Device Statistics – Usage

T13 Technical Proposal – e06180r7

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[This document is a proposal for the T13 to describe the Device Statistics for the device to report. The device usage is the information for the device usage history such as the length of the use period. The statistics supported are optional, and only applicable to the applicable devices.]

A.5 Device Statistics (Log Address TBAh)

A.5.1 Overview

The optional Device Statistics log contains selected statistics about the device. This log shall be read-only, and shall only be accessed via the GPL feature set. This log is supported if there is a non-zero length for log address TBAh in the General Purpose Log Directory. The format of the data is defined in table TBA. If the Device Statistics log is supported, only the Structure Version field is required. Each statistic is composed of a 1-byte flag field and a value field. If the bit 7 of the flag field is set to one then the value field of that statistic is valid. Each statistic shall be a multiple of 8 bytes long. The number of log pages may be greater than one.

A.5.2 Device Usage Statistics (Page TBA)

A.5.2.1 Overview

Device Statistics log page TBA contains device usage information about the device as described in table TBA.

The summary of this usage statistics is as followed:

1. Structure Version
2. Power-On Hours (Lifetime)
3. Spindle Motor Power-on Hours (Lifetime)
4. Head-Flying Hours (Lifetime)
5. Head Load Events (Lifetime)
6. Active/Idle Power Loss Events (Lifetime)
7. Total Write Data (Lifetime)
8. Number of Write Commands (Lifetime)
9. Total Read Data (Lifetime)
10. Number of Read Commands (Lifetime)

Table TBA – Usage Statistics

Offset	Type	Content
0-7	QWord	Structure Version
		Bit **Meaning** 63:56 Reserved 55:48 Device Statistics Version Number = 0001h 47:16 Reserved 15:0 TBAh
8-15	QWord	Power-On Hours (Lifetime)
		Bit **Meaning** 63 1 = Counter supported, 0 = Counter not supported 62 0 = Raw data reported , 1 = Normalized data reported 61:56 Reserved for flags 55:32 Reserved 31:0 Power-On Hours (Lifetime)
16-23	QWord	Spindle Motor Power-on Hours (Lifetime)

Offset	Type	Content
		Bit **Meaning** 63 1 = Counter supported, 0 = Counter not supported 62:56 Reserved for flags 55:32 Reserved 31:0 Spindle Motor Power-on Hours (Lifetime)
24-31	QWord	Head-Flying Hours (Lifetime)
		Bit **Meaning** 63 1 = Counter supported, 0 = Counter not supported 62:56 Reserved for flags 55:32 Reserved 31:0 Head-Flying Hours (Lifetime)
32-39	QWord	Head Load Events (Lifetime)
		Bit **Meaning** 63 1 = Counter supported, 0 = Counter not supported 62:56 Reserved for flags 55:32 Reserved 31:0 Head Load Events (Lifetime)
40-47	QWord	Active/Idle Power Loss Events (Lifetime)
		Bit **Meaning** 63 1 = Counter supported, 0 = Counter not supported 62:56 Reserved for flags 55:32 Reserved 31:0 Active/Idle Power Loss Events (Lifetime)
48-55	QWord	Total Write Data (Lifetime)
		Bit **Meaning** 63 1 = Counter supported, 0 = Counter not supported 62:56 Reserved for flags 55:32 Reserved 31:0 Total Write Data (Lifetime)
56-63	QWord	Number of Write Commands (Lifetime)
		Bit **Meaning** 63 1 = Counter supported, 0 = Counter not supported 62:56 Reserved for flags 55:32 Reserved 31:0 Number of Write Commands (Lifetime)
64-71	QWord	Total Read Data (Lifetime)
		Bit **Meaning** 63 1 = Counter supported, 0 = Counter not supported 62:56 Reserved for flags 55:32 Reserved 31:0 Total Read Data (Lifetime)
72-79	QWord	Number of Read Commands (Lifetime)
		Bit **Meaning** 63 1 = Counter supported, 0 = Counter not supported 62:56 Reserved for flags 55:32 Reserved 31:0 Number of Read Commands (Lifetime)

Offset	Type	Content
80-511	Byte	Reserved

A.5.2.2 Structure Version

A.5.2.2.1 Description

Structure Version defines the version of the data structure arrangement for this statistics. The structure is defined by the T13 committee. When a new structure is defined the version number will be assigned.

Bit 56:48 is used for the revision number of the statistics structure. Bit 15:0 is used for the page number of the Log Page for this statistics.

A.5.2.2.2 Update Interval

Update interval is not applicable to the Structure Version field.

A.5.2.2.3 Measurement Unit

Measurement unit is not applicable to the Structure Version field.

A.5.2.2.4 Initialization

Structure Version shall be initialized to the corresponding number at the time of manufacture.

A.5.2.3 Power-On Hours (Lifetime)

A.5.2.3.1 Description

Power-On Hours (Lifetime) is a counter that records the amount of time that the device has been operational since the device was manufactured. The device is operational when it is in Active/Idle/Standby state. The Sleep state is not an operational state. The power-on hours is sampled and recorded to a volatile counter with a minimum resolution of one minute. This volatile counter is accumulated into a non-volatile location per the following update criteria. The reporting of power on hours is truncated to hour units.

A.5.2.3.2 Update Interval

Power-On Hours (Lifetime) is updated on the following events. When the device is operational the counter is updated and stored in a non-volatile location at a minimum interval of one hour.

1. Update on Timer: Yes (= 1 hour)
2. Update on entering Standby state: Yes
3. Update on entering Sleep state: Yes
4. Update on Device Statistics Page Read: Yes

A.5.2.3.3 Measurement Units

Power-On Hours (Lifetime) is incremented by one for each hour of operation.

A.5.2.3.4 Initialization

Power-On Hours (Lifetime) shall be initialized to zero at the time of manufacture.

A.5.2.4 Spindle Motor Power-on Hours (Lifetime)

A.5.2.4.1 Description

Spindle Motor Power-on Hours (Lifetime) is a counter that records the amount of time that the spindle motor has been powered on since the device was manufactured. The spindle motor power on time is sampled and recorded to a volatile counter with a minimum resolution one minute. This volatile counter is accumulated into a non-volatile location per the following update criteria. The reporting of spindle motor power on hours is truncated to hour units.

A.5.2.4.2 Update Interval

Spindle Motor Power-on Hours (Lifetime) is updated on the following events. When the device is operational the counter is updated and stored in a non-volatile location at an interval of no greater that one hour

1. Update on Timer: Yes (= 1 hour)
2. Update on entering Standby state: Yes
3. Update on entering Sleep state: Yes
4. Update on Device Statistics Page Read: Yes

A.5.2.4.3 Measurement Units

Spindle Motor Power-on Hours (Lifetime) is incremented by one for each hour of spindle powered on.

A.5.2.4.4 Initialization

Spindle Motor Power-on Hours (Lifetime) shall be initialized to zero at the time of manufacture.

A.5.2.5 Head-Flying Hours (Lifetime)

A.5.2.5.1 Description

Head-Flying Hours (Lifetime) is a counter that records number of hours that the device head(s) is(are) flying over the surface of the media since the device was manufactured. The head-flying time is sampled and recorded to a volatile counter with a minimum resolution of one minute. This volatile counter is accumulated into a non-volatile location per the following update criteria. The reporting of the head-flying hours is truncated to hour units.

A.5.2.5.2 Update Interval

Head-Flying Hours (Lifetime) is updated on the following events. When the device is operational the counter is updated and stored in a non-volatile location at an interval of no greater that one hour

1. Update on Timer: Yes (= 1 hour)
2. Update on entering Standby state: Yes
3. Update on entering Sleep state: Yes
4. Update on Device Statistics Page Read: Yes

A.5.2.5.3 Measurement Units

Head-Flying Hours (Lifetime) is incremented by one for each hour of head(s) flying over the surface of media.

A.5.2.5.4 Initialization

Head-Flying Hours (Lifetime) shall be initialized to zero at the time of manufacture.

A.5.2.6 Head Load Events (Lifetime)

A.5.2.6.1 Description

Head Load Events (Lifetime) is a counter that records the number of events that the device loads its head(s) over the surface of the media. If the device is a ramp load device the number of times that the head(s) is(are) loaded from the ramp to the media are counted. If the device is a contact start stop device the number of time that the head(s) move away from the landing zone are counted.

A.5.2.6.2 Update Interval

Head Load Events (Lifetime) is updated on the following events. When the device is operational the counter is updated and stored in a non-volatile location at an interval of no greater that one hour

1. Update on Timer: Yes (= 1 hour)
2. Update on entering Standby state: Yes
3. Update on entering Sleep state: Yes
4. Update on Device Statistics Page Read: Yes

A.5.2.6.3 Measurement Units

Head Load Events (Lifetime) is incremented by one for each time the device loads its head(s) over the surface of the media.

A.5.2.6.4 Initialization

Head Load Events (Lifetime) shall be initialized to zero at the time of manufacture.

A.5.2.7 Active/Idle Power Loss Events (Lifetime)

A.5.2.7.1 Description

Active/Idle Power Loss Events (Lifetime) is a counter that records number of power loss events that have occurred when the device was in Active or Idle state. The device indicates its entering Standby or Sleep state by setting a flag. At power-on the device checks this flag to verify the device was powered off after Standby or Sleep. If the flag is not set the device increment and records the counter in its non-volatile location.

A.5.2.7.2 Update Interval

Active/Idle Power Loss Events (Lifetime) is updated on the following events. When the device is powered on, if it detects that an Active/Idle Power Loss Event has occurred, then the counter is incremented and stored in a non-volatile location.

1. Update on Timer: No (=1 hour)

2. Update on entering Standby state: No
3. Update on entering Sleep state: No
4. Update on Device Statistics Page Read: No
5. Update on following power on: Yes

A.5.2.7.3 Measurement Units

Active/Idle Power Loss Events (Lifetime) is incremented by one each time the Active/Idle Power Loss Event is detected.

A.5.2.7.4 Initialization

Active/Idle Power Loss Events (Lifetime) shall be initialized to zero at the time of manufacture.

A.5.2.8 Total Write Data (Lifetime)

A.5.2.8.1 Description

Total Write Data (Lifetime) is a counter that records the total amount of logical data blocks transferred for write commands that complete successfully.

A.5.2.8.2 Update Interval

Total Write Data (Lifetime) is updated on the following events. When the device is operational the counter is updated and stored in a non-volatile location at an interval of no greater that one hour The counter is also updated and stored in a non-volatile location when the device enters Standby or Sleep state.

1. Update on Timer: Yes (= 1 hour)
2. Update on entering Standby state: Yes
3. Update on entering Sleep state: Yes
4. Update on Device Statistics Page Read: Yes

A.5.2.8.3 Measurement Units

Total Write Data (Lifetime) is incremented by one for each logical data block that was written successfully.

A.5.2.8.4 Initialization

Total Write Data (Lifetime) shall be initialized to zero at the time of manufacture.

A.5.2.9 Number of Write Commands (Lifetime)

A.5.2.9.1 Description

Number of Write Commands (Lifetime) is a counter that records the number of write commands that complete successfully.

A.5.2.9.2 Update Interval

Number of Write Commands (Lifetime) is updated on the following events. When the device is operational the counter is updated and stored in a non-volatile location at an interval of no greater that one hour The counter is also updated and stored to a non-volatile location when the device enters Standby or Sleep state.

1. Update on Timer: Yes (= 1 hour)
2. Update on entering Standby state: Yes
3. Update on entering Sleep state: Yes
4. Update on Device Statistics Page Read: Yes

A.5.2.9.3 Measurement Units

Number of Write Commands (Lifetime) is incremented by one for each write command that is completed successfully.

A.5.2.9.4 Initialization

Number of Write Commands (Lifetime) shall be initialized to zero at the time of manufacture.

A.5.2.10 Total Read Data (Lifetime)

A.5.2.10.1 Description

Total Read Data (Lifetime) is a counter that records the total amount of logical data blocks transferred for read commands that complete successfully.

A.5.2.10.2 Update Interval

Total Read Data (Lifetime) is updated on the following events. When the device is operational the counter is updated and stored in a non-volatile location at an interval of no greater that one hour. The counter is also updated and stored to a non-volatile location when the device enters Standby or Sleep state.

5. Update on Timer: Yes (= 1 hour)
6. Update on entering Standby state: Yes
7. Update on entering Sleep state: Yes
8. Update on Device Statistics Page Read: Yes

A.5.2.10.3 Measurement Units

Total Read Data (Lifetime) is incremented by one for each logical data block that was read successfully.

A.5.2.10.4 Initialization

Total Read Data (Lifetime) shall be initialized to zero at the time of manufacture.

A.5.2.11 Number of Read Commands (Lifetime)

A.5.2.11.1 Description

Number of Read Commands (Lifetime) is a counter that records the number of read commands that complete successfully.

A.5.2.11.2 Update Interval

Number of Read Commands (Lifetime) is updated on the following events. When the device is operational the counter is updated and stored in a non-volatile location at an interval of no greater that one hour. The counter is also updated and stored in a non-volatile location when the device entering Standby or Sleep state.

1. Update on Timer: Yes (= 1 hour)
2. Update on entering Standby state: Yes
3. Update on entering Sleep state: Yes
4. Update on Device Statistics Page Read: Yes

A.5.2.11.3 Measurement Units

Number of Read Commands (Lifetime) is incremented by one for each read command that is completed successfully.

A.5.2.11.4 Initialization

Number of Read Commands (Lifetime) shall be initialized to zero at the time of manufacture.

(The following section is copied from previous version for reference.)

e06180r6

Proposal for the Device Statistic Information Additions Device Usage Statistics Group

To: T13 Technical Committee
From: Joseph Chen, Samsung
Steve Livaccari, IBM
Date: Apr 4, 2008

This document shows the list of candidates of device usage information to be included in the Device Statistic Information Log. Each of the candidates will be reviewed and included in the standard after approval. Supporting of each of the item on the list is optional.

The statistics shall follow these rules:

1. Device statistics shall be preserved across hardware reset
2. Device statistics shall be preserved across software reset
3. Device statistics shall be preserved across device reset
4. The device shall not exit standby to update the log (e.g., do not spin up).

Summary of Device Statistic Information Candidates:

11. Device Statistic Information Header
12. Power-on Hours (Lifetime)
13. Spindle Motor Power-on Hours (Lifetime)
14. Head-Flying Hours (Lifetime)
15. Head Load Events (Lifetime)
16. Active/Idle Power Loss Events (Lifetime)
17. Total Write Data (Lifetime)
18. Number of Write Commands (Lifetime)
19. Read Data Amount (Lifetime)
20. Read Command Count (Lifetime)

Device Statistic Information Table

Byte Offset	Bit	Description	
0		Device Statistic Information Header	
		Description:	When T13 decides to make a new revision to this structure
		Update Criteria:	NA
		Measurement Units:	NA
		Initialization:	at the time of manufacture
	63:48	Revision number	0001h
	47:16	Reserved	
	15:0	Page Number	0004h
8		Power-on Hours (Lifetime)	

		Description: This value reports number of power-on hours since the device was manufactured. The power-on hours is defined as the amount of time the power has been applied to the device and the device is operational. The device is operational when it is in Active/Idle/Standby state. The Sleep state is not an operational state. The power-on hours is sampled and recorded into a volatile counter with a resolution of one minute or shorter interval. This volatile counter is accumulated into a non-volatile location per the following update criteria. The report of the power on hours is truncated to the hour unit. Update Criteria: Update on Timer: Yes (= 1 hour) Update on entering Standby state: Yes Update on entering Sleep state: Yes Update on Device Statistics Page Read: Yes Measurement Units: Hours Initialization: Cleared to 0 at the time of manufacture = yes Preserve over all resets = yes
	63	1=valid statistic data
	62:56	Reserved
	55:32	Reserved
	31:0	Unsigned DWORD Power-on Hours (Lifetime)
16		Spindle Motor Power-on Hours (Lifetime)
		Description: This value reports number of hours the spindle motor is powered on since the device was manufactured. The spindle motor power on time is sampled and recorded into a volatile counter with a resolution of one minute or shorter interval. This volatile counter is accumulated into a non-volatile location per the following update criteria. The report of the power on hours is truncated to the hour unit. Update Criteria: Update on Timer: Yes (= 1 hour) Update on entering Standby state: Yes Update on entering Sleep state: Yes Update on Device Statistics Page Read: Yes Measurement Units: Hours Initialization: Cleared to 0 at the time of manufacture = yes Preserve over all resets = yes
	63	1=valid statistic data
	62:56	Reserved
	55:32	Reserved
	31:0	Unsigned DWORD Spindle Motor Power-on Hours (Lifetime)
24		Head-Flying Hours (Lifetime)

		Description:	This value reports number of hours the device head(s) is flying over the surface of the media since the device was manufactured. The head-flying time is sampled and recorded into a volatile counter with a resolution of one minute or shorter interval. This volatile counter is accumulated into a non-volatile location per the following update criteria. The report of the head-flying hours is truncated to the hour unit.
		Update Criteria:	Update on Timer: Yes (= 1 hour) Update on entering Standby state: Yes Update on entering Sleep state: Yes Update on Device Statistics Page Read: Yes
		Measurement Units:	Hours
		Initialization:	Cleared to 0 at the time of manufacture = yes Preserve over all resets = yes
	63	1=valid statistic data	
	62:56	Reserved	
	55:32	Reserved	
	31:0	Unsigned DWORD Head-Flying Hours (Lifetime)	
32		Head Load Events (Lifetime)	
		Description:	This value records number of events the device loads its head(s) over the surface of the media. If the device is a ramp load device, this event counts the number of time for the head moves from the ramp to the media. If the device is a contact start stop device, this event counts the number of time the head moves away from the landing zone.
		Update Criteria:	Update on Timer: Yes (=1 hour) Update on entering Standby state: Yes Update on entering Sleep state: Yes Update on Device Statistics Page Read: Yes
		Measurement Units:	Head load events
		Initialization:	Cleared to 0 at the time of manufacture = yes Preserve over all resets = yes
	63	1=valid statistic data	
	62		
	61:56	Reserved	
	55:33	Reserved	
	32	1=Ramp loaded device 0=Not ramp loaded device	
	31:0	Unsigned DWORD Head Load Events (Lifetime)	
40		Active/Idle Power Loss Events (Lifetime)	
		Description:	Power loss when the device is in Active or Idle state.
		Update Criteria:	Update on Timer: No (=1 hour) Update on entering Standby state: No Update on entering Sleep state: No Update on Device Statistics Page Read: No Update on following power on: Yes
		Measurement Units:	Events
		Initialization:	Cleared to 0 at the time of manufacture = yes Preserve over all resets = yes
	63	1=valid statistic data	
	62:56	Reserved	
	55:32	Reserved	

	31:0	Unsigned DWORD Active/Idle Power Loss Events (Lifetime)
48		Total Write Data (Lifetime)
		Description: This statistic reports the amount of data for write commands that complete successfully. Update Criteria: Update on Timer: Yes (= 1 hour) Update on entering Standby state: Yes Update on entering Sleep state: Yes Update on Device Statistics Page Read: Yes Measurement Units: Logical blocks Initialization: Cleared to 0 at the time of manufacture = yes Preserve over all resets = yes
	63	1=valid statistic data
	62:0	Unsigned Integer Value Total Write Data (Lifetime)
56		Write Command Count (Lifetime)
		Description: This statistic reports the number of write commands that complete successfully. Update Criteria: Update on Timer: Yes (= 1 hour) Update on entering Standby state: Yes Update on entering Sleep state: Yes Update on Device Statistics Page Read: Yes Measurement Units: Number of commands Initialization: Cleared to 0 at the time of manufacture = yes Preserve over all resets = yes
	63	1=valid statistic data
	62:56	Reserved
	55:0	Unsigned Integer Value Write Command Count (Lifetime)
64		Read Data Amount (Lifetime)
		Description: This statistic reports the amount of data for read commands that complete successfully. Update Criteria: Update on Timer: Yes (= 1 hour) Update on entering Standby state: Yes Update on entering Sleep state: Yes Update on Device Statistics Page Read: Yes Measurement Units: Logical blocks Initialization: Cleared to 0 at the time of manufacture = yes Preserve over all resets = yes
	63	1=valid statistic data
	62:56	Reserved
	55:0	Unsigned Integer Value Read Data Amount (Lifetime)
72		Read Command Count (Lifetime)
		Description: This statistic reports the number of read commands that complete successfully. Update Criteria: Update on Timer: Yes (= 1 hour) Update on entering Standby state: Yes Update on entering Sleep state: Yes Update on Device Statistics Page Read: Yes Measurement Units: Number of commands Initialization: Cleared to 0 at the time of manufacture = yes Preserve over all resets = yes
	63	1=valid statistic data
	62:56	Reserved
	55:0	Unsigned Integer Value Read Command Count (Lifetime)