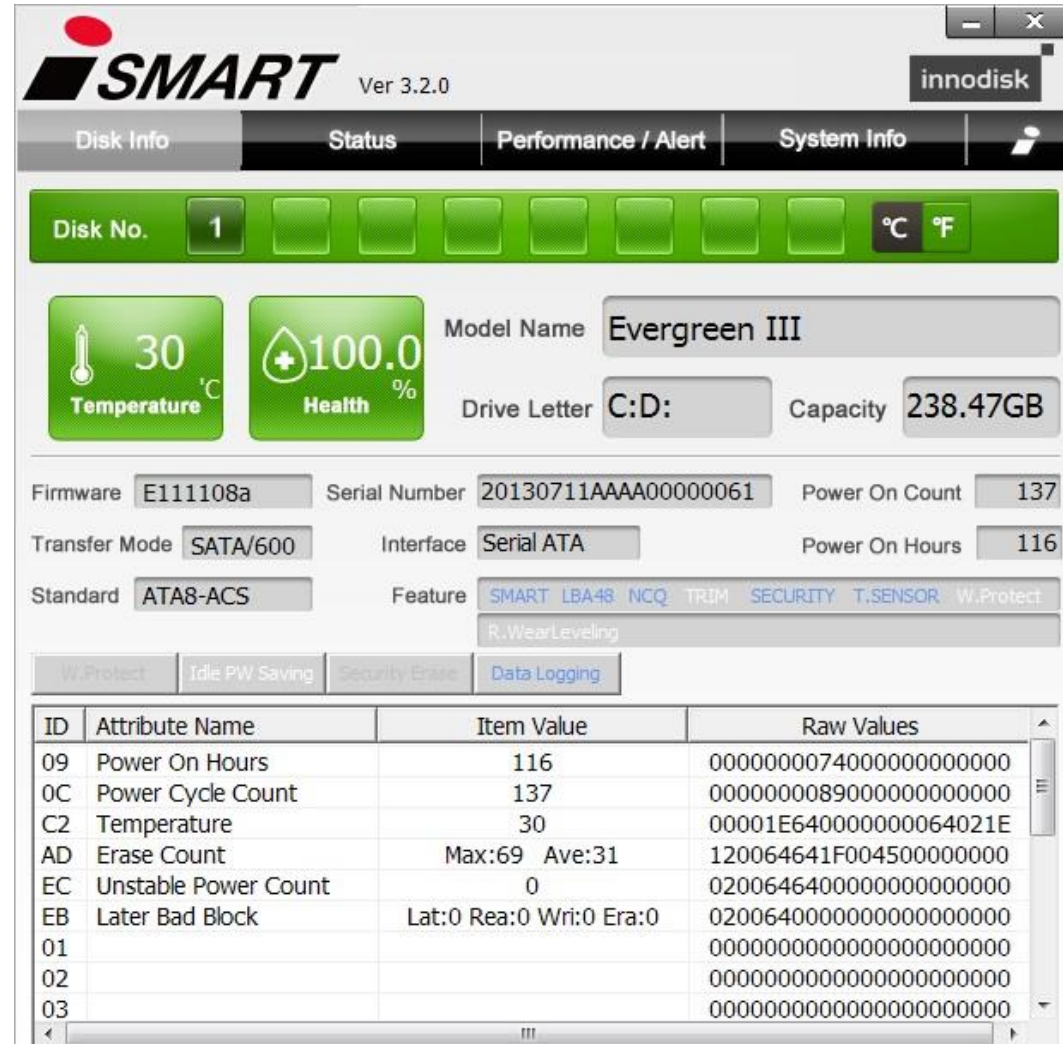
Office 2007 Installation

- Analyze write behavior
- 20% Sequential write command
 - 64% is 1MB
- 80% is Random write command
 - 62% is 4KB



Windows 7 User behavior

- Time: 18 days
- Application
 - Office 2007
 - Email
- 8 Hours per day



SMART Ver 3.2.0 innodisk

Disk Info | **Status** | Performance / Alert | System Info

Disk No. 1 °C °F

Temperature 30 °C Health 100.0 %

Model Name Evergreen III

Drive Letter C:D Capacity 238.47GB

Firmware E111108a Serial Number 20130711AAAA00000061 Power On Count 137

Transfer Mode SATA/600 Interface Serial ATA Power On Hours 116

Standard ATA8-ACS Feature SMART LBA48 NCQ TRIM SECURITY T.SENSOR W.Protect
R.WearLeveling

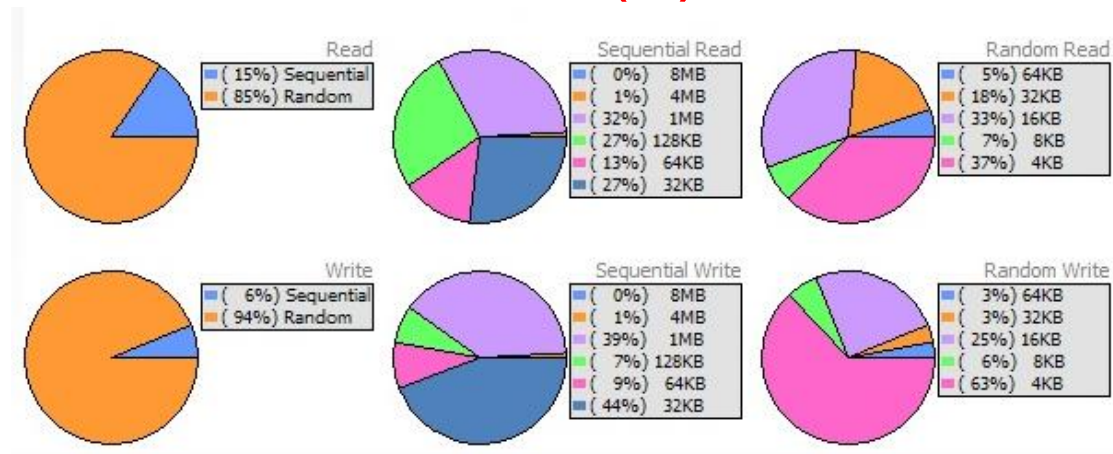
W.Protect Idle PW Saving Security Erase Data Logging

ID	Attribute Name	Item Value	Raw Values
09	Power On Hours	116	0000000074000000000000
0C	Power Cycle Count	137	0000000089000000000000
C2	Temperature	30	00001E640000000064021E
AD	Erase Count	Max:69 Ave:31	120064641F004500000000
EC	Unstable Power Count	0	0200646400000000000000
EB	Later Bad Block	Lat:0 Rea:0 Wri:0 Era:0	0200640000000000000000
01			0000000000000000000000
02			0000000000000000000000
03			0000000000000000000000

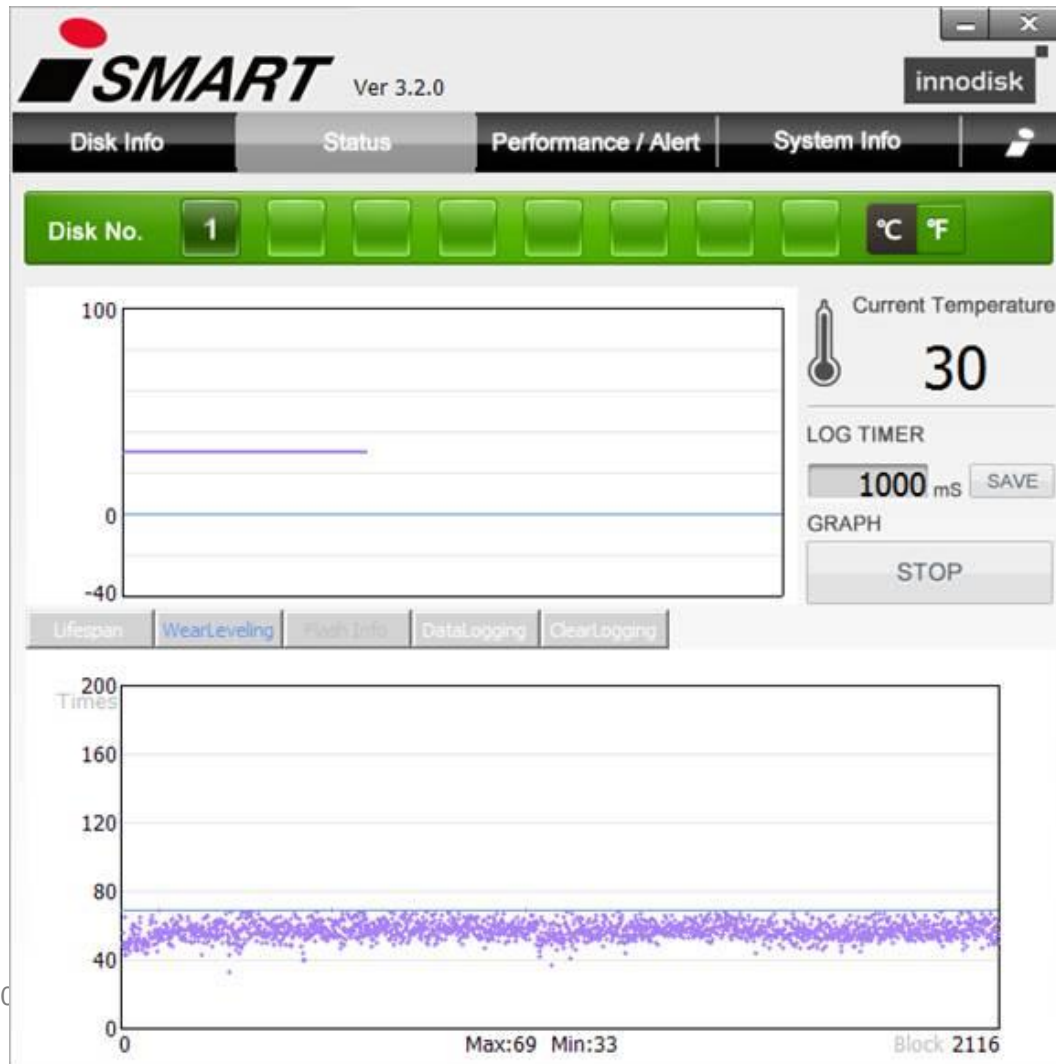
Windows 7 User behavior(2)

- Read
 - 15% Sequential
 - 32% is 128KB
 - 85% Random
 - 37% is 4KB

- Write
 - 6% Sequential
 - 44% 32KB
 - 94% Random
 - 63% 4KB



Windows 7 User behavior(3)



	Random Write	4K
WinXp In	85%	60%
Win7 In	83%	68%
Ubuntu In	74%	64%
Office 2007 In	80%	62%
Win7 User email..	94%	63%

- More powerful SMART tool for SSD
- Data log just a beginning stage. innodisk will provide more useful function in near future

- www.innodisk.com
- Industrial solution for Flash product and DRAM

