

Scaleable Intelligent Video Server System

<i>Title</i>	SIVSS integration-ready hardware platform compatible with SIVSS requirement as specified earlier in the project
<i>Revision</i>	A
<i>Deliverable #</i>	11.1
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<i>Date</i>	24 Feb. 2006
<i>Filename</i>	Deliverable D11.1 rev A.doc
<i>Dissemination[†]</i>	CO

REVISION	DATE	DESCRIPTION
A	24 Feb 2006	Created by Jørn Raastad

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1 INTRODUCTION

This document describes the delivery of a fully tested and qualified prototype of a high capacity, high speed, industry standard interface, scalable tape system that is being integrated with the other building blocks of the program and being used as part of the SIVSS test platform. Most of the work has been put into improvements of the capability to provide error statistics to the system level error monitoring system (WP 9). By reporting certain error logs to Data Mover (WP8), the quality of each tape, drive and recording in the system can be tracked over time, and potential problems can be corrected prior to any fatal errors.

2 TECHNICAL DESCRIPTION

2.1 Tape Sub-System Overview

The tape subsystem is connected to the rest of the system through the Data Mover Engine (DME) (WP 8). The DME runs on servers physically connected to the tape drives through SCSI connection.

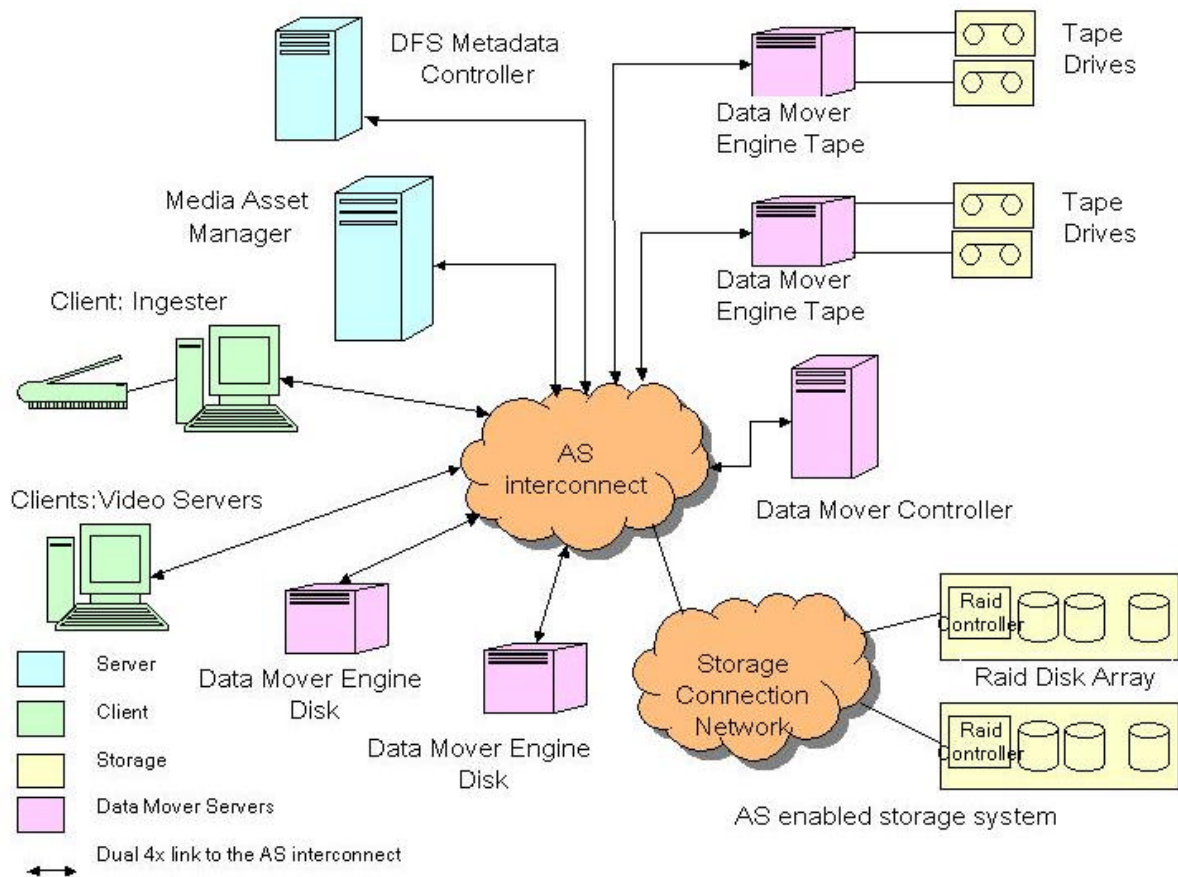


Figure 1 – SIVSS system architecture, showing the tape subsystem in the upper right corner.

The tape drive prototypes that were used in the SIVSS demonstration setup have the following main characteristics:

Tape Format	Capacity [‡]	Sustained Transfer Rate	Interface Type
Ultrium Gen. 2	200/400 GB	24/48 Mbyte/sec	Ultra160

The number of drives required in the tape subsystem was primarily determined by the required transfer rate. In the SIVSS demo system, a transfer rate of ~100 MB/sec was requested. Based on the above data, a minimum of four tape drives were needed in order to fulfil the SIVSS requirements. In the IBC demo setup six drives were running, providing ~140 MB/sec transfer rate and 1.2 TByte native capacity. This was more than the host was capable of delivering.

2.2 Error Monitoring

The DME is highly dependant on the write and read performance of the tape drive in order to operate efficiently. In order to monitor the write and read quality of the tapes, SIVSS has created a high speed tape drive real time quality monitoring software that provides overall reliability performances of the video system tape archive resources.

Most of the work in WP11 has been put into providing error statistics for the quality monitoring software:

- Various counters are implemented and brought to the host through the SCSI protocol
- “Tape Alert” functionality build some level of intelligence in to the drive to allow the drive to warn the host about possibly critical events that can prevent the writing or reading of a tape to complete. Hundreds of tapes were tested for thousands of hours to establish meaningful criteria for messages to be sent to the host.

As an example, tape media degradation is shown in Figure 2 and Figure 3 below. Initially, the capacity per tape is about 208 GByte. As the media starts to wear, the tape drives detects errors on the fly while writing the tape, and corrects for these errors by rewriting the data somewhere else on the tape. The rewrite error rate is therefore a good indication of the quality of the media. As the rewrite error rate increase the capacity drops (because some the data must be rewritten). This can be seen in Figure 2 and Figure 3 below.

[‡] Capacity and transfer rate in native/compressed (assuming 2:1 compression)

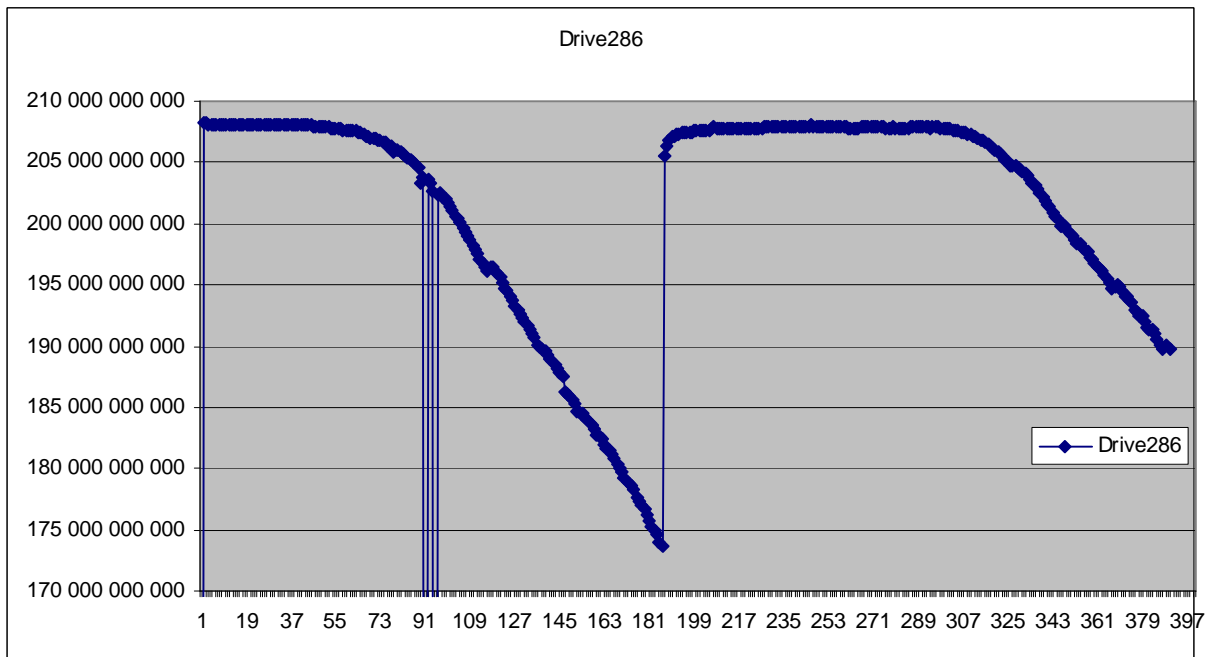


Figure 2 – Written capacity (GBytes) as a function of number of full writes. The tape media was changed after run #187.

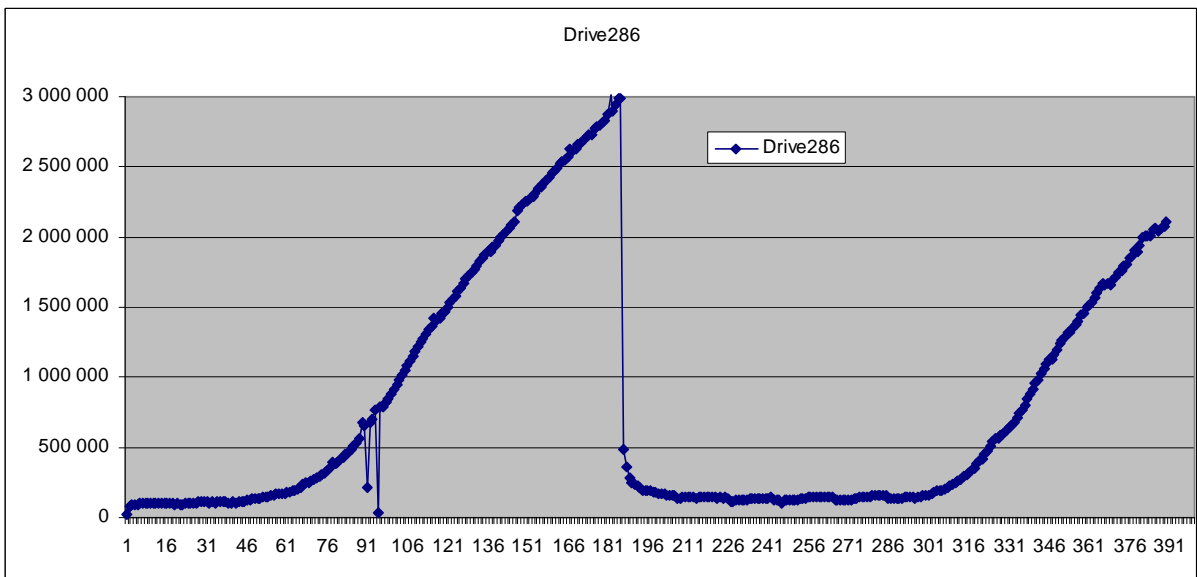
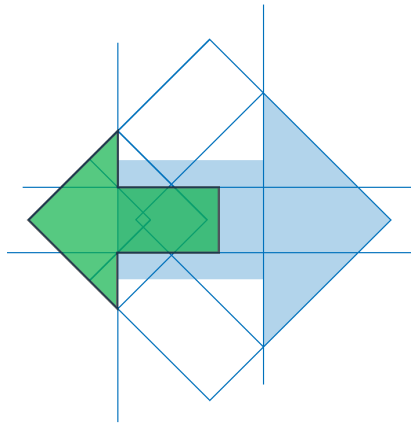


Figure 3 – Rewrite error rate as a function of number of full writes. The tape media was changed after run #187. As the number of rewrites increase, the capacity (above figure) drops.

A large number of counters are reported to the outside world to be used by the quality monitoring software to predict write or read failures. Appendix A lists all the counters and describes how to access them, as well as the use of TapeAlert.



Scaleable Intelligent Video Server System

3 APPENDIX A: DETAILED DESCRIPTION OF ERROR DATA PROVIDED

Reporting of Error Statistics For Preventive Maintenance of Tape Drive and Media

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1. INTRODUCTION

3.1 1.1. General

This manual covers the Error Statistics available through the SCSI Interface for the tape drive used in the SIVSS integration product line of tape drives.

2. ABOUT THE TAPE DRIVE

2.1. The Tape Cartridge.

The prototypes integrated into the SIVSS demonstrator system has these main specifications:

Tape Format	Capacity ¹	Sustained Transfer Rate	Interface Type
Ultrium Gen. 2	200/400 GB	24/48 Mbyte/sec	Ultra160

The drive uses LTO tape cartridges:

- 512 track magnetic tape cartridge. The tape format used is Ultrium 2. The cartridge has, with an average 2:1 data compression ratio, a capacity of 400 GBytes. The native capacity for the tape is 200 GBytes.

¹ Capacity and transfer rate in native/compressed (assuming 2:1 compression)

2.2. TapeAlert

The TapeAlert information is accessed via LOG SENSE page 2Eh, and configuration is done via MODE SELECT page 1Ch. The Mode Sense/Select configuration of the TapeAlert interface is compatible with the SMART diagnostic standard for disc drives. The host software should first check the tape drive to determine whether it supports the TapeAlert Log Sense page 2Eh. By default the host software access to the TapeAlert Log Sense page is via polling.

The TapeAlert Log Sense page shall be read from a tape drive device at the following times as a minimum:

- At the beginning of a write/read job, even if media is not loaded.
- Immediately after a fatal error during the write/read job.
- At the end of each tape when the write/read job spans multiple tapes. If the tape is to be ejected then the Log Sense page must be read BEFORE this.
- At the end of a write/read job.

Though not mandatory, the host software may also poll the Log Sense page at regular intervals (e.g. every 60 seconds) while the tape drive is idle.

The TapeAlert Log page contains 64 one-byte alert flags.

There are three flag severity levels, listed below in order of severity:

- Critical (C)
- Warning (W)
- Information (I)

Each time the host software reads the TapeAlert Log page, it should check all 64 flags to discover which are set (there may be more than one). The definitions of the 64 flags are device type specific, so that there is one definition for tape drive devices, and a different definition for stand-alone changer devices (in libraries). For each flag that is set, the host software shall communicate the defined error message and severity for that flag to the user, and also log it. If multiple flags are set simultaneously, they will be displayed together in ascending order of severity. At the beginning of each set of TapeAlert error messages, the tape device that initiated them must be identified. For the tape drive media-related flags (flags 4, 7 and 14) the software label of the media, if such exist, should be included in the TapeAlert error messages so that the user is aware what piece of media the error refers to. Such information could also be displayed with the messages for other flags as well if required. The information read in the TapeAlert flags should not in itself cause the software to stop a current backup/restore job.

3. LOG SENSE

3.1. Command Description

The LOG SENSE command is used to retrieve statistical information maintained by the Drive¹.

The log information consists of numerous counters related to Drive use and write/read operations to/from the magnetic tape. When the Log Sense command is issued, the Drive will return the requested parameter page(s).

Power-on or Hard Reset will set most counters to zero.

The parameter list is transferred during the DATA IN phase of the command.

3.2. Command Descriptor Block

BYTE	BIT 7	6	5	4	3	2	1	0
00	Operation Code 4Dh							
01	RESERVED						PPC	SP
02	PC			Page Code				
03	RESERVED							
04	RESERVED							
05	Parameter Pointer							
06								
07	Allocation Length							
08								
09	Control Byte							

Table 1: LOG SENSE Command Descriptor Block

- PPC** The parameter Pointer Control (PPC) bit must be set to 0.
- SP** The Drive does not support saving of log parameters and the Save Parameters (SP) bit must be set to 0.
- PC** The Page Control (PC) field indicates what type of parameter value the Drive returns to the initiator.

Note: For page 2Eh (TapeAlert) this field is ignored.

- 00b** : Current Threshold Values (always returns maximum possible values)
- 01b** : Current Cumulative Values
- 10b** : Default Threshold Values (always returns maximum possible values)
- 11b** : Default Cumulative Values (always returns 0)

¹ Note that the log counter *updates* are not necessarily synchronized with the events that they monitor.

Page Code

The Page Code field specifies which page to return. Legal Page Codes are:

- 00h** : Supported Log Pages Page
- 02h** : Recoverable Write Error Counter Page
- 03h** : Recoverable Read Error Counters Page
- 0Ch** : Sequential Access Device Page
- 2Eh** : TapeAlert Page
- 30h** : Tape Usage Page
- 31h** : Tape Capacity Page
- 33h** : Error History Page

Parameter Pointer

The Parameter Pointer field must be set to 0 to indicate that the Drive always transfers all supported parameter codes for each page.

Allocation Length

This field specifies the maximum number of bytes that the Initiator has allocated for returned LOG SENSE data. An Allocation Length of 0 indicates that no LOG SENSE data is sent. The Drive terminates the DATA IN phase when Allocation Length bytes have been transferred or when all available LOG SENSE data have been transferred, whichever is less.

3.3. Supported Log Parameters

The following log parameters are supported by the Drive:

- 02h** : Recoverable Write Error Counter Page
 - 0001h** : Total Rewrite Counter
 - 0002h** : Total Write Errors Counter
 - 0003h** : Total Write Errors Corrected Counter
 - 0004h** : Reserved
 - 0005h** : Total Bytes Written Counter
 - 0006h** : Total Uncorrected Write Errors Counter
- 03h** : Recoverable Read Error Counters Page
 - 0001h** : Total Reread Counter
 - 0002h** : Total Read Errors Counter
 - 0003h** : Total Read Errors Corrected Counter
 - 0004h** : Total ECC Correction Counter
 - 0005h** : Total Bytes Read Counter
 - 0006h** : Total Uncorrected Read Errors Counter
 - 8004h** : Total ECC Errors Counter
- 0Ch** : Sequential Access Device Page
 - 0100h** : Cleaning Required Flag
 - 8000h** : Head Cleaning Time Counter
 - 8001h** : Cumulative Head Cleaning Counter
 - 8002h** : Cumulative Cartridge Load Counter

8003h	:	Total Power-On Time Counter
8004h	:	Total Drive Motion Time Counter
2Eh	:	TapeAlert Page
0001h	:	TapeAlert Flag 1
...	:	TapeAlert Flag n
0040h	:	TapeAlert Flag 64
30h	:	Tape Usage Page
0001h	:	Thread Counter
0002h	:	Total Data Sets Written Counter
0003h	:	Total Write Retries Counter
0004h	:	Total Unrecovered Write Errors Counter
0005h	:	Total Suspended Writes Counter
0006h	:	Total Fatal Suspended Writes Counter
0007h	:	Total Data Sets Read Counter
0008h	:	Total Read Retries Counter
0009h	:	Total Unrecovered Read Errors Counter
000Ah	:	Total Suspended Read Counter
000Bh	:	Total Fatal Suspended Reads Counter
000Ch	:	Total Suspended Append Writes Counter
31h	:	Tape Capacity Page
0001h	:	Remaining Capacity Counter – Main Partition
0002h	:	Remaining Capacity Counter – Current Partition
0003h	:	Maximum Capacity Counter – Main Partition
0004h	:	Maximum Capacity Counter . Current Partition
33h	:	Error History Page
0000h	:	Error History Element 0
...	:	Error History Element n
000Fh	:	Error History Elemet 15

3.4. Parameter List

3.4.1. Log Pages Format

The log information returned by the Drive are formatted into *Log Pages*. These pages have the following general format:

BYTE	BIT 7	6	5	4	3	2	1	0
00	RESERVED		Page Code					
01	RESERVED							
02	Page Length							
03								
04 n	One or more Log Parameters (or Supported Pages list)							

Table 2: Log Pages Format

Page Code

The Page Code for this page.

Page Length

This field indicates the length of the following Log Parameters (or Supported Pages list).

3.4.2. Log Parameters Format

The Log Parameters contained in the Log Pages returned by the Drive have the following general format:

BYTE	BIT 7	6	5	4	3	2	1	0
m+0 m+1	Parameter Code							
m+2	DU	DS	TSD	ETC	TMC		LBIN	LP
m+3	Parameter Length							
m+4 m+11	Parameter Value							

Table 3: Log Parameter Format

Parameter Code

The Parameter Code field identifies the log parameter value being transferred for this Log Parameter.

DU

A Disable Update (DU) bit set to 0 indicates that the Drive is free to update the counter.

A DU bit set to 1 indicates that the Drive shall not update the counter. The Drive sets the DU bit to 1 when the counter reaches its maximum value.

DS

The Disable Save (DS) bit is set to 1 to indicate that the Drive does support saving of log parameters.

TSD

The Target Save Disable (TSD) bit is set to 0.

ETC

The Enable Threshold Comparison (ETC) bit is set to 0 to indicate that threshold comparison is not performed.

TMC

The Threshold Met Criteria (TMC) field is set to 0 as the Drive does not support log threshold comparison.

LBIN

The List Binary (LBIN) bit is set to 0 to indicate that the log parameters are data counters.

LP

The List Parameters (LP) bit is set to 0 to indicate that log parameters are data counters.

Parameter Length

The parameter length field specifies the length in bytes of the following Parameter Value.

Parameter Value

The actual log parameter value.

3.4.3. Supported Log Pages (00h)

BYTE	BIT 7	6	5	4	3	2	1	0
00	RESERVED		Page Code = 00h					
01	RESERVED							
02	Page Length = 0008h							
03								
04	Supported Page = 00h							
05	Supported Page = 02h							
06	Supported Page = 03h							
07	Supported Page = 0Ch							
08	Supported Page = 2Eh							
09	Supported Page = 30h							
10	Supported Page = 31h							
11	Supported Page = 33h							

Table 4: Supported Log Pages Page

Page Code

The Page Code for this page is 00h.

Page Length

This field is set to 0008h indicating that the Supported Log Pages page contains 8 bytes/page codes.

3.4.4. Write Error Counter Page (02h)

BYTE	BIT 7	6	5	4	3	2	1	0
00	RESERVED		Page Code = 02h					
01	RESERVED							
02	Page Length = 0038h							
03								
04 15	Total Rewrites Counter Log Parameter							
16 23	Total Write Errors Log Parameter							
24 31	Total Write Errors Corrected Log Parameter							
32 39	Total Times Errors Processed Log Parameter							
40 51	Total Bytes Written Log Parameter							
52 59	Total Uncorrected Write Errors Log Parameter							

Table 5: Write Error Counter Page

Page Code

The Page Code for this page is 02h.

Page Length

This field is set to 0038h indicating that the page parameters occupy 56 bytes.

Total Rewrites Counter Log Parameter

BYTE	BIT 7	6	5	4	3	2	1	0
n+0 n+1	Parameter Code = 0001h							
n+2	DU	DS	TSD	ETC	TMC	LBIN	LP	
n+3	Parameter Length = 08h							
n+4 n+11	Total Rewrites Counter							

Table 6: Total Rewrite Counter Log Parameter

Parameter Code

The Parameter Code is set to 0001h.

Parameter Length

This field is set to 08h to indicate that the counter is 8 bytes wide.

Total Rewrites Counter

This counter counts re-writes during write operations. When a block is re-written (one or more times), the counter is incremented by one. The increment(s) are performed each time the hub motors stop.

Total Write Errors Log Parameter

BYTE	BIT 7	6	5	4	3	2	1	0
n+0 n+1	Parameter Code = 0002h							
n+2	DU	DS	TSD	ETC	TMC	LBIN	LP	
n+3	Parameter Length = 04h							
n+4 n+7	Total Write Errors Counter							

Table 7: Total Write Errors Log Parameter

Parameter Code

The Parameter Code is set to 0002h.

Parameter Length

This field is set to 04h to indicate that the counter is 4 bytes wide.

Total Write Errors Counter

This counter counts re-writes and uncorrectable write errors during write operations. The increment(s) are performed each time hub motors stop.

Total Write Errors Corrected Log Parameter

BYTE	BIT 7	6	5	4	3	2	1	0
n+0 n+1	Parameter Code = 0003h							
n+2	DU	DS	TSD	ETC	TMC	LBIN	LP	
n+3	Parameter Length = 04h							
n+4 n+7	Total Write Errors Corrected Counter							

Table 8: Total Write Errors Corrected Log Parameter

Parameter Code

The Parameter Code is set to 0003h.

Parameter Length

This field is set to 04h to indicate that the counter is 4 bytes wide.

Total Write Errors Corrected Counter

This counter counts re-writes during write operations. When a block is re-written (one or more times), the counter is incremented by one. The increment(s) are performed each time hub motors stop. This counter counts the same events as a counter in the parameter 0001 of this page, but it is smaller.

Total Times Errors Processed Log Parameter

BYTE	BIT 7	6	5	4	3	2	1	0
n+0 n+1	Parameter Code = 0004h							
n+2	DU	DS	TSD	ETC	TMC	LBIN	LP	
n+3	Parameter Length = 04h							
n+4 n+7	Counter (Reserved)							

Table 9: Total Times Errors Processed Log Parameter

Parameter Code

The Parameter Code is set to 0004h.

Parameter Length

This field is set to 04h to indicate that the counter is 4 bytes wide.

Counter

This is a dummy counter that always returns 0.

Total Bytes Written Log Parameter

BYTE	BIT 7	6	5	4	3	2	1	0
n+0 n+1	Parameter Code = 0005h							
n+2	DU	DS	TSD	ETC	TMC	LBIN	LP	
n+3	Parameter Length = 08h							
n+4 n+11	Total Bytes Written Counter							

Table 10: Total Bytes Written Parameter

Parameter Code

The Parameter Code is set to 0005h.

Parameter Length

This field is set to 08h to indicate that the counter is 8 bytes wide.

Total Bytes Written Counter

This counter counts the total number of bytes processed. This is the total number of Data Set written. The increment(s) are performed each time hub motors stop.

Total Uncorrected Write Errors Log Parameter

BYTE	BIT 7	6	5	4	3	2	1	0
n+0 n+1	Parameter Code = 0006h							
n+2	DU	DS	TSD	ETC	TMC	LBIN	LP	
n+3	Parameter Length = 04h							
n+4 n+7	Total Uncorrectable Write Errors Counter							

Table 11: Total Uncorrected Write Errors Log Parameter

Parameter Code

The Parameter Code is set to 0006h.

Parameter Length

This field is set to 04h to indicate that the counter is 4 bytes wide.

**Total Uncorrectable
Write Error Counter**

This counter counts hard (unrecovered) write errors.

3.4.5. Read Error Counter Page (03h)

BYTE	BIT 7	6	5	4	3	2	1	0
00	RESERVED		Page Code = 03h					
01	RESERVED							
02	Page Length = 0040h							
03								
04 15	Total Rereads Counter Log Parameter							
16 23	Total Read Error Log Parameter							
24 31	Total Read Error Corrected Log Parameter							
32 39	Total ECC Correction Counter Log Parameter							
40 51	Total Bytes Read Counter Log Parameter							
52 59	Total Uncorrected Read Errors Log Parameter							
60 67	Total ECC Error Counter Log Parameter							

Table 12: Read Error Counter Page

Page Code

The Page Code for this page is 03h.

Page Length

This field is set to 0040h indicating that the page parameters occupy 64 bytes.

Total Rereads Counter Log Parameter

BYTE	BIT 7	6	5	4	3	2	1	0
n+0 n+1	Parameter Code = 0001h							
n+2	DU	DS	TSD	ETC	TMC	LBIN	LP	
n+3	Parameter Length = 08h							
n+4 n+11	Total Rereads Counter							

Table 13: Reread Counter Log Parameter

Parameter Code

The Parameter Code is set to 0001h.

Parameter Length

This field is set to 08h to indicate that the counter is 8 bytes wide.

Total Rereads Counter

This counter counts re-reads during read operations (when the tape is stopped, repositioned back and started again to re-read data).

Total Read Errors Log Parameter

BYTE	BIT 7	6	5	4	3	2	1	0
n+0 n+1	Parameter Code = 0002h							
n+2	DU	DS	TSD	ETC	TMC	LBIN	LP	
n+3	Parameter Length = 04h							
n+4 n+7	Total Read Errors Counter							

Table 14: Total Read Error Parameter

Parameter Code

The Parameter Code is set to 0002h.

Parameter Length

This field is set to 04h to indicate that the counter is 4 bytes wide.

Total Read Errors Counter

This counter counts re-reads and unrecoverable errors during read operations. The increment(s) are performed each time hub motors stop.

Total Read Errors Corrected Log Parameter

BYTE	BIT 7	6	5	4	3	2	1	0
n+0 n+1	Parameter Code = 0003h							
n+2	DU	DS	TSD	ETC	TMC	LBIN	LP	
n+3	Parameter Length = 04h							
n+4 n+7	Total Read Errors Corrected Counter							

Table 15: Total Read Error Corrected Log Parameter

Parameter Code

The Parameter Code is set to 0003h.

Parameter Length

This field is set to 04h to indicate that the counter is 4 bytes wide.

Total Read Errors Corrected Counter

This counter counts re-reads during read operations. The increment(s) are performed each time hub motors stop. This counter counts the same events as the counter in parameter 0001h of this page, but it is smaller.

Total ECC Correction Counter Log Parameter

BYTE	BIT 7	6	5	4	3	2	1	0
n+0 n+1	Parameter Code = 0004h							
n+2	DU	DS	TSD	ETC	TMC		LBIN	LP
n+3	Parameter Length = 04h							
n+4 n+7	Total ECC Correction Counter							

Table 16: ECC Correction Counter Log Parameter

Parameter Code

The Parameter Code is set to 0004h.

Parameter Length

This field is set to 04h to indicate that the counter is 4 bytes wide.

Total ECC Correction Counter

This counter counts the number of blocks corrected by ECC during tape read operations.

This counter can be incremented during following SCSI commands: read, verify, space, locate or during “read ahead”.

Total Bytes Read Counter Log Parameter

BYTE	BIT 7	6	5	4	3	2	1	0
n+0 n+1	Parameter Code = 0005h							
n+2	DU	DS	TSD	ETC	TMC		LBIN	LP
n+3	Parameter Length = 08h							
n+4 n+11	Total Bytes Read Counter							

Table 17: Total Bytes Read Counter Log Parameter

Parameter Code

The Parameter Code is set to 0005h.

Parameter Length

This field is set to 08h to indicate that the counter is 8 bytes wide.

Total Bytes Read Counter

This counter counts the total number of bytes processed. This is the total amount of Data Sets read.

Total Uncorrected Read Errors Log Parameter

BYTE	BIT 7	6	5	4	3	2	1	0
n+0 n+1	Parameter Code = 0006h							
n+2	DU	DS	TSD	ETC	TMC	LBIN	LP	
n+3	Parameter Length = 04h							
n+4 n+7	Uncorrectable Read Errors Counter							

Table 18: Total Uncorrected Read Errors Log Parameter

Parameter Code

The Parameter Code is set to 0006h.

Parameter Length

This field is set to 04h to indicate that the counter is 4 bytes wide.

Uncorrectable Read Error Counter

This counter counts hard (unrecovered) read errors.

Total ECC Errors Counter Log Parameter

BYTE	BIT 7	6	5	4	3	2	1	0
n+0 n+1	Parameter Code = 8004							
n+2	DU	DS	TSD	ETC	TMC	LBIN	LP	
n+3	Parameter Length = 04h							
n+4 n+7	Total ECC Errors Counter							

Table 19: ECC Error Counter Log Parameter

Parameter Code

The Parameter Code is set to 8004h.

Parameter Length

This field is set to 04h to indicate that the counter is 4 bytes wide.

Total ECC Errors Counter

This counter counts the number of blocks where the CRC check failed during tape read operations. These are incorrect blocks reported to be correct by the CRC check but identified as incorrect by ECC. When this occurs tape motions stops and hard read error is reported.

3.4.6. Sequential Access Device Page (0Ch)

BYTE	BIT 7	6	5	4	3	2	1	0
00	RESERVED		Page Code = 0Ch					
01	RESERVED							
02	Page Length = 0034h							
03								
04 15	Cleaning Required Parameter							
16 23	Head Cleaning Time Log Parameter							
24 31	Cumulative Head Cleaning Count Log Parameter							
32 39	Cumulative Cartridge Load Counter Log Parameter							
40 47	Total Power On Time Log Parameter							
48 55	Total Drive Motion Time Log Parameter							

Table 20: Sequential Access Device Page

Page Code

The Page Code for this page is 0Ch.

Page Length

This field is set to 0034h indicating that the page parameters occupy 52 bytes.

Cleaning Required Log Parameter

BYTE	BIT 7	6	5	4	3	2	1	0
n+0 n+1	Parameter Code = 0100h							
n+2	DU	DS	TSD	ETC	TMC	LBIN	LP	
n+3	Parameter Length = 08h							
n+4 n+11	Cleaning Required Flag							

Table 21: Logical Block Counter Log Parameter

Parameter Code

The Parameter Code is set to 0100h.

Parameter Length

This field is set to 08h to indicate that the counter is 8 byte wide.

Cleaning Required Flag

A non-zero value of the cleaning required parameter indicates that a condition requiring cleaning has been detected and a subsequent cleaning cycle has not been completed. The cleaning required parameter is persistent across I_T nexus losses, logical unit resets, and power cycles.

Head Cleaning Time Log Parameter

BYTE	BIT 7	6	5	4	3	2	1	0
n+0 n+1	Parameter Code = 8000h							
n+2	DU	DS	TSD	ETC	TMC	LBIN	LP	
n+3	Parameter Length = 04h							
n+4 n+7	Head Cleaning Time Counter							

Table 22: Head Cleaning Time Log Parameter

Parameter Code

The Parameter Code is set to 8000h.

Parameter Length

This field is set to 04h to indicate that the counter is 4 byte wide.

Head Cleaning Time Counter

The Head Cleaning Time Counter indicates the number of minutes of motion since last head cleaning.

Cumulative Head Cleaning Count Log Parameter

BYTE	BIT 7	6	5	4	3	2	1	0
n+0 n+1	Parameter Code = 8001h							
n+2	DU	DS	TSD	ETC	TMC	LBIN	LP	
n+3	Parameter Length = 04h							
n+4 n+7	Cumulative Head Cleaning Counter							

Table 23: Cumulative Head Cleaning Count Log Parameter

Parameter Code

The Parameter Code is set to 8001h.

Parameter Length
Cumulative Head Cleaning Counter

This field is set to 04h to indicate that the counter is 4 byte wide.

The Cumulative Head Cleaning counter indicates the number of successfully performed head cleanings.

Cumulative Cartridge Load Counter Log Parameter

BYTE	BIT 7	6	5	4	3	2	1	0
n+0 n+1	Parameter Code = 8002h							
n+2	DU	DS	TSD	ETC	TMC	LBIN	LP	
n+3	Parameter Length = 04h							
n+4 n+7	Cumulative Cartridge Load Counter							

Table 24: Cumulative Cartridge Load Counter Log Parameter

Parameter Code
Parameter Length
Cumulative Cartridge Load Counter

The Parameter Code is set to 8002h.

This field is set to 04h to indicate that the counter is 4 byte wide.

The Cumulative Cartridge Load counter increments each time a new cartridge has been loaded.

Total Power On Time Log Parameter

BYTE	BIT 7	6	5	4	3	2	1	0
n+0 n+1	Parameter Code = 8003h							
n+2	DU	DS	TSD	ETC	TMC	LBIN	LP	
n+3	Parameter Length = 04h							
n+4 n+7	Total Power On Time Counter							

Table 25: Total Power On Time Log Parameter

Parameter Code
Parameter Length
Total Power On Time

The Parameter Code is set to 8003h.

This field is set to 04h to indicate that the counter is 4 byte wide.

The Total Power On Time counter indicates the total number of minutes the Drive has been powered on.

Total Drive Motion Time Log Parameter

BYTE	BIT 7	6	5	4	3	2	1	0
n+0 n+1	Parameter Code = 8004h							
n+2	DU	DS	TSD	ETC	TMC		LBIN	LP
n+3	Parameter Length = 04h							
n+4 n+7	Total Drive Motion Time Counter							

Table 26: Total Drive Motion Time Log Parameter

Parameter Code

The Parameter Code is set to 8004h.

Parameter Length

This field is set to 04h to indicate that the counter is 4 byte wide.

Total Drive Motion Time Counter

Total Drive Motion Time Counter indicates the total number of minutes of motion for the Drive.

3.4.7. TapeAlert Page (2Eh)

The TapeAlert Page (page code 2Eh), has 64 log parameters. Each 5 byte log parameter field holds a Boolean parameter value. If bit 0 of the Parameter Value byte is set to 1 the value is TRUE. The remaining 7 bits are reserved for future use and will always be set to 0.

Since the TapeAlert data is event based, the Page Control bits in the LOG SENSE CDB are not applicable, and will therefore be ignored by the drive.

BYTE	BIT 7	6	5	4	3	2	1	0
00	RESERVED		Page Code = 2Eh					
01	RESERVED							
02	Page Length = 0140h							
03								
04 323	TapeAlert Log Parameters (64 x 5 bytes)							

Table 21: TapeAlert Page

Page Code

The Page Code for this page is 2Eh.

Page Length

This field is set to 0140h indicating that a list of 64 TapeAlert flags each of length 5 bytes follows.

TapeAlert Information Log Parameters

BYTE	BIT 7	6	5	4	3	2	1	0
5n-1 5n	Parameter Code = <i>n</i>							
5n+1	DU	DS	TSD	ETC	TMC	LBIN	LP	
5n+2	Parameter Length = 01h							
5n+3	Value of TapeAlert Flag <i>n</i>							

Table 22: TapeAlert Information Log Parameters

Parameter Code

The Parameter Code for each TapeAlert flag field is set to *n* where *n* is the TapeAlert flag number. *n* is in the range (1..64). The different parameter fields are returned in ascending order of the parameter code.

Parameter Length

This field is set to 1 to indicate that the parameter field is one byte long.

Value of TapeAlert Flag

Bit 0 of this byte is set to 0 when the flag is FALSE. Bit 0 of this byte is set to 1 when the flag is TRUE. Bit 1..7 are all reserved and are set to 0. Unsupported TapeAlert flags are all set to FALSE.

The following TapeAlert flags are supported:

Flag Number	Flag	Severity	Cause
Flag 3:	Hard Error	W	This flag is set to 1 for any unrecoverable read/write/positioning error, and is internally cleared when the media is ejected. (This flag is set as an explanation of the error in conjunction with one of the recovery action flags 4,5 or 6.)
Flag 4:	Media	C	This flag is set to 1 when the Media Management algorithm detects a medium with severely degraded performance. The drive will monitor the media performance and maintain a media performance history log in the media header. The algorithm is executed each time the media header is updated (i.e. after a REWIND or LOAD/UNLOAD command). This flag is also set to 1 for any unrecoverable read/write/positioning error that is due to faulty media. The flag is internally cleared when the media is ejected.
Flag 5:	Read Failure	C	This flag is set to 1 for an unrecoverable read error where the diagnosis is uncertain and could either be faulty media or faulty drive hardware. The flag is internally cleared when the media is ejected.
Flag 6:	Write Failure	C	This flag is set to 1 for an unrecoverable write error where the diagnosis is uncertain and could either be faulty media or faulty drive hardware. The flag is internally cleared when the media is ejected.
Flag 20:	Clean Now	C	This flag is set to 1 when the tape drive detects that the head needs cleaning. The flag is internally cleared after a successful cleaning operation.
Flag 22:	Expired Cleaning	C	This flag is set to 1 when the drive detects that an inserted cleaning cartridge has been exhausted. The flag is internally cleared after a successful cleaning operation with a new cleaning cartridge.
Flag 31:	Hardware B	C	This flag is set to 1 when the drive fails in it's internal Power On Selftest (POST). The flag is only cleared when the drive power is turned off.
Flag 39:	Diagnostics Required	W	This flag is set to 1 when the Media Management algorithm detects a drive with a dead channel. The drive will monitor the channel performance and maintain a drive performance history log in the media header. The algorithm is executed each time the media header is updated (i.e. after a REWIND or LOAD/UNLOAD command). Run extended diagnostics (e.g. Stand Alone Diagnostics (SAD) test or Send Diagnostics) to verify that the drive has a fault. The flag is internally cleared when the media is ejected.

Table 23: Supported TapeAlert Flags

Each flag will be cleared to zero in the following circumstances:

- At drive power on
- When the TapeAlert Log page is read.
- When specified corrective action has been taken (such as using a cleaning cartridge)
- On SCSI bus reset or Bus Device Reset Message
- On Log Select reset

NOTE: When a flag is cleared by reading the TapeAlert Log page, the flag will not be set again until the error condition is removed (e.g. the specified corrective action has been taken). All other methods of clearing allow the flag to be set again.

3.4.8. Tape Usage Page (30h)

BYTE	BIT 7	6	5	4	3	2	1	0
00	RESERVED		Page Code = 30h					
01	RESERVED							
02	Page Length = 005Ah							
03								
04 11	Thread Count							
12 23	Total Data Sets Written							
24 31	Total Write Retries							
32 37	Total Unrecovered Write Errors							
38 43	Total Suspended Writes							
44 49	Total Fatal Suspended Writes							
50 61	Total Data Sets Read							
62 69	Total Read Retries							
70 75	Total Unrecovered Read Errors							
76 81	Total Suspended Reads							
82 87	Total Fatal Suspended Reads							
88 93	Total Suspended Append Writes							

Table 27: Tape Usage Page

Page Code

The Page Code for this page is 30h.

Page Length

This field is set to 005Ah indicating that the page parameters occupy 90 bytes.

Thread Count Log Parameter

BYTE	BIT 7	6	5	4	3	2	1	0
n+0 n+1	Parameter Code = 0001h							
n+2	DU	DS	TSD	ETC	TMC	LBIN	LP	
n+3	Parameter Length = 04h							
n+4 n+7	Thread Counter							

Table 28: Thread Count Log Parameter

Parameter Code

The Parameter Code is set to 0001h.

Parameter Length

This field is set to 04h to indicate that the counter is 4 byte wide.

Thread Counter

This counter counts thread counts.

Total Data Sets Written Log Parameter

BYTE	BIT 7	6	5	4	3	2	1	0
n+0 n+1	Parameter Code = 0002h							
n+2	DU	DS	TSD	ETC	TMC	LBIN	LP	
n+3	Parameter Length = 08h							
n+4 n+11	Total Data Sets Written Counter							

Table 29: Total Data Sets Written Log Parameter

Parameter Code

The Parameter Code is set to 0002h.

Parameter Length

This field is set to 08h to indicate that the counter is 8 byte wide.

Total Data Sets Written Counter

This counter counts the total number of data sets written.

Total Write Retries Log Parameter

BYTE	BIT 7	6	5	4	3	2	1	0
n+0 n+1	Parameter Code = 0003h							
n+2	DU	DS	TSD	ETC	TMC	LBIN	LP	
n+3	Parameter Length = 04h							
n+4 n+7	Total Write Retries Counter							

Table 30: Total Write Retries Log Parameter

Parameter Code

The Parameter Code is set to 0003h.

Parameter Length

This field is set to 04h to indicate that the counter is 4 byte wide.

Total Write Retries Counter

This counter counts the total number of writes retries (rewrites).

Total Unrecovered Write Errors Log Parameter

BYTE	BIT 7	6	5	4	3	2	1	0
n+0 n+1	Parameter Code = 0004h							
n+2	DU	DS	TSD	ETC	TMC	LBIN	LP	
n+3	Parameter Length = 02h							
n+4 n+5	Total Unrecovered Write Errors Counter							

Table 31: Total Unrecovered Write Errors Log Parameter

Parameter Code

The Parameter Code is set to 0004h.

Parameter Length

This field is set to 02h to indicate that the counter is 2 byte wide.

Total Unrecovered Write Errors Counter

This counter counts the total number of unrecovered writes errors (hard write write errors).

Total Suspended Writes Log Parameter

BYTE	BIT 7	6	5	4	3	2	1	0
n+0 n+1	Parameter Code = 0005h							
n+2	DU	DS	TSD	ETC	TMC	LBIN	LP	
n+3	Parameter Length = 02h							
n+4 n+5	Total Suspended Writes Counter							

Table 32: Total Suspended Writes Log Parameter

Parameter Code

The Parameter Code is set to 0005h.

Parameter Length

This field is set to 02h to indicate that the counter is 2 byte wide.

Total Suspended Writes Counter

This counter counts the total number of suspended writes.

Total Fatal Suspended Writes Log Parameter

BYTE	BIT 7	6	5	4	3	2	1	0
n+0 n+1	Parameter Code = 0006h							
n+2	DU	DS	TSD	ETC	TMC	LBIN	LP	
n+3	Parameter Length = 02h							
n+4 n+5	Total Fatal Suspended Writes Counter							

Table 33: Total Fatal Suspended Writes Log Parameter

Parameter Code

The Parameter Code is set to 0006h.

Parameter Length
Total Fatal Suspended Writes Counter

This field is set to 02h to indicate that the counter is 2 byte wide.
 This counter counts the total number of fatal suspended writes.

Total Data Sets Read Log Parameter

BYTE	BIT 7	6	5	4	3	2	1	0
n+0 n+1	Parameter Code = 0007h							
n+2	DU	DS	TSD	ETC	TMC	LBIN	LP	
n+3	Parameter Length = 08h							
n+4 n+11	Total Data Sets Read Counter							

Table 34: Total Data Sets Read Log Parameter

Parameter Code
Parameter Length
Total Data Sets Read Counter

The Parameter Code is set to 0007h.
 This field is set to 08h to indicate that the counter is 8 byte wide.
 This counter counts the total number of data sets read.

Total Read Retries Log Parameter

BYTE	BIT 7	6	5	4	3	2	1	0
n+0 n+1	Parameter Code = 0008h							
n+2	DU	DS	TSD	ETC	TMC	LBIN	LP	
n+3	Parameter Length = 04h							
n+4 n+7	Total Read Retries Counter							

Table 35: Total Read Retries Log Parameter

Parameter Code
Parameter Length
Total Read Retries Counter

The Parameter Code is set to 0008h.
 This field is set to 04h to indicate that the counter is 4 byte wide.
 This counter counts the total number of read retries (rereads).

Total Unrecovered Read Errors Log Parameter

BYTE	BIT 7	6	5	4	3	2	1	0
n+0 n+1	Parameter Code = 0009h							
n+2	DU	DS	TSD	ETC	TMC	LBIN	LP	
n+3	Parameter Length = 02h							
n+4 n+5	Total Unrecovered Read Errors Counter							

Table 36: Total Unrecovered Write Errors Log Parameter

Parameter Code

The Parameter Code is set to 0009h.

Parameter Length

This field is set to 02h to indicate that the counter is 2 byte wide.

Total Unrecovered Read Errors Counter

This counter counts the total number of unrecovered read errors (hard read write errors).

Total Suspended Reads Log Parameter

BYTE	BIT 7	6	5	4	3	2	1	0
n+0 n+1	Parameter Code = 000Ah							
n+2	DU	DS	TSD	ETC	TMC	LBIN	LP	
n+3	Parameter Length = 02h							
n+4 n+5	Total Suspended Read Counter							

Table 37: Total Suspended Reads Log Parameter

Parameter Code

The Parameter Code is set to 000Ah.

Parameter Length

This field is set to 02h to indicate that the counter is 2 byte wide.

Total Suspended Reads Counter

This counter counts the total number of suspended reads.

Total Fatal Suspended Read Log Parameter

BYTE	BIT 7	6	5	4	3	2	1	0
n+0 n+1	Parameter Code = 000Bh							
n+2	DU	DS	TSD	ETC	TMC	LBIN	LP	
n+3	Parameter Length = 02h							
n+4 n+5	Total Fatal Suspended Reads Counter							

Table 38: Total Fatal Suspended Writes Log Parameter

Parameter Code

The Parameter Code is set to 000Bh.

Parameter Length

This field is set to 02h to indicate that the counter is 2 byte wide.

Total Fatal Suspended Reads Counter

This counter counts the total number of fatal suspended reads.

Total Suspended Append Writes Log Parameter

BYTE	BIT 7	6	5	4	3	2	1	0
n+0 n+1	Parameter Code = 000Ch							
n+2	DU	DS	TSD	ETC	TMC		LBIN	LP
n+3	Parameter Length = 02h							
n+4 n+5	Total Suspended Append Writes Counter							

Table 39: Total Suspended AppendWrites Log Parameter

Parameter Code

The Parameter Code is set to 0003h.

Parameter Length

This field is set to 02h to indicate that the counter is 2 byte wide.

Total Suspended Append Writes Counter

This counter counts the total number of suspended append writes.

3.4.9. Tape Capacity Page (31h)

BYTE	BIT 7	6	5	4	3	2	1	0
00	RESERVED		Page Code = 31h					
01	RESERVED							
02	Page Length = 0020h							
03								
04 11	Remaining Capacity Parameter - Main Partition							
12 19	Remaining Capacity Parameter - Current Partition							
20 27	Maximum Capacity Parameter – Main Partition							
28 35	Maximum Capacity Parameters - Current Partition							

Table 40: Tape Capacity Page

Page Code

The Page Code for this page is 31h.

Page Length

This field is set to 0020h indicating that the page parameters occupy 32 bytes.

Remaining Capacity Log Parameter – Main Partition

BYTE	BIT 7	6	5	4	3	2	1	0
n+0 n+1	Parameter Code = 0001h							
n+2	DU	DS	TSD	ETC	TMC		LBIN	LP
n+3	Parameter Length = 04h							
n+4 n+7	Remaining Capacity Counter – Main Partition							

Table 41: Remaining Capacity Log Parameter– Main Partition

Parameter Code

The Parameter Code is set to 0001h.

Parameter Length

This field is set to 04h to indicate that the counter is 4 bytes wide.

Remaining Capacity Counter – Main Partition

When the Drive operates in write mode this counter counts/presents remaining native capacity of partition 0 (the main and only partition), scaled in megabytes. When the drive operates in read mode this counter reflects the potential amount of data stored from the current tape position to the end of the partition and not the actual remaining storage capacity of the partition.

Note that the capacity indicated is the capacity up to the *logical early warning* marker.

This counter is not designed for use as an absolute count of remaining capacity at any arbitrary moment, but as a means to calculate approximate fraction of tape usage during backup or restore operations.

Note: The Remaining Capacity counter presents an approximate amount of native physical data which can be written to the current tape partition. This count can be related to logical user data only if the tape drive is used in an optimal way. A high number of underruns during write (due to a tape of poor quality, not favorable system settings, low host transfer rate and/or writing of a small amount of data per session) or excessive use of forced streaming might reduce the actual remaining capacity significantly. In addition, the counter does not reflect any impact of a possible use of data compression. The Remaining Capacity counter is controlled by processes on the tape side of the data buffer and is thus not fully synchronized with the data stream on the SCSI-bus.

Remaining Capacity Log Parameter - Current Partition

BYTE	BIT 7	6	5	4	3	2	1	0
n+0 n+1	Parameter Code = 0002h							
n+2	DU	DS	TSD	ETC	TMC		LBIN	LP
n+3	Parameter Length = 04h							
n+4 n+7	Remaining Capacity Counter - Current Partition							

Table 42: Remaining Capacity Log Parameter - Current Partition

Parameter Code

The Parameter Code is set to 0002h.

Parameter Length

This field is set to 04h to indicate that the counter is 4 bytes wide.

Remaining Capacity Counter - Current Partition

When the drive operates in write mode this counter counts/presents the remaining physical native capacity of the current (active) partition, scaled in megabytes. When the drive operates in read mode this counter will reflect the potential amount of data stored from the current tape position to the end of the partition and not the actual remaining storage capacity of the partition.

Note that the capacity indicated is the capacity up to the *logical early warning* marker.

This counter is not designed for use as an absolute count of remaining capacity at any arbitrary moment, but as a means to calculate the approximate fraction of tape usage during backup or restore operations.

See also the note for the Remaining Capacity Counter – Main Partition parameter.

Maximum Capacity Log Parameter – Main Partition

BYTE	BIT 7	6	5	4	3	2	1	0
n+0 n+1	Parameter Code = 0003h							
n+2	DU	DS	TSD	ETC	TMC	LBIN	LP	
n+3	Parameter Length = 04h							
n+4 n+7	Maximum Capacity Counter – Main Partition							

Table 43: Maximum Capacity Log Parameter – Main Partition

Parameter Code

The Parameter Code is set to 0003h.

Parameter Length

This field is set to 04h to indicate that the counter is 4 bytes wide.

Maximum Capacity Counter - Partition 0

This counter presents an estimation of the maximum capacity of partition 0 (the main and only partition) scaled to megabytes.

Maximum Capacity Log Parameter - Current Partition

BYTE	BIT 7	6	5	4	3	2	1	0
n+0 n+1	Parameter Code = 0004h							
n+2	DU	DS	TSD	ETC	TMC	LBIN	LP	
n+3	Parameter Length = 04h							
n+4 n+7	Maximum Capacity Counter - Current Partition							

Table 44: Maximum Capacity Log Parameter - Current Partition

Parameter Code

The Parameter Code is set to 0004h.

Parameter Length

This field is set to 04h to indicate that the counter is 4 bytes wide.

Maximum Capacity Counter - Current Partition

This counter presents an estimate of the maximum capacity of the current partition scaled to megabytes.

3.4.10. Error History Log Page (33h)

The Error History Log page holds 16 log parameters that reflect the contents of a FIFO that holds the 16 last drive (error) conditions caused by one of 10 specific Sense Keys or 4 additional events. Each element in the FIFO stores a time stamp, a media signature, the Sense Key and certain other error information.

All information in the FIFO is stored in a non-volatile storage. This means that the FIFO is able to store the 16 last entries of the error log through both resets and power-cycles. The time stamp functions in an odometer style (always incrementing over the entire life of the drive).

Error conditions that can be be logged include all errors with the following Sense Keys:

1h	:	Recovered Error
2h	:	Not Ready
3h	:	Medium Error
4h	:	Hardware Error
5h	:	Illegal Request
6h	:	Unit Attention
7h	:	Data Protect
8h	:	Blank Check
Bh	:	Aborted Command
Dh	:	Volume Overflow

In addition the following events can also be logged

- Microcode Download
- Fatal Trap
- Degraded Media
- Degraded Drive

The conditions/events actually logged is configurable (each of the conditions/events described above can be either logged or not logged).

The Error History Log page will always return 16 log parameters even if less than 16 (error) conditions have been logged. Elements of the FIFO that have not yet been filled with log information will return a time stamp of zero (00000000h), a media signature of zero (00000000h) and all zero error information (Sense Key = 0, Additional Sense Code = 0, Additional Sense Code Qualifier = 0 and Additional Error Information = 0).

Each time a new (error) condition is logged and a new element is moved into the one end of the FIFO, the oldest element at the other end is removed and discarded.

Executing a LOG SENSE command with a request for the Error History page will not affect the contents of the FIFO. This means that if no new conditions are logged, two consecutive LOG SENSE commands requesting the Error History Log page will both return the same data. When requesting

Error History Log data the host will therefore need to figure out which data is actually new data (data logged and moved into the FIFO since last time Error History Log data was requested).

Consecutive entries that contain duplicate data (with the exception of the time stamp) will not be logged within 5 minutes of the last entry. This does not apply to logging of Fatal Traps.

3.4.11. Page Layout

BYTE	BIT 7	6	5	4	3	2	1	0
00	RESERVED		Page Code = 33h					
01	RESERVED							
02	Page Length = 0100h							
03								
04	FIFO Element 0							
19								
↓								
n*16+4	FIFO Elements n (n = 1..14)							
n*16+19								
↓								
244	FIFO Element 15							
259								

Table 2: Error History Log Page

- Page Code** The Page Code for this page is 33h.
- Page Length** This field is set to 000100h indicating that the page parameters occupy 256 bytes (there are 16 Log Parameters each with a length of 16 bytes) .
- FIFO Element 0..15** These are 16 log parameters, one for each element in the FIFO. They are detailed below.

3.4.12. FIFO Element 0..15

Each of the 16 FIFO Log Parameter elements has the same format. FIFO Element 0 has a Parameter Code of 0000h and contains the oldest information. FIFO Element 15 has a Parameter Code of 000Fh and contains the newest information.

The FIFO Log Parameter elements can hold 5 different types of logged information:

- Drive/Media Error Information (Sense Key 1h..Eh)
- Microcode Changes
- Fatal Trap Information
- Degraded Media
- Degraded Drive

The layout of the FIFO Log Parameter elements are somewhat different for the three information types.

Drive/Media Error Information

When the drive reports Check Condition with a Sense Keys of 1h to Eh a Drive/Media Error Information event may be generated. The layout of these FIFO Log Parameter elements are shown below

BYTE	BIT 7	6	5	4	3	2	1	0
n+0 n+1	Parameter Code							
n+2	DU	DS	TSD	ETC	TMC		LBIN	LP
n+3	Parameter Length = 0Ch							
n+4 n+7	Time Stamp							
n+8 n+11	Media Signature							
n+12	Sense Key							
n+13	Additional Sense Code							
n+14	Additional Sense Code Qualifier							
n+15	Additional Error Information							

Table 3: FIFO Elements 0..15, Drive/Media Errors

Parameter Code The Parameter Code is a number in the range 0000h .. 000Fh.

Parameter Length This field is set to 0Ch to indicate that 12 bytes of log data follows.

Time Stamp The Time Stamp parameter is a long word field that is used to mark the relative time that the log entry occurred. The Time Stamp indicates the total number of minutes any tape media has been moving against the head over the life of the drive.

Media Signature

The Media Signature field holds parts of the media serial number. The 4 least significant characters of the Serial Number is used only. If there is no serial number available, the 4 least significant bytes of the Media Signature will be set to zero

Byte	Usage
n+8	Media Serial Number (byte 6)
n+9	Media Serial Number (byte 7)
n+10	Media Serial Number (byte 8)
n+11	Media Serial Number (byte 9)

Table 4: The format of the Media Signature field

Sense Key

The corresponding Sense Key of the error/event logged.

Additional Sense Code

The corresponding Additional Sense Code of the error/event logged (more info can be found on General Exception handling or the REQUEST SENSE command).

Additional Sense Code Qualifier

The corresponding Additional Sense Code Qualifier of the error/event logged (more info can be found on General Exception handling or the REQUEST SENSE command).

Additional Error Information

An internal error code.

Microcode Download

When a new microcode has been downloaded to the drive, Microcode Download event may be logged. The layout of the FIFO Log Parameter elements are shown below

BYTE	BIT 7	6	5	4	3	2	1	0
n+0 n+1	Parameter Code							
n+2	DU	DS	TSD	ETC	TMC		LBIN	LP
n+3	Parameter Length = 0Ch							
n+4 n+7	Time Stamp							
n+8 n+11	Media Signature							
n+12	Event Type							
n+13	Microcode Revision MSB							
n+14	Microcode Revision LSB							
n+15	Event SubType							

Table 5: FIFO Elements 0..15, Microcode Download

For a description of the following fields, see the section on Drive/Media Error Information:

- Parameter Code
- Parameter Length
- Time Stamp
- Media Signature

Event Type

Will be set to **9h** to indicate an event that is not a Drive/Media error event.

Microcode Revision MSB

Used to log a binary representation of the two most significant digits of the “Main Microcode Revision Level” (byte 32 and 33 of the Standard Inquiry Data list). The two digits are converted as if they represents two hex digits (i.e. “12” will be represented as 0x12).

Microcode Revision LSB

Used to log a binary representation of the two least significant digits of the “Main Microcode Revision Level” (byte 34 and 35 of the Standard Inquiry Data list). The two digits are converted as if they represents two hex digits (i.e. “34” will be represented as 0x34).

Event SubType

Set to **00h** to indicate a Microcode Download event.

Fatal Trap Information

When a Fatal Trap has occurred a Fatal Trap Information event may be logged. The layout of the FIFO Log Parameter elements are shown below

BYTE	BIT 7	6	5	4	3	2	1	0
n+0 n+1	Parameter Code							
n+2	DU	DS	TSD	ETC	TMC		LBIN	LP
n+3	Parameter Length = 0Ch							
n+4 n+7	Time Stamp							
n+8 n+11	Program Counter							
n+12	Event Type							
n+13	Fatal Trap Code							
n+14	RESERVED							
n+15	Event SubType							

Table 5: FIFO Elements 0..15, Fatal Trap Information

For a description of the following fields, see the section on Drive/Media Error Information:

- Parameter Code
- Parameter Length
- Time Stamp

Program Counter The Value of the microcontroller Program Counter (PC) where the Fatal Trap occurred.

Event Type Will be set to **9h** to indicate an event that is not a Drive/Media error event.

Fatal Trap Code Indicates what kind of Fatal Trap that has occurred.

Event SubType Set to **01h** to indicate a Fatal Trap event.

Degraded Media

When the Media Management algorithm detects a media with severely degraded performance the Degraded Media event may be logged. The layout of the FIFO Log Parameter elements are shown below

BYTE	BIT 7	6	5	4	3	2	1	0
n+0 n+1	Parameter Code							
n+2	DU	DS	TSD	ETC	TMC	LBIN	LP	
n+3	Parameter Length = 0Ch							
n+4 n+7	Time Stamp							
n+8 n+11	Media Signature							
n+12	Event Type							
n+13	Media Motion Time							
n+14	Reserved					LED	REQ	REP
n+15	Event SubType							

Table 5: FIFO Elements 0..15, Degraded Media

For a description of the following fields, see the section on Drive/Media Error Information:

- Parameter Code
- Parameter Length
- Time Stamp
- Media Signature

Event Type Will be set to **9h** to indicate an event that is not an ordinary “Sense Key” Drive/Media error event.

Media Motion Time This counter indicates how many hours this medium has been in physical motion. The unit is 10 hours. If the counter is set to **FFh** the medium is used for 2550 hours or more.

REP This bit is set to 1 when Degraded Media is reported to the host.

REQ This bit is set to 1 when the Media Management algorithm requests Degraded Media. This bit is always set if the REP bit is set.

LED This field is set to 1 if the Drives cleaning LED was on when this Media Management cycle causing Degraded Media was generated.

Event SubType Set to **02h** to indicate a Degraded Media event.

Degraded Drive

When the Media Management algorithm detects a drive with severely degraded performance due to a dead channel the Degraded Drive event may be logged. The layout of the FIFO Log Parameter elements are shown below

BYTE	BIT 7	6	5	4	3	2	1	0
n+0 n+1	Parameter Code							
n+2	DU	DS	TSD	ETC	TMC	LBIN	LP	
n+3	Parameter Length = 0Ch							
n+4 n+7	Time Stamp							
n+8 n+11	Media Signature							
n+12	Event Type							
n+13	Dead Channel Number							
n+14	Reserved				DIR	LED	REQ	REP
n+15	Event SubType							

Table 5: FIFO Elements 0..15, Degraded Drive

For a description of the following fields, see the section on Drive/Media Error Information:

- Parameter Code
- Parameter Length
- Time Stamp
- Media Signature

Event Type	Will be set to 9h to indicate an event that is not an ordinary “Sense Key” Drive/Media error event.
Dead Channel Number	This number indicates which channel is dead. The DPC channel number is used.
DIR	This bit is set to 0 if the dead channel is in forward direction and 1 in reverse direction.
REP	This bit is set to 1 when Degraded Drive is reported to the host.
REQ	This bit is set to 1 when the Media Management algorithm requests Degraded Drive. This bit is always set if the REP bit is set.
LED	This field is set to 1 if the Drives cleaning LED was on when this Media Management cycle causing Degraded Drive was generated.
Event SubType	Set to 03h to indicate a Degraded Drive event.