

General Storage Device Information

What are S.M.A.R.T attributes?

SMART attributes are a series of raw values reported by drives during operation. These attributes can be used to interpret the health of the drives and in some cases even predict an imminent hardware failure. Currently, there's no standard for which attributes a drive manufacturer should report, in what format and how each attribute must be interpreted.

The following list contains some S.M.A.R.T. attributes and the typical meaning of their raw values:

| ID | Name | Description |
|-----------|--------------------------------|---|
| 1 | Read Error Rate | The rate of hardware read errors that occurred when reading data |
| 2 | Throughput Performance | Throughput performance of a hard disk drive. |
| 3 | Spin-Up Time | Average time of spindle to spin up from zero RPM to fully operational |
| 4 | Start/Stop Count | A counter of spindle start/stop cycle |
| 5 | Reallocated Sectors Count | The count of bad sectors that have been found and remapped |
| 6 | Read Channel Margin | Margin of a channel while reading data |
| 7 | Seek Error Rate | Rate of seek errors of the magnetic heads |
| 8 | Seek Time Performance | Average performance of seek operations of the magnetic heads. |
| 9 | Power-On Hours | Total amount of hours the disk has been operational |
| 10 | Spin Retry Count | Total count of the spin start attempts |
| 11 | Calibration Retry Count | Total count of recalibrations requested |
| 12 | Power Cycle Count | The count of full hard disk power on/off cycles. |
| 13 | Soft Read Error Rate | Uncorrected read errors reported to the operating system. |
| 14 | Current Helium Level | This value measures the helium inside of the drive |
| 15 | Available Reserved Space | - |
| 16 | SSD Program Fail Count | The total number of flash program operation failures since the drive was deployed |
| 17 | SSD Erase Fail Count | The number of flash erase failures |
| 18 | SSD Wear Leveling Count | The maximum worst erase count on any block. |

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| 3 | | |
| 1 | Unexpected power loss count | The number of unclean shutdowns. |
| 7 | | |
| 4 | | |
| 1 | Power Loss Protection Failure | - |
| 7 | | |
| 5 | | |
| 1 | Erase Fail Count | The number of flash erase command failures |
| 7 | | |
| 6 | | |
| 1 | Wear Range Delta | Delta between most-worn and least-worn Flash blocks |
| 7 | | |
| 7 | | |
| 1 | Used Reserved Block Count Total | - |
| 7 | | |
| 9 | | |
| 1 | Unused Reserved Block Count Total | - |
| 8 | | |
| 0 | | |
| 1 | Program Fail Count Total | Total number of Flash program operation failures since the drive was deployed |
| 8 | | |
| 1 | Erase Fail Count | - |
| 8 | | |
| 2 | | |
| 1 | Runtime Bad Block | - |
| 8 | | |
| 3 | | |
| 1 | End-to-End error | Number of parity errors during transfer between the cache RAM and the host |
| 8 | | |
| 4 | | |
| 1 | Head Stability | - |
| 8 | | |
| 5 | | |
| 1 | Induced Op-Vibration Detection | - |
| 8 | | |
| 6 | | |
| 1 | Reported Uncorrectable Errors | The count of errors that could not be recovered using hardware ECC |
| 8 | | |
| 7 | | |
| 1 | Command Timeout | The count of aborted operations due to HDD timeout |
| 8 | | |
| 8 | | |
| 1 | High Fly Writes | Number of unsafe write operations outside the normal head flying range. |
| 8 | | |
| 9 | | |
| 1 | Airflow Temperature | The temperature of the air inside the hard disk housing. |
| 9 | | |
| 0 | | |

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| 1 9 1 | G-sense Error Rate | The count of errors resulting from externally induced shock and vibration. |
| 1 9 2 | Power-off Retract Count, | Number of power-off or emergency retract cycles |
| 1 9 3 | Load Cycle Count | Number of cycles the head moved into landing zone position. |
| 1 9 4 | Temperature | The temperature of the disk |
| 1 9 5 | Hardware ECC Recovered | Number of errors corrected by the internal error correcting mechanism. |
| 1 9 6 | Reallocation Event Count | Count of remap operations. |
| 1 9 7 | Current Pending Sector Count ^L | Count of unstable sectors |
| 1 9 8 | (Offline) Uncorrectable Sector Count | The total count of uncorrectable errors when reading/writing a sector. |
| 1 9 9 | UltraDMA CRC Error Count | The count of errors in data transfer via the interface cable as determined by ICRC (Interface Cyclic Redundancy Check). |
| 2 0 0 | Multi-Zone Error Rate | The count of errors found when writing a sector. |
| 2 0 1 | Soft Read Error Rate | The total count of errors when writing a sector. |
| 2 0 2 | Data Address Mark Errors | Count of Data Address Mark errors |
| 2 0 3 | Run Out Cancel | The number of errors caused by incorrect checksum during the error correction. |
| 2 0 4 | Soft ECC Correction | Count of errors corrected by the internal error correction software |
| 2 0 5 | Thermal Asperity Rate | Count of errors due to high temperature |
| 2 0 6 | Flying Height | Height of heads above the disk surface |

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|-------------|----------------------------|---|
| 2 0 7 | Spin High Current | The current needed to spin up the drive. |
| 2 0 8 | Spin Buzz | Count of buzz routines needed to spin up the drive due to insufficient power |
| 2 0 9 | Offline Seek Performance | Drive's seek performance during its internal tests |
| 2 1 0 | Vibration During Write | A recording of a vibration encountered during write operations |
| 2 1 1 | Vibration During Write | A recording of a vibration encountered during write operations |
| 2 1 2 | Shock During Write | A recording of shock encountered during write operations |
| 2 2 0 | Disk Shift | Distance the disk has shifted relative to the spindle (usually due to shock or temperature) |
| 2 2 1 | G-Sense Error Rate | The count of errors resulting from externally induced shock and vibration |
| 2 2 2 | Loaded Hours | Time spent operating under data load |
| 2 2 3 | Load/Unload Retry Count | Count of times head changes position |
| 2 2 4 | Load Friction | Resistance caused by friction in mechanical parts while operating |
| 2 2 5 | Load/Unload Cycle Count | Total count of load cycles |
| 2 2 6 | Load 'In'-time | Total time of loading on the magnetic heads actuator |
| 2 2 7 | Torque Amplification Count | Count of attempts to compensate for platter speed variations |
| 2 2 8 | Power-Off Retract Cycle | The number of times the head was retracted as a result of power loss |
| 2 3 0 | GMR Head Amplitude | Head moving distances between operations. |
| 2 | Life Left (SSDs) | Indicates the approximate SSD life left |

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| 3 | | |
| 1 | | |
| 2 | Endurance Remaining | - |
| 3 | | |
| 2 | | |
| 2 | Media Wearout Indicator (SSDs) | - |
| 3 | | |
| 3 | | |
| 2 | Average erase count AND Maximum Erase Count | - |
| 3 | | |
| 4 | | |
| 2 | Good Block Count AND System(Free) Block Count | - |
| 3 | | |
| 5 | | |
| 2 | Head Flying Hours | Time spent during the positioning of the drive heads |
| 4 | | |
| 0 | | |
| 2 | Total LBAs Written | Total count of LBAs written. |
| 4 | | |
| 1 | | |
| 2 | Total LBAs Read | Total count of LBAs read. |
| 4 | | |
| 2 | | |
| 2 | Total LBAs Written Expanded | - |
| 4 | | |
| 3 | | |
| 2 | Total LBAs Read Expanded | - |
| 4 | | |
| 4 | | |
| 2 | NAND Writes | Total NAND Writes. |
| 4 | | |
| 9 | | |
| 2 | Read Error Retry Rate | Count of errors while reading from a disk. |
| 5 | | |
| 0 | | |
| 2 | Minimum Spares Remaining | The number of remaining spare blocks as a percentage of the total number of spare blocks available |
| 5 | | |
| 1 | | |
| 2 | Newly Added Bad Flash Block | The total number of bad flash blocks the drive detected since it was first initialized in manufacturing |
| 5 | | |
| 2 | | |
| 2 | Free Fall Protection | Number of free fall events detected by the accelerometer sensor. |
| 5 | | |
| 4 | | |

Sources:

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- <https://en.wikipedia.org/wiki/S.M.A.R.T.>
- <https://www.backblaze.com/blog-smart-stats-2014-8.html>
- https://www.hdsentinel.com/help/en/56_attrib.html

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