
NVME INFO USER GUIDE

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NVMe Info is an interactive application to view NVMe SSD information on Windows or Linux computers. It was developed as part of a personal project to sandbox JavaScript, html, C++, NodeJS and the electron framework for fun and learning. The entire project is available under the MIT license.

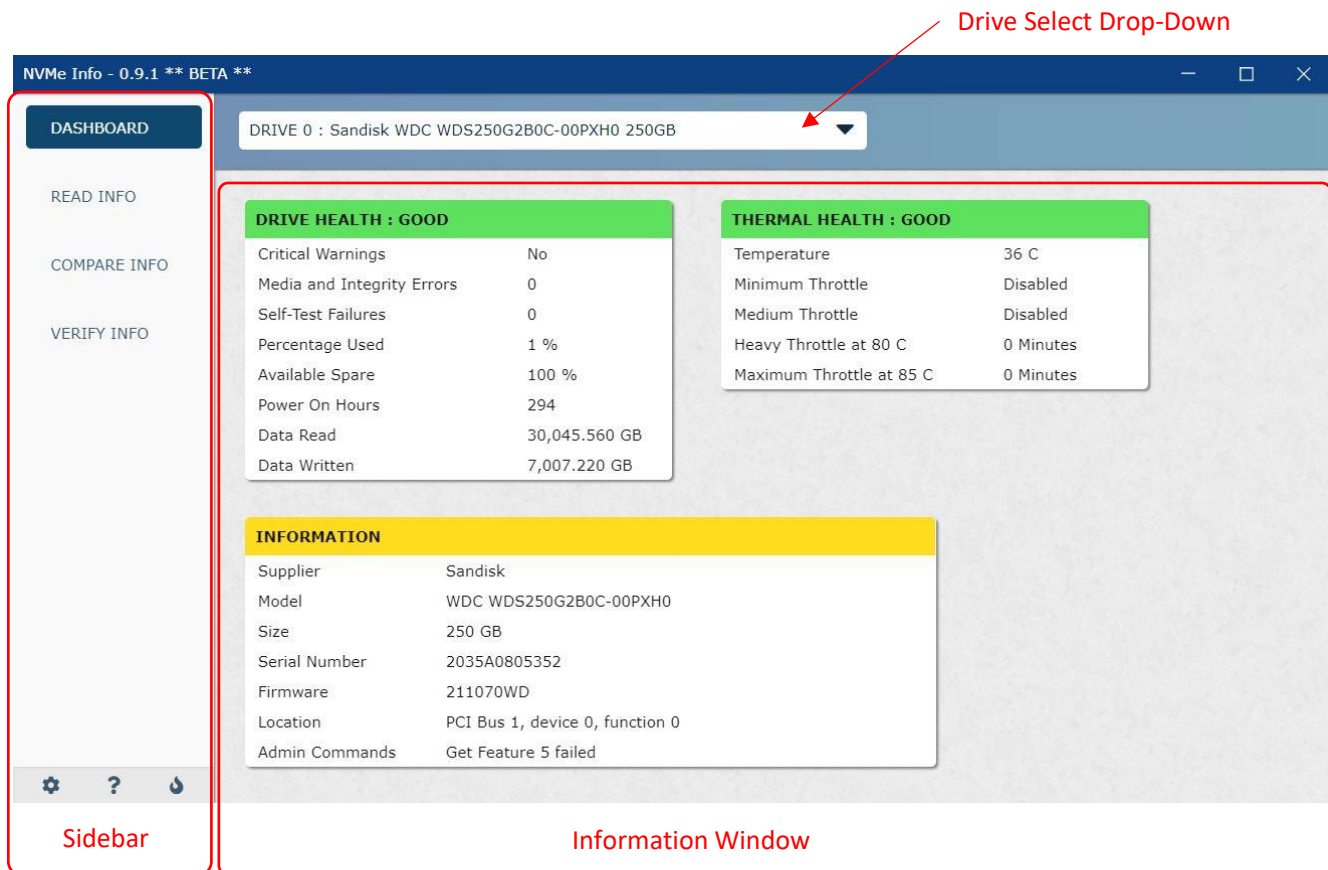
Please note this application reads a lot, but not all, of the information available for NVMe drives.

OVERVIEW

The image below is displayed when the application starts. The drop-down at the top selects the NVMe drive to read in cases more than one drive exists. The first NVMe drive, typically drive 0, is shown by default at startup.

The left-hand sidebar is used for navigation. The sidebar's four buttons (DASHBOARD, READ INFO, COMPARE INFO, and VERIFY INFO) select the type of information displayed in the information window. The DASHBOARD displays a quick-view of the drive health and information. READ INFO displays an interface to read the drive information. COMPARE INFO displays an interface to compare the current drive information against previous information saved to a file. VERIFY INFO displays an interface to verify the current drive information against a set of rules.

At the bottom of the Sidebar are three icons. The gear icon displays an interface to edit the application settings. The question mark icon displays this user guide. The fire icon displays the directory with internal application logs.



DASHBOARD PAGE

Clicking the DASHBOARD button displays the dashboard page. The first NVMe drive, typically drive 0, is displayed by default. To display a different drive, select the drive from the drop-down list. Selecting a drive from the drop-down will refresh the data displayed, even if the same drive is selected.

DRIVE HEALTH TABLE

The drive's health can be GOOD (green background), SUSPECT (yellow background), or POOR (red background). The health is calculated based on the number of errors, critical warnings and percentage used.

DRIVE HEALTH : GOOD	
Critical Warnings	No
Media and Integrity Errors	0
Self-Test Failures	0
Percentage Used	0 %
Available Spare	100 %
Power On Hours	31
Data Read	0.001 GB
Data Written	0.000 GB

The Power On Hours, Data Read, and Data Written are listed for reference but are not used in the health calculation.

THERMAL HEALTH TABLE

The drive's thermal health can be GOOD, SUSPECT, or POOR. The thermal health is based on the amount and severity of thermal throttling. Thermal throttling is the drive's ability to throttle performance (slow down) when its temperature rises above a set limit. Drives typically have multiple temperature limits where the least amount of performance loss occurs at the lowest temperature limit and the highest performance loss occurs at the highest temperature.

The temperature of an NVMe drive is dependent on the computer design. In one computer design a drive may operate at a low temperature with no performance loss while in another computer design the same drive could run at a higher temperature and have severe performance loss.

THERMAL HEALTH : GOOD	
Temperature	25 C
Minimum Throttle	Disabled
Medium Throttle	Disabled
Heavy Throttle at 80 C	0 Minutes
Maximum Throttle at 85 C	0 Minutes

INFORMATION TABLE

The last table displays some basic information to identify the specific drive. Any Admin commands that failed are noted in the last row. In the example below Get Feature 05h failed on this NVMe drive.

INFORMATION	
Supplier	Sandisk
Model	WDC WDS250G2B0C-00PXH0
Size	250 GB
Serial Number	2035A0805352
Firmware	211070WD
Location	PCI Bus 1, device 0, function 0
Admin Commands	Get Feature 5 failed

READ INFO PAGE

Clicking the READ INFO button displays the interface to read and view drive information.

INFORMATION SOURCE

NVMe Info calls the command line utility `nvmecli` to read the drive information. This utility uses the NVMe Admin Commands Identify, Get Log Page, and Get Features to read most of the information. The utility gets the remaining PCI and driver information from the OS. *NVMe Info does not read the following information: vendor specific information, log pages 7 and higher, features 3, 7 and higher. A complete list of parameters read by NVMe Info can be found in the View Filter file: `All.Filters.json`.*

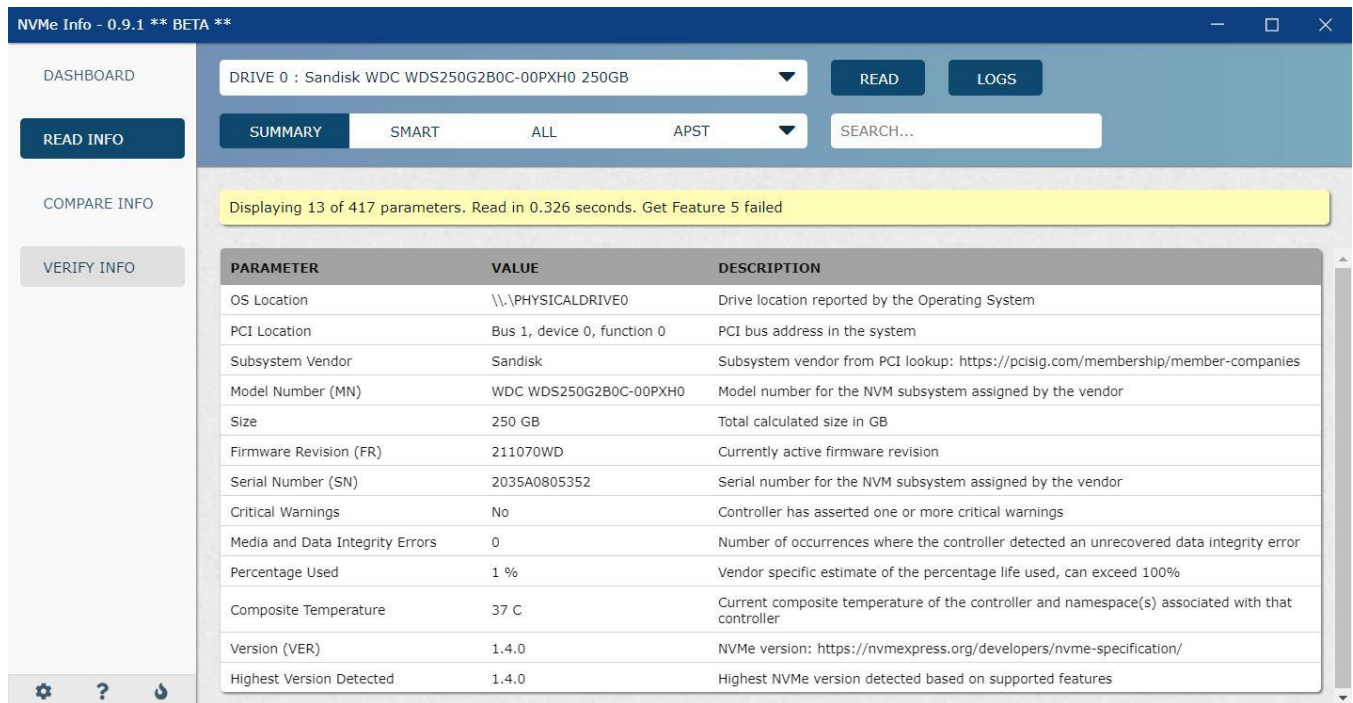
READING INFORMATION

To read the NVMe information select the drive in the drop-down and then click the READ button. Every time the READ button is clicked the information is refreshed.



After the READ button is clicked the NVMe information is displayed and additional buttons and fields are enabled to filter the data.

The NVMe parameters are displayed in a table as shown below. Above the table is a banner which displays the number of parameters read, displayed, and how long it took to read them. It also notes any failures that occurred.



The screenshot shows the NVMe Info application window. The title bar reads "NVMe Info - 0.9.1 ** BETA **". On the left is a sidebar with buttons: DASHBOARD, READ INFO (selected), COMPARE INFO, and VERIFY INFO. The main area has a top bar with a drive selector showing "DRIVE 0 : Sandisk WDC WDS250G2B0C-00PXH0 250GB", a "READ" button, and a "LOGS" button. Below this is a filter bar with buttons: SUMMARY (selected), SMART, ALL, and APST, along with a "SEARCH..." input field. A yellow banner above the table states: "Displaying 13 of 417 parameters. Read in 0.326 seconds. Get Feature 5 failed". The table below has three columns: PARAMETER, VALUE, and DESCRIPTION.

PARAMETER	VALUE	DESCRIPTION
OS Location	\\.\PHYSICALDRIVE0	Drive location reported by the Operating System
PCI Location	Bus 1, device 0, function 0	PCI bus address in the system
Subsystem Vendor	Sandisk	Subsystem vendor from PCI lookup: https://pcisig.com/membership/member-companies
Model Number (MN)	WDC WDS250G2B0C-00PXH0	Model number for the NVM subsystem assigned by the vendor
Size	250 GB	Total calculated size in GB
Firmware Revision (FR)	211070WD	Currently active firmware revision
Serial Number (SN)	2035A0805352	Serial number for the NVM subsystem assigned by the vendor
Critical Warnings	No	Controller has asserted one or more critical warnings
Media and Data Integrity Errors	0	Number of occurrences where the controller detected an unrecovered data integrity error
Percentage Used	1 %	Vendor specific estimate of the percentage life used, can exceed 100%
Composite Temperature	37 C	Current composite temperature of the controller and namespace(s) associated with that controller
Version (VER)	1.4.0	NVMe version: https://nvmexpress.org/developers/nvme-specification/
Highest Version Detected	1.4.0	Highest NVMe version detected based on supported features

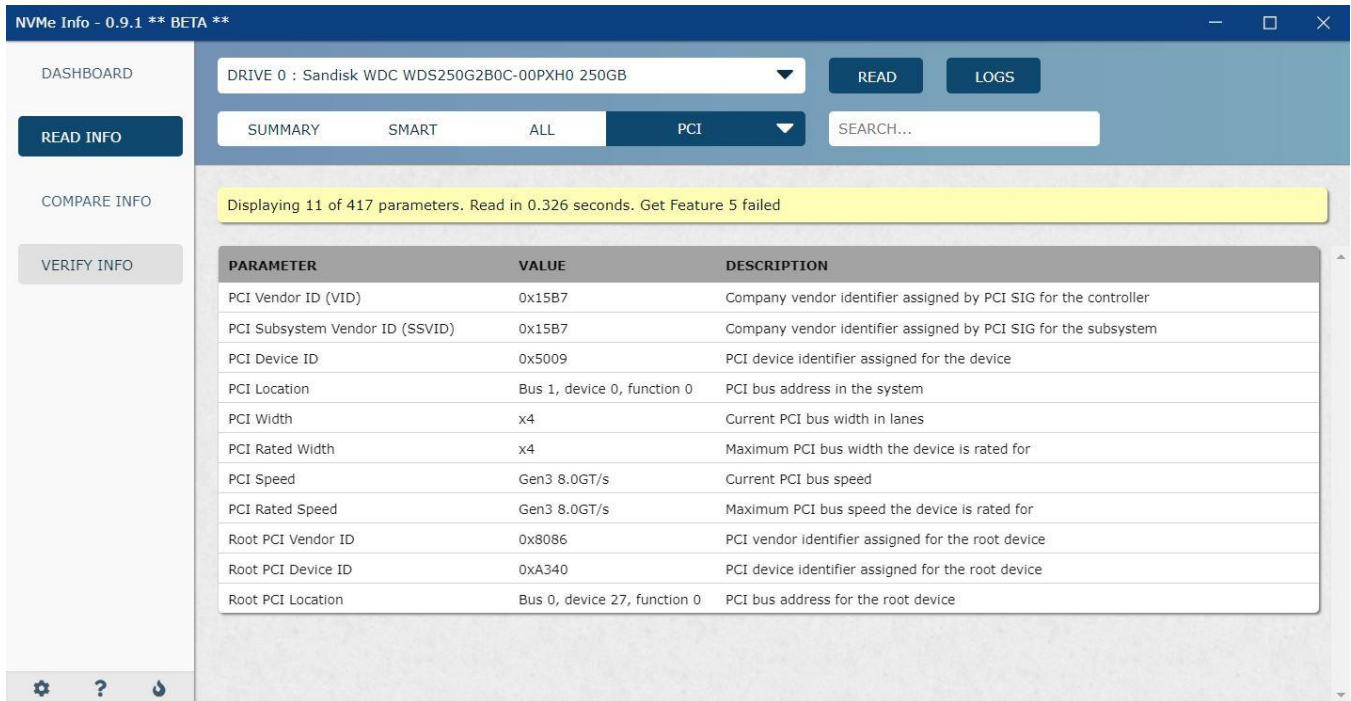
The LOGS button displays the directory with the nvme cmd logs. Details on these logs are available in the nvme cmd User Guide. These logs will be automatically deleted when the application starts if they are older than the age specified in the settings page.

The parameters displayed in the table can also be filtered using the SEARCH field. Typing text into the SEARCH field will display only parameters that contain that text in the parameter name, value, or description.

VIEW FILTERS

The parameters displayed in the table can be filtered using the set of buttons below the drive select drop-down. The SUMMARY button displays a summary of the NVMe parameters. The SMART button displays the Log Page 2 parameters. The ALL button displays all parameters.

The right-hand drop-down list, labeled DATA above, contains additional “views” that display a unique subset of parameters. For example, the PCI view lists only the PCI parameters as shown below.



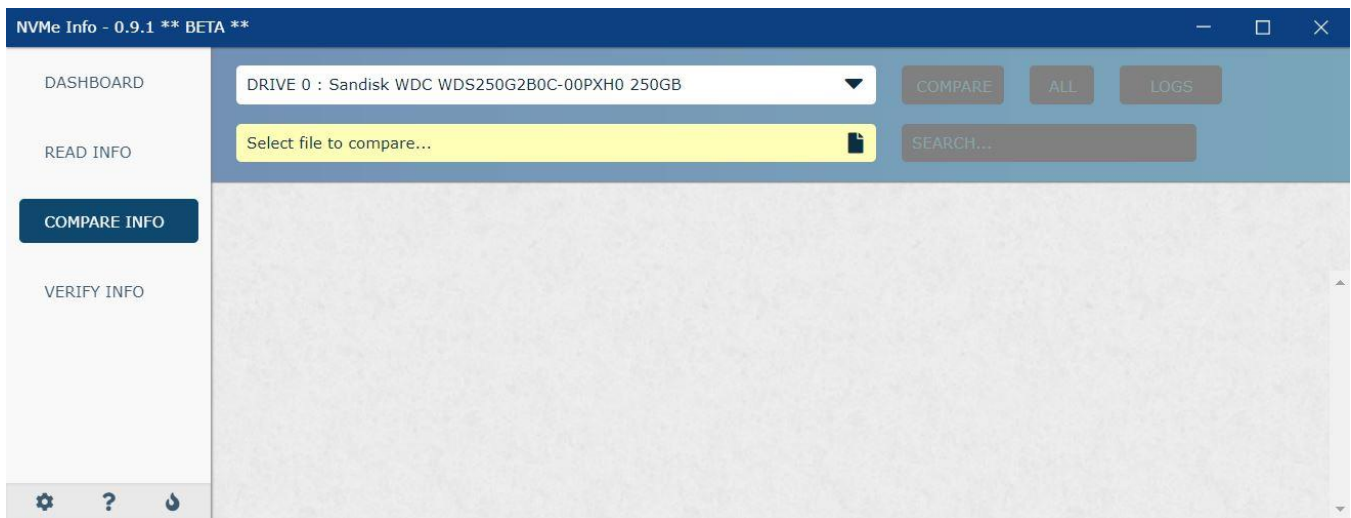
Views in the drop-down list can be deleted, added, or edited by the user. See the View Filter Files section for details.

COMPARE INFO PAGE

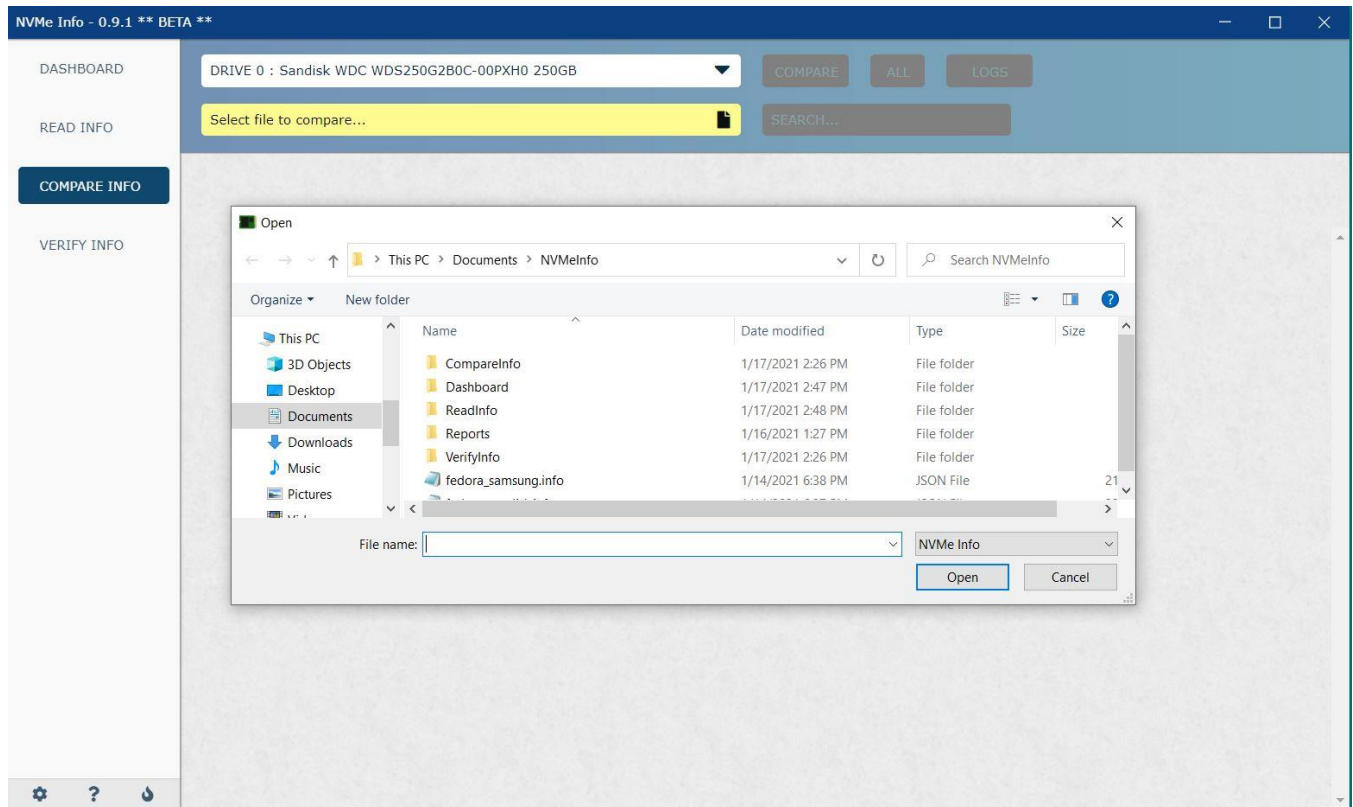
Clicking the COMPARE INFO button displays the interface to compare the current drive information against previous information saved to a file. Some example use cases for comparisons are 1) identifying changes to a drive over time 2) comparing two different drives or 3) comparing how different OS (Linux/Windows) configure a drive.

COMPARING INFORMATION

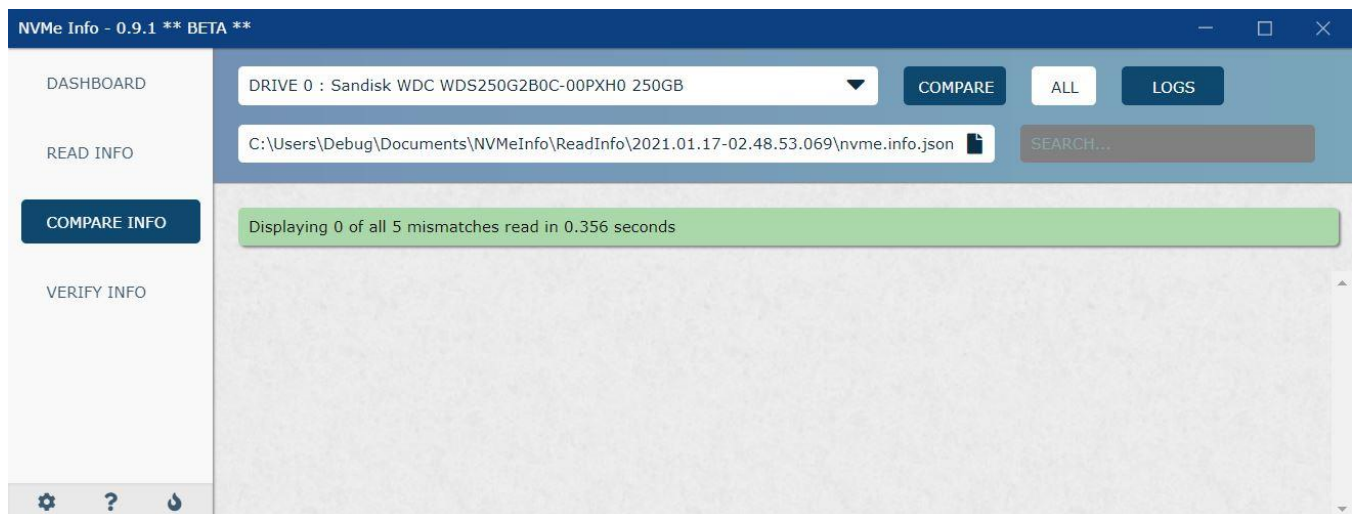
To compare NVMe information select the drive in the drop-down.



Next select the file to compare. Clicking the SELECT FILE field opens a file dialog to select the file to compare. Note the file must have the extension info.json to be compared.



Once the file has been selected the COMPARE button will be enabled. Click COMPARE to do the comparison. After the COMPARE button is clicked the parameters with values that do not match are displayed and additional buttons and controls are enabled.



The LOGS button and SEARCH fields work the same as described in the READ INFO PAGE section. Note if there are no mismatches then no results are displayed and the SEARCH field is not enabled.

COMPARE METHOD

There are two methods used for the comparison: DEFAULT and ALL. The ALL button toggles between the two methods.

The ALL comparison compares the values of all parameters. If any parameter has a different value from the value in the compare file a mismatch is displayed.

The DEFAULT comparison compares static parameters and, if the same drive, Log Page 2 counters. Specifically, the DEFAULT comparison will:

- Compare all parameters from the Admin Identify Controller and Identify Namespace commands
- Compare all PCI and driver parameters from the OS
- NOT compare any log pages except for:
 - Log Page 3
 - Log Page 2 except for:
 - composite temperature
 - temperature sensors
 - If the same drive remaining counter parameters must be greater or equal to the previous values in the compare file
- Compare features except for:
 - Feature 2 (Power Management)
 - Feature 0xE (Timestamp)
 - Feature 0xD (Host Memory Buffer)
 - Host Memory Descriptor List Address (HMDLAL)
 - Host Memory Descriptor List Address (HMDLAU)

The image below shows the difference from the image above after the ALL button is clicked. If the ALL button is dark blue the results are displayed for the ALL comparison. If the ALL button is white results are for the DEFAULT comparison.

The screenshot shows the NVMe Info application window. The title bar reads "NVMe Info - 0.9.1 ** BETA **". The left sidebar contains navigation links: DASHBOARD, READ INFO, COMPARE INFO (highlighted), and VERIFY INFO. The main area shows a dropdown for "DRIVE 0 : Sandisk WDC WDS250G2B0C-00PXH0 250GB". Below this is a file path for the compare file: "C:\Users\Debug\Documents\NVMeInfo\ReadInfo\2021.01.17-02.48.53.069\nvme.info.json". There are buttons for "COMPARE", "ALL" (dark blue), and "LOGS". A search bar is also present. A red banner indicates "Displaying 5 of all 5 mismatches". Below this is a table with the following data:

PARAMETER	CURRENT VALUE	COMPARE FILE VALUE	DIFFERENCE
Composite Temperature	36 C	37 C	-1
Host Timestamp	1,610,923,881,987 mS	1,610,923,733,365 mS	148,622
Host Timestamp Decoded	2021-01-17 14:51:21.987	2021-01-17 14:48:53.365	Mismatch
Timestamp	1,610,643,074,807 mS	1,610,642,926,196 mS	148,611
Timestamp Decoded	2021-01-14 08:51:14.807	2021-01-14 08:48:46.196	Mismatch

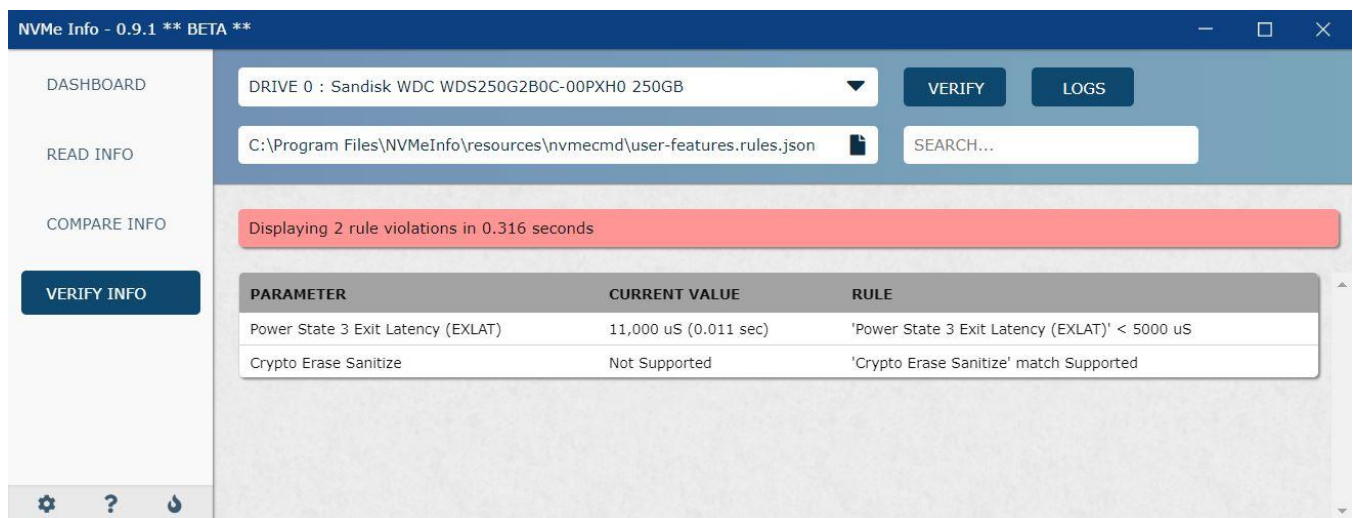
VERIFY INFO PAGE

Clicking the VERIFY INFO button displays the interface to verify the current NVMe information against a set of rules. The rule set can be used to verify a drive is new or meets custom requirements. For example, a rule could be created to verify the power state 0 maximum power is less than 5 watts.

VERIFYING INFORMATION

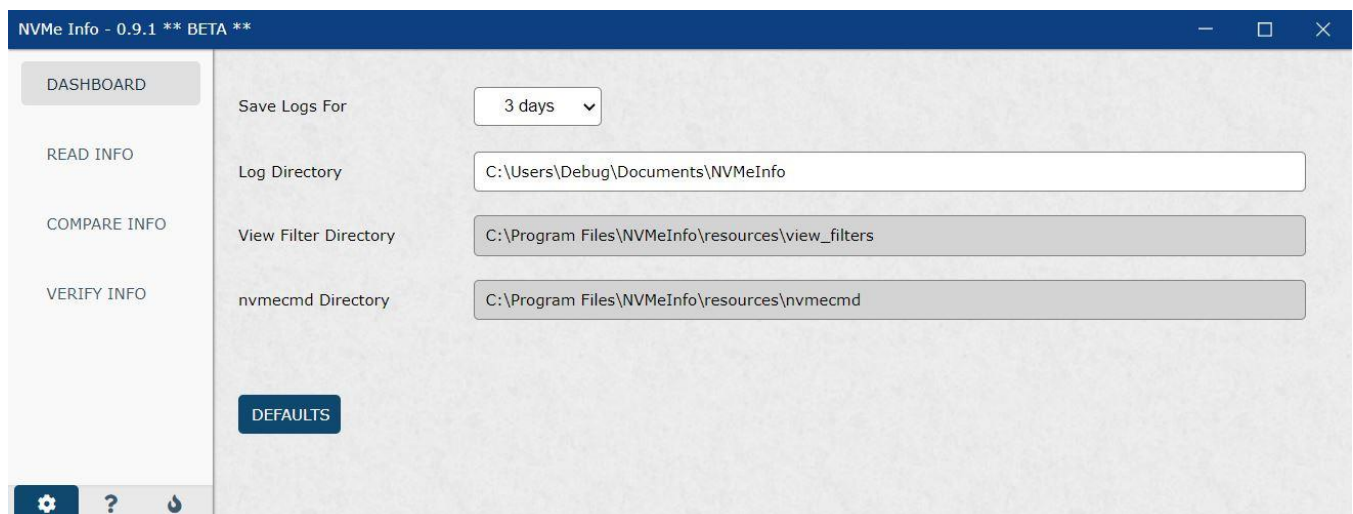
To verify NVMe information first select the drive in the drop-down. Then select the rules file to verify by clicking the SELECT FILE field. After the rules file is selected the VERIFY button is enabled. Click VERIFY to run the verify.

The image below shows a drive being verified against a rules file call new-drive. The results below show the drive is not new and fails several rules.



GEAR ICON (SETTINGS)

Clicking the gear button in the lower left will open the settings page. This page allows the user to change the default behavior of the application.



The Save Logs For field determines how long the logs are saved for. When the application starts any logs older than this value are deleted. The Log Directory determines where the logs are saved. The View Filter and nvme cmd directories are for reference only.

HELP ICON (USER GUIDE)

Clicking the question mark in the lower left will open this User Guide.

FIRE ICON (APP LOGS)

Clicking the fire in the lower left will open the internal application logs. These are only needed when the application itself fails for an unhandled exception or fatal errors. In these cases, the logs should be sent to the developer.

VIEW FILTER FILES

View filters are json files that contain an array of parameters to display on the READ INFO page. The files must be located in the View Filters directory and have a .filter.json extension. The content of the PCI.filter.json view filter file is listed here as an example:

```

1  {
2    "filter": [
3      "PCI Vendor ID (VID)",
4      "PCI Subsystem Vendor ID (SSVID)",
5      "PCI Device ID",
6      "PCI Location",
7      "PCI Width",
8      "PCI Rated Width",
9      "PCI Speed",
10     "PCI Rated Speed",
11     "Root PCI Vendor ID",
12     "Root PCI Device ID",
13     "Root PCI Location"
14   ]
15 }
```

On the READ INFO page, selecting PCI from the drop-down displays the parameters in the PCI.filter.json file in the same order as the file.

For a complete list of parameters see the ALL.filter.json file. A simple way to create a new filter is to copy the ALL.filter.json file to a new name and remove the unwanted parameters. Once the file is created the drop-down will contain the file the next time the application is started.

If creating custom filters, it is strongly recommended to keep a copy in a separate location as future updates may overwrite the files in directory.

PARAMETER	VALUE	DESCRIPTION
PCI Vendor ID (VID)	0x15B7	Company vendor identifier assigned by PCI SIG for the controller
PCI Subsystem Vendor ID (SSVID)	0x15B7	Company vendor identifier assigned by PCI SIG for the subsystem
PCI Device ID	0x5009	PCI device identifier assigned for the device
PCI Location	Bus 1, device 0, function 0	PCI bus address in the system
PCI Width	x4	Current PCI bus width in lanes
PCI Rated Width	x4	Maximum PCI bus width the device is rated for
PCI Speed	Gen3 8.0GT/s	Current PCI bus speed
PCI Rated Speed	Gen3 8.0GT/s	Maximum PCI bus speed the device is rated for
Root PCI Vendor ID	0x8086	PCI vendor identifier assigned for the root device
Root PCI Device ID	0xA340	PCI device identifier assigned for the root device
Root PCI Location	Bus 0, device 27, function 0	PCI bus address for the root device

RULE FILES

Rule files are json files that contain an array of strings where each string defines a rule. The files have a .rules.json extension. Below is an example file:

```
{
  "rules": [
    "'Critical Warnings' match No",
    "'Composite Temperature' > 20 C",
    "'Composite Temperature' < 82 C",
    "'Media and Data Integrity Errors' = 0",
    "'Warning Composite Temperature Time' = 0 Min",
    "'Critical Composite Temperature Time' = 0 Min",
    "'Device Self-test Command' match Supported",
    "'Number Of Failed Self-Tests' = 0",
    "'Extended Device Self-test Time (EDSTT)' > 0 Min",
    "'PCI Width' match x2",
    "'PCI Speed' match Gen3 8.0GT/s",
    "'RTD3 Entry Latency (RTD3E)' < 500000 uS",
    "'RTD3 Resume Latency (RTD3R)' < 1000000 uS",
    "'Firmware Activation Without Reset' match Supported",
    "'Power State 0 Maximum Power (MP)' < 5 Watts",
    "'Power State 1 Maximum Power (MP)' < 4 Watts",
    "'Power State 2 Maximum Power (MP)' < 3 Watts",
    "'Power State 3 Maximum Power (MP)' < 0.1 Watts",
    "'Power State 4 Maximum Power (MP)' < 0.01 Watts"
  ]
}
```

Each string has the format: <parameter> <operator> <value> where...

<parameter> is the parameter name in single quotes

<operator> can be a numeric operator (<, <=, =, !=, >=, or >) or a string operator (match, not-match)

<value> is the value of the parameter to verify using the operator

Numeric operators take into account units so the value must include the proper unit. For example, a power measurement value can be 5 Watts but not 5.

ACKNOWLEDGEMENTS

NVMe Info is created using the electron framework

<https://www.electronjs.org/>

The following very cool Nodejs add-ins are used in the project:

- custom-electron-titlebar <https://www.npmjs.com/package/custom-electron-titlebar>
- dateformat <https://www.npmjs.com/package/dateformat>
- electron-log <https://www.npmjs.com/package/electron-log>
- electron-unhandled <https://www.npmjs.com/package/electron-unhandled>
- find-remove <https://www.npmjs.com/package/find-remove>

The following background patterns are used from Toptal Subtle Patterns:

<https://www.toptal.com/designers/subtlepatterns/white-wall-3/>
<https://www.toptal.com/designers/subtlepatterns/white-plaster/>

Some of the icons from are Font Awesome

<https://fontawesome.com/>

Electron-builder is used to create the distribution:

<https://www.electron.build/>

NSIS is used to create the Windows installer:

https://nsis.sourceforge.io/Main_Page

NSIS add-ins or plug-ins:

- MUI2.nsh <https://nsis.sourceforge.io/Docs/Modern%20UI%202/Readme.html>
- LogicLib.nsh <https://nsis.sourceforge.io/LogicLib>
- NSIS EnVar https://nsis.sourceforge.io/EnVar_plug-in

Refer to the nvme cmd User Guide for acknowledgements on the nvme cmd utility.