

# Intel® SSD Quick Screen Tool, Version 4.0.4

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*User Guide*

July 2018

Software Version 4.0.4



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## Revision History

Tool Revision Number	Document Revision Number	Description	Revision Date
1.0	001	<ul style="list-style-type: none"> <li>Publication</li> </ul>	June 2012
1.1	002	<ul style="list-style-type: none"> <li>Adding new supported products</li> </ul>	December 2012
1.2	003	<ul style="list-style-type: none"> <li>Updating for version 2.1.0</li> </ul>	February 2013
1.3	004	<ul style="list-style-type: none"> <li>Updating for version 3.0.0</li> </ul>	October 2013
1.4	005	Updating for version 3.0.2. <ul style="list-style-type: none"> <li>Added Pro 2500 Series support.</li> <li>Data Integrity now tests all partitions found on the selected physical drive.</li> </ul>	March 2014
1.5	006	Updating for version 3.1.0. <ul style="list-style-type: none"> <li>Added DC P3500, DC P3600, and DC P3700 support.</li> <li>Added Format capability to support erasing NVMe drives.</li> <li>Added commands to facilitate reading log pages off of certain Intel SSDs.</li> </ul>	July 2014
1.6	007	Updating for version 4.0.2 <ul style="list-style-type: none"> <li>New and improved CLI syntax.</li> <li>Added support for DC S4500, DC S4500, 540s, E 5400s, Pro 5400s, 540s, DC S3100, DC S3110s, Pro 5450s, 545s, DC P4510, DC P4500, DC P4501, DC P4600, DC P4608, 600p, Pro 6000p, 760p and Pro 7600p.</li> <li>Extended health analysis support</li> <li>Additional drive debug support</li> </ul>	March 2018
1.7	008	Updating for version 4.0.4 <ul style="list-style-type: none"> <li>New logs saved as parts of the store logs feature               <ul style="list-style-type: none"> <li>Command versions log</li> <li>Efuse key log</li> <li>Block info log</li> <li>Erase count log</li> </ul> </li> <li>New SMART parser feature (mimics other customer tool implementations)</li> <li>Added Triage configuration .txt file as part of drive logs data</li> <li>NLog analysis bug fix</li> <li>Neptune Harbor support</li> <li>Updated product detection</li> <li>Various bug fixes</li> </ul>	July 2018



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# 1 Introduction

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This guide describes how to use the Intel® SSD Quick Screen Tool (i.e. QST). The tool provides a command line interface for interacting with, and issuing commands to, Intel SSD drives.

## 1.1 Features

This tool provides a suite of functions for interacting with and testing Intel® SSDs. The functionality includes:

- Detecting drives attached on the system.
- Detecting problems with attached SSDs
- Erasing a drive
- Running health analysis checks
- Running read scan tests
- Running a data integrity test through the file system
- Saving drive debug logs
- Parsing SMART data

## 1.2 System Requirements

The tool is supported on the following operating systems:

- Windows Server 2016
- Windows Server 2012
- Windows Server 2008 SP2 / R2
- Windows Server 2003
- Windows 10
- Windows 8
- Windows 7
- Windows Vista
- Windows XP
- Standard Linux distributions
  - Tested on Ubuntu\* 14.0.4, Ubuntu 16.04, RHEL\* 6.5, RHEL 7.0., RHEL 7.2, Open SUSE 13.1, SLES 11

**Note:** On Vista\*, Windows\* 7, Windows 8, Windows 10, Windows Server 2016, Windows Server 2012, and Windows Server 2008/R2, administrator access is required via one of the following methods:

- Open a command prompt as administrator and run the tool via the commands listed below
- Disable UAC where applicable and run the tool by running it in a command prompt

**Note:** On Linux\* distributions, you must ensure that the QST commands are being run as root. On Ubuntu and RHEL, this can be done by using the 'sudo' command:

```
sudo ./qst show -intelssd
```

You must provide the root password when prompted to enable QST functionality.

## 2 Command Line Options

The Intel® SSD Quick Screen Tool uses a Command Line Interface (CLI). Below is a table of the available command line options, and following the table is a detailed description of each option. Alternatively, you can execute the tool without any options to print out the table.

The command line options listed below include an example command usage. The Windows\* version of the command is shown. For Linux\* usage, substitute:

```
qst.exe
```

for

```
sudo ./qst
```

Verb	Description	Targets	Options
<a href="#">show</a>	Scan the system for attached drives and adapters, and display the results.	-intelssd (Index Serial Number) -smart	[-help -h] [-output -o] (text nvmxml json)
<a href="#">delete</a>	Erases data on the drive. This deletes all user data!	-intelssd (Index Serial Number)	[-help -h] [-output -o] (text nvmxml json) [-force -f]
<a href="#">start</a>	Run a health related feature. Default behavior is to run a health scan and store drive log information. User can also specify between the following features: data integrity scan, read scan, health scan, and store drive logs.	-intelssd (Index Serial Number) -scan (Health DataIntegrity ReadScan Logs)	[-help -h] [-output -o] (text nvmxml json)
<a href="#">help</a>	Prints help information.	N/A	[-help -h] [-output -o] (text nvmxml json)
<a href="#">version</a>	Prints tool version and licensing information.	N/A	[-help -h] [-output -o] (text nvmxml json) [-all -a] [-display -d] (Property1...)

### 2.1 Show

<b>Description</b>	Scan the system for attached Intel® SSD devices. Return the data and display the results. User can specify a specific drive through a drive index value or serial number or scan for all attached Intel SSDs.
<b>Targets</b>	-intelssd (Index Serial Number)
<b>Options</b>	-help -h -output -o (text nvmxml json)
<b>Usage</b>	qst.exe show -intelssd qst.exe show -intelssd 1 qst.exe show -output json -intelssd BTDV539501J8240AGN



## 2.2 Delete

<b>Description</b>	Erases the data on the drive. This deletes all user data! Delete will prompt a user before deleting data on the drive. To bypass this prompt, please specify the -force option
<b>Targets</b>	-intelssd (Index Serial Number)
<b>Options</b>	-help -h -output -o (text nvmxm json) -force -f
<b>Usage</b>	qst.exe delete -intelssd 1 qst.exe delete -force -intelssd BTDV539501J8240AGN

## 2.3 Start

<b>Description</b>	<p>Run a health related feature. Default behavior is to run a health scan and store drive log information (i.e. -scan with no qualifier). User can also specify between the following features: data integrity scan, read scan, health scan, store drive logs.</p> <p>A health analysis scan (i.e. -scan Health) will examine drive specifics such as identify info and SMART attributes to determine whether a drive is healthy or not.</p> <p>A read scan (i.e. -scan ReadScan) will read LBAs on the drive to determine whether LBAs are operational or not. Default behavior is to read 3,000,000 million random LBAs. To read all LBAs on the drive, specify FullScan=True property.</p> <p>A data integrity scan (i.e. -scan DataIntegrity) will write files to the free space on a filesystem with a known pattern, read the files back, and verify that the data contained in the written file match the known pattern. This feature aids in determining the health of the filesystem(s) on a drive. Files are cleaned up and deleted before command completion. Default behavior is to write and verify one gigabyte worth of data on all filesystem volumes associated with the selected drive. To write and verify data on all remaining free space on the volume, specify the FullScan=True property. To select a specific drive letter to run the data integrity scan on, specify Path=(drive letter) property.</p> <p>A drive debug log scan (i.e. -scan Logs) will read drive logs and save the resulting binaries to a known directory structure. The logs are specific to debug and help enable Intel representatives perform debug remotely. The logs saved vary based on product.</p> <p>Note: The default behavior of the health scan feature is to restrict functionality on the OS drive. Specify IncludeOS=True to run the feature on the host drive.</p>
<b>Targets</b>	-intelssd (Index Serial Number) -scan (Health DataIntegrity ReadScan Logs)
<b>Options</b>	-help -h -output -o (text nvmxm json)
<b>Properties</b>	IncludeOS=(true false) FullScan=(true false) Path=(drive letter)
<b>Usage</b>	qst.exe start -scan -intelssd qst.exe start -scan Health -intelssd IncludeOS=True qst.exe start -scan DataIntegrity -intelssd 2 FullScan=True qst.exe start -scan ReadScan -intelssd 0 IncludeOS=True Path=C qst.exe start -scan Logs -intelssd 1



## 2.4 Help

<b>Description</b>	Retrieve the in-tool help. One can specify, the Name=(target) property to get descriptive help information on a target and the Verb=(verb) property to get descriptive help information on a verb
<b>Targets</b>	None
<b>Options</b>	-help -h -output -o (text nvmlxml json)
<b>Properties</b>	Name=(target) Verb=(verb)
<b>Usage:</b>	qst.exe help Name=scan qst.exe help Verb=show

## 2.5 Version

<b>Description</b>	Show QST's version information and End-User License Agreement. To display the license, the user must specify –display License or –all option.
<b>Targets</b>	None
<b>Options</b>	-help -h -output -o (text nvmlxml json) -display (Property) -all
<b>Usage</b>	qst.exe version qst.exe version –display License qst.exe version -all

## 2.6 SMART

<b>Description</b>	Show parsed SMART information on the target drive.
<b>Targets</b>	-smart -intelssd (Index Serial Number)
<b>Options</b>	-help -h -output -o (text nvmlxml json)
<b>Usage</b>	qst.exe show –smart –intelssd # qst.exe show –o json –smart –intelssd BTDV539501J8240AGN



### 3 Error Codes

Below is a table of all the possible error and status codes that are returned from the tool. The first column lists the numeric value of the error/status code. This is the value returned by the tool. The second column lists a description for each error/status.

In Windows, type the following at the command prompt after running the tool to see the numeric return value:

```
echo %errorlevel%
```

#### 3.1 General

Value	Name	Description
0	No Errors	Completed Successfully
1	TDK Interface Failed	Failed to run TDK job
2	TDK Feature Failed	A TDK feature failed
3	Read File Failed	Reading a file failed
4	Write File Failed	Writing a file failed
5	Invalid Boolean	Invalid boolean value
6	Invalid Property	Invalid property specified
7	Invalid argument	Invalid command line arguments specified
8	No status	No status available

#### 3.2 Health Scan

Value	Name	Description
4	Invalid drive index	Provided device index is invalid
5	Invalid drive serial	Provided device serial is invalid
10	Error Task File	ATA command reported a problem
11	RAID Volume	Feature cannot run on a RAID volume.
25	Error NVMe Completion Entry	NVMe Command Reported a Problem
182	Nlog Critical Hardware	Potentially critically hardware error.
183	Nlog Critical NAND	Potentially critically NAND error.
184	Nlog Critical Firmware	Potentially critically firmware error.



Value	Name	Description
185	Nlog LBA Mismatch	Data loss due to caught LBA mismatch
186	Nlog Data Loss NAND	Data loss due to NAND error(s)
187	Nlog XOR Disabling	XOR disabling. Data loss will occur on the next NAND fatal event.
191	Panic Log Detected	Failure detected in log data.

### 3.3 Data Integrity

Value	Name	Description
2	Disable logical state	Drive is in a disable logical state
3	No Partitions	Device has no partitions
4	Invalid drive index	Provided device index is invalid
5	Invalid drive serial	Provided device serial is invalid
10	Error Task File	ATA command reported a problem
12	RAID Member	Feature cannot run on a RAID member
13	Storage Space Member	Selected drive is part of a storage space
25	Error NVMe Completion Entry	NVMe Command Reported a Problem
54	Error reading file	Failed reading a file necessary for the feature
97	No Drive Letter	Selected partition has no drive letter
100	Not Enough Free Space	Partition does not have enough free space for this feature
122	Partition is not formatted	SSD does not have a formatted partitions
124	Error Opening File	Failed opening a file necessary for the feature
147	Data Integrity Mismatch	Data mismatch during data integrity scan
193	No Partitions Found	No partitions found for specified drive letter



### 3.4 Read Scan

Value	Name	Description
2	Disable logical state	Drive is in a disable logical state
4	Invalid drive index	Provided device index is invalid
5	Invalid drive serial	Provided device serial is invalid
10	Error Task File	ATA command reported a problem
11	RAID Volume	Feature cannot run on a RAID volume
12	RAID Member	Feature cannot run on a RAID member
25	Error NVMe Completion Entry	NVMe Command Reported a Problem

### 3.5 Drive Debug Log/System Information

Value	Name	Description
10	Error Task File	ATA command reported a problem
11	RAID Volume	Feature cannot run on a RAID volume
25	Error NVMe Completion Entry	NVMe Command Reported a Problem
107	Unsupported OS	Feature is not supported on this operating system
188	Failed Initialize WMI	Failed to initialize WMI
189	Failed WMI Query	Failed to query desired WMI object
190	Failed Retrieve Next Object	Failed to retrieve next WMI class object
194	Failed Create Directory	Failed to create directory
196	Invalid directory path	Directory does not exist

### 3.6 Secure Erase

Value	Name	Description
2	Disable logical state	Drive is in a disable logical state
4	Invalid drive index	Provided device index is invalid
5	Invalid drive serial	Provided device serial is invalid
7	Security frozen	SSD is in a security frozen state
8	Security erase prepare failed	Secure erase prepare command failed
9	Security erase unit failed	Secure erase unit command failed



Value	Name	Description
10	Security enable failed	Security set password command failed
10	Error Task File	ATA command reported a problem
11	RAID Volume	Feature cannot run on a RAID volume
12	RAID Member	Feature cannot run on a RAID member
13	Storage Space Member	Selected drive is part of a storage space
14	Security not supported	Secure erase cannot be run because ATA security is not supported
15	Security Enabled	ATA security is enabled
16	Standby Immediate failed	Standby immediate command failed
25	Error NVMe Completion Entry	NVMe Command Reported a Problem
28	Invalid LBA format	Invalid LBA format
29	Invalid protection information value	Invalid protection information value
30	Invalid protection information location	Invalid protection information location
31	Invalid metadata settings	Invalid metadata settings
41	ATA Secure Erase Win 8	Secure erase cannot be run on Server 2012, Windows 8, or newer
94	Has Partition	Selected drive contains a partition
166	Opal Activated	Device is Opal activated
171	Failed format	Failed to format drive

### 3.7 Device Identification

Value	Name	Description
4	Invalid drive index	Provided device index is invalid
5	Invalid drive serial	Provided device serial is invalid
5	No device selected	No device selected
10	Error Task Field	ATA command reported a problem
25	Error NVMe Completion Entry	NVMe Command Reported a Problem



## 4 Examples

Examples are provided using the Windows versions of QST. The Linux versions use the same command-line interface, but the call to the QST application must be done differently. For example, in Ubuntu and RHEL, you must use the 'sudo' command to run the command. For the 'show', the command would be:

```
sudo ./qst show -intelssd
```

### 4.1 Help

The help table can be displayed by using the 'help' command line option:

```
qst.exe help
```

```
c:\Users\kdedow\Desktop\SDL\QST>qst_4.0.2_win32.exe help
Usage:  qst_4.0.2_win32.exe <verb>[<options>][<targets>][<properties>]

Commands:
Help:
    help [-help|-h] [-output|-o (text|nvmxml|json)] [Name = (name)] [verb = (verb)]
IntelSSD:
    show [-help|-h] [-output|-o (text|nvmxml|json)] [-intelssd [(Index|SerialNumber)]] [-log (Filename)]
Scan:
    start [-help|-h] [-output|-o (text|nvmxml|json)] -scan [(Health|DataIntegrity|ReadScan|Logs)] [-intelssd
    [(Index|SerialNumber)]] [-log (Filename)] [IncludeOS = (true|false)] [FullScan = (true|false)] [Path = ((drive
    letter))]
SecureErase:
    delete [-help|-h] [-force|-f] [-output|-o (text|nvmxml|json)] -intelssd (Index|SerialNumber) [-log (Filename)]
Version:
    version [-all|-a] [-display|-d (Property1,...)] [-help|-h] [-output|-o (text|nvmxml|json)]

c:\Users\kdedow\Desktop\SDL\QST>
```



## 4.2 Displaying Drives

The 'show' feature will display a list of detected drives:

```
qst.exe show -intelssd
```

```
c:\qst>qst_4.0.1_win64.exe show -intelssd
- Attached SSDs -
- Intel SSD DC S3520 Series Karl OS Drive! -
Model Number : INTEL SSDSC2BB800G7
Device Path : \\.\PHYSICALDRIVE0
Marketing String : Intel SSD DC S3520 Series
Firmware : N2010013
Serial Number : Karl OS Drive!
Index : 0
Device Status : Healthy
Opal State : Unsupported
eDrive Supported : False
- Intel SSD DC P4608 Series PHLF635200461P0NGN-1 -
Model Number : INTEL SSDPECKX010T7ES
Device Path : \\.\PHYSICALDRIVE1
Marketing String : Intel SSD DC P4608 Series
Firmware : QDU10150
Serial Number : PHLF635200461P0NGN-1
Index : 1
Device Status : Healthy
Opal State : Unsupported
eDrive Supported : Property not found
- Intel SSD DC P4608 Series PHLF635200461P0NGN-2 -
Model Number : INTEL SSDPECKX010T7ES
Device Path : \\.\PHYSICALDRIVE2
Marketing String : Intel SSD DC P4608 Series
Firmware : QDU10150
Serial Number : PHLF635200461P0NGN-2
Index : 2
Device Status : Healthy
Opal State : Unsupported
eDrive Supported : Property not found
- Intel SSD DC S3520 Series PHDU61610044150MGN -
Model Number : INTEL SSDSC2BB150G7
Device Path : \\.\PHYSICALDRIVE3
Marketing String : Intel SSD DC S3520 Series
Firmware : N2010120
Serial Number : PHDU61610044150MGN
Index : 3
Device Status : Selected drive is in a disable logical state.
Opal State : Selected drive is in a disable logical state.
eDrive Supported : False
c:\qst>
```



## 4.3 Health Analysis

The 'start -scan Health' option runs a quick health screen of all Intel SSDs on the system (unless used with '-intelssd (Index|Serial Number)'). It analyzes various internal drive logs in order to determine the overall health of the drive.

```
qst.exe start -scan Health -intelssd
```

```
c:\qst>qst_4.0.1_win64.exe start -scan -intelssd
- Scan Results -
- Intel SSD Karl OS Drive! -
No results
- Intel SSD PHLF635200461P0NGN-1 -
- HealthScan -
FAILURE : Critical error caught by drive. Drive is in a disable logical state.
FAILURE : Critical error caught by drive. Drive is in a disable logical state.
- StoreLogs -
Result : Completed successfully.
- Intel SSD PHLF635200461P0NGN-2 -
- HealthScan -
SUCCESS : Completed successfully.
- StoreLogs -
Result : Completed successfully.
- Intel SSD PHDV61610044150MGN -
- HealthScan -
SUCCESS : Completed successfully.
- StoreLogs -
Result : Completed successfully.
c:\qst>
```

### 4.3.1 SMART

If any SMART attributes are pre-fail and are in the failing state, the health scan will fail.

### 4.3.2 SMART Health

For NVMe SSDs, the SMART Health Critical Warnings will be analyzed. If any warnings are triggered, the health scan will report a failure.

### 4.3.3 Error String

If any error information is found in words 140-149 of the IDENTIFY DEVICE data or in the NVMe Identify Controller data, a failure will be recorded.



### 4.3.4 Nlog

For certain Intel SSDs, an analysis will be conducted on an internal log. Certain events will be recorded as a failure.

### 4.3.5 Lifespan

Expected lifespan remaining calculations are performed on every health scan. If the expected lifespan for the drive has been exceeded, the health scan will report a failure.

## 4.4 Drive Debug Logs

The 'start -scan Logs' option will save drive debug logs for all Intel SSDs on the system (unless used with '-intelssd (Index|Serial Number)'). In addition, system specific information is also saved. The stored logs vary based on product and protocol (e.g. NVMe vs. ATA).

```
qst.exe start -scan Logs -intelssd
```

```
c:\qst>qst_4.0.2_win64.exe start -scan -intelssd
```

```
- Scan Results -
```

```
- Intel SSD Karl OS Drive! -
```

```
No results
```

```
- Intel SSD BTLA725308YZ128BGN -
```

```
- HealthScan -
```

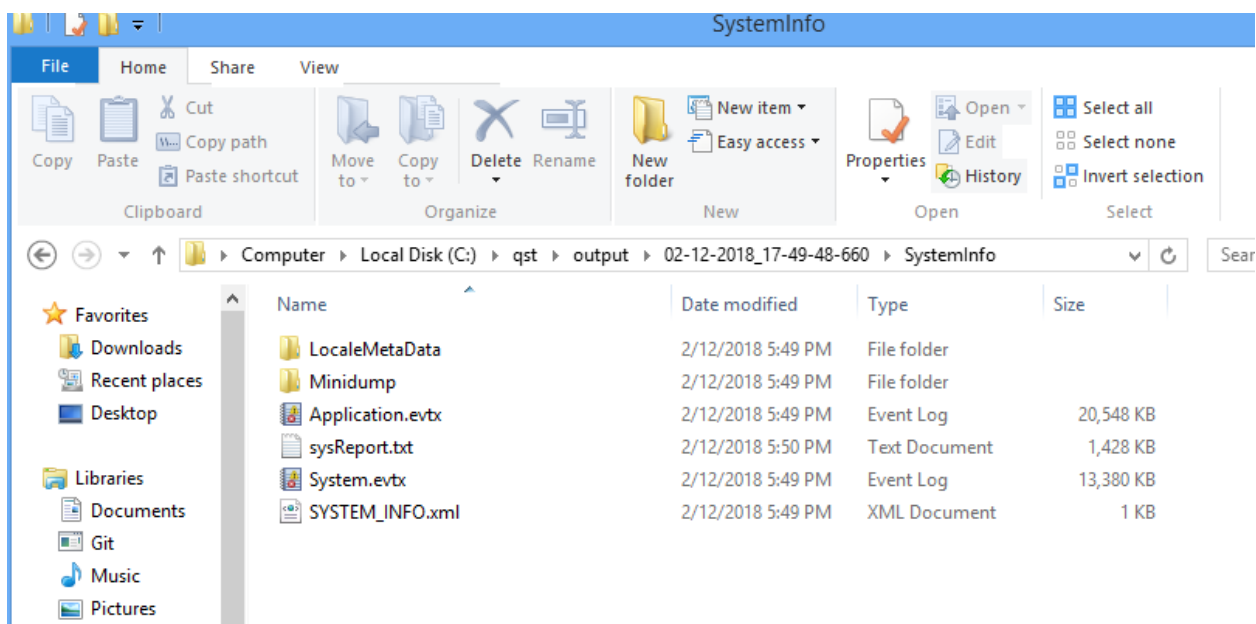
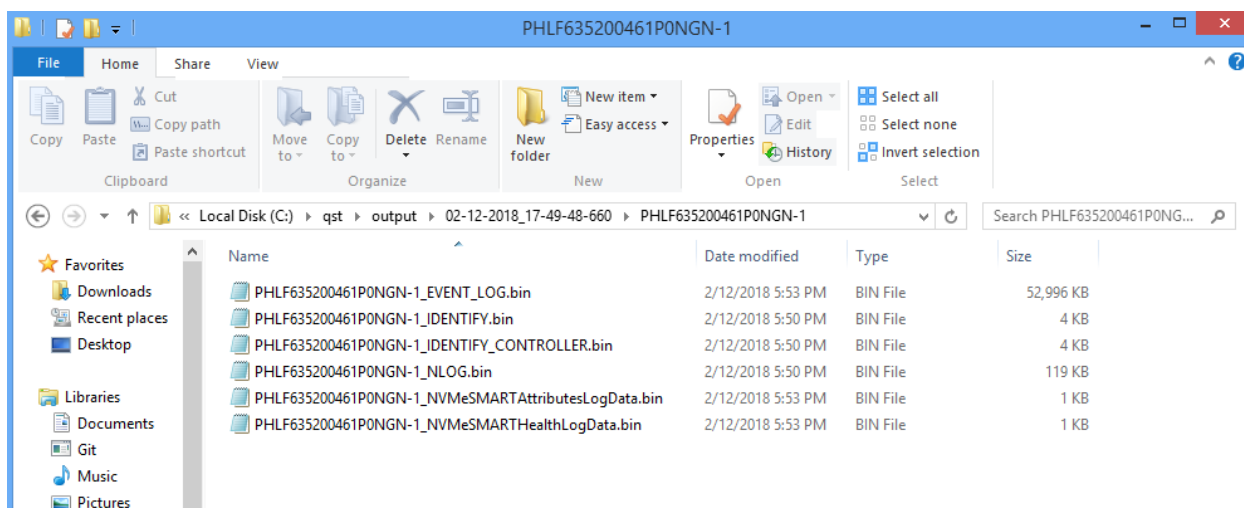
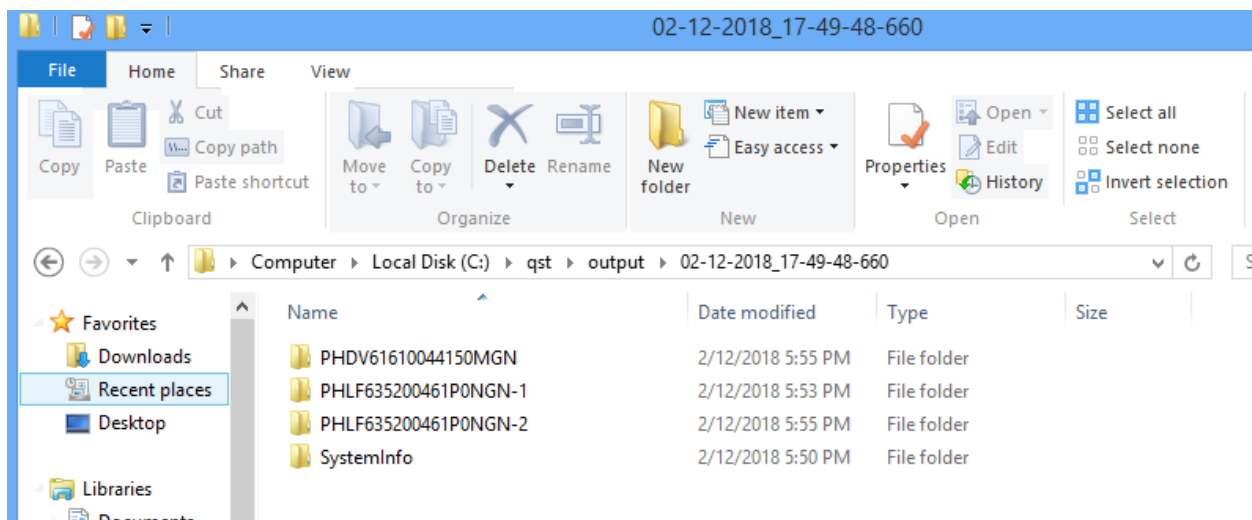
```
SUCCESS : Completed successfully.
```

```
- StoreLogs -
```

```
Result : Completed successfully.
```

```
c:\qst>
```

This drive debug logs are stored in the following location (created off of the location the QST executable is run from): ".\output/time\_stamp/". The aggregation of drive logs is further separated per drive based on serial number. The system specific information is stored in the 'SystemInfo' directory. This info can aid in drive debug by providing valuable information about a customer's system and system state.





## 4.5 Read Scan

The 'start -scan ReadScan' option runs a read test across LBAs on the drive.

To test 3,000,000 random LBAs, run the following:

```
qst.exe start -scan ReadScan -intelssd 1
```

To test every LBA sequentially, run:

```
qst.exe start -scan ReadScan -intelssd 1 FullScan=True
```

## 4.6 Data Integrity

The 'start -scan DataIntegrity' option examines the health of a user's filesystem. Under the hood, a data integrity scan will write files with a known pattern to a filesystem's free space read the files back, and then check the soundness of the data by comparing generated files to the known pattern. A success is reported when the created files match the known pattern. Before returning, a data integrity scan will clean up and remove all the created files.

To test 1GB of filesystem free space, run the following:

```
qst.exe start -scan DataIntegrity -intelssd 1
```

To test all the remaining free space associated with the filesystem, run:

```
qst.exe start -scan ReadScan -intelssd 1 FullScan=True
```

## 4.7 Secure Erase

The 'delete' feature will securely erase all the data on the selected drive. A user will be prompted before a drive is securely erased.

To securely erase data on a selected drive, run:

```
qst.exe delete -intelssd 1
```

```
c:\qst>qst_4.0.2_win64.exe delete -intelssd 1
WARNING! You have selected to erase the drive! This will delete all data on the
drive.
Proceed with the erase? (Y|N): y
Erasing drive...

- Delete -

- Intel SSD DC P4500 Series BTLA725308YZ128BGN -

Status : Delete successful.

c:\qst>
```



## 4.8 SMART

The SMART feature will return parsed SMART data on the selected drive. A user can specify the format of the parsed data (e.g. JSON, XML, text).

To return parsed SMART info on a selected drive, run:

```
qst.exe show -smart -intelssd 1
```

```
Administrator: Command Prompt
c:\qst>qst_4.0.4_win64.exe show -o json -smart -intelssd 1
{
  "SMART Attributes PHLE701300322P0DGN":
  {
    "AB":
    {
      "ID": "AB",
      "Normalized": 100,
      "Description": "Program Fail Count",
      "Raw": 0,
      "Action": "Pass"
    },
    "AC":
    {
      "ID": "AC",
      "Normalized": 100,
      "Description": "Erase Fail Count",
      "Raw": 0,
      "Action": "Pass"
    },
    "AD":
    {
      "ID": "AD",
      "Minimum erase cycles": 13,
      "Normalized": 100,
      "Description": "Wear Leveling Count",
      "Raw": 60130721805,
      "Maximum erase cycles": 18,
      "Average erase cycles": 14,
      "Action": "Pass"
    },
    "B8":
    {
      "ID": "B8",
      "Normalized": 100,
      "Description": "End-to-End Error Detection Count",
      "Raw": 0,
      "Action": "Pass"
    },
    "C7":
    {
      "ID": "C7",
      "Normalized": 100,
      "Description": "CRC Error Count",
      "Raw": 0,
      "Action": "Pass"
    },
    "E2":
    {
      "ID": "E2",
      "Normalized": 100,
      "Description": "Timed Workload - Media Wear",
      "Raw": 65535,
      "Action": "Pass"
    },
    "E3":
    {
      "ID": "E3",
      "Normalized": 100,
      "Description": "Timed Workload - Host Read/Write Ratio",
      "Raw": 65535,
      "Action": "Pass"
    },
    "E4":
    {
      "ID": "E4",
```



## 4.9 Version

The 'version' feature displays versioning and licensing information.

To retrieve the current tool version, run:

```
qst.exe version
```

```
c:\qst>qst_4.0.2_win64.exe version
- Version Information -
Name: Intel(R) Quick Screen Tool
Version: 4.0.2
Description: Intel SSD Quick Screen Tool is used to determine the health of attached drives.

c:\qst>
```

To retrieve the in-tool license, run:

```
qst.exe version -d license
```