Exos E 4U106 JBOD

GEM 5 SES-3 Addenda

205135400-00-A
March 2023

Revision History

Revision	Date	Change Description
00-A	2023-03-30	Initial release

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1 Introduction

1.1 Scope

This document is provided as an extension to the GEM 5 SES-3 Specification to detail exact SES page layouts and specification deviations implemented by the Exos E 4U106 12G SAS JBOD product. It is a guide to inform both customers and product testers of the intended SES page structure a product variant provides.

This document is not intended to cover all specifics of SES implementation for the Seagate storage enclosure platform. For details on element/descriptor formats and behavior, the GEM 5 SES-3 Specification [3] and ANSI T-10 SES Specification [1] should be referenced.

This document applies to the following enclosure product IDs.

- SP-34106-CFFE12P

1.2 Terms and Abbreviations

ANSI	American National Standards Institute
CDB	Command Descriptor Block
CLI	Command Line Interface
EEPROM	Electrically Erasable Programmable Read-Only Memory
EIIOE	Element Index Includes Overall Element
EIP	Element Index Present
EM	Enclosure Management
ESI	Enclosure Services Interface Processor
ESP	Enclosure Services Process
FRU	Field Replaceable Unit
GEM	Generic Enclosure Management
IOM	I/O Module
LED	Light-Emitting Diode
LSB	Least Significant Bit
MSB	Most Significant Bit
NAA	Network Address Authority
PCM	Power Cooling Module
PSU	Power Supply Unit
RQST	Request
RSVD	Reserved
SAS	Serial Attached SCSI
SBB	Storage Bridge Bay
SBBMI	SBB Midplane Interconnect
SCSI	Small Computer System Interface
SEP	Storage Enclosure Processor
SES	SCSI Enclosure Services
SGPIO	Serial General Purpose I/O
TWI	Two Wire Interface
VPD	Vital Product Data

Application client	An object that is the source of SCSI commands.
Attached ESP	An ESP that is attached to another device server.
Critical condition	An enclosure condition established when one or more elements inside the enclosure have failed or are operating outside of their specification. The failure of the element makes continued normal operation of at least some

	elements in the enclosure impossible. Some elements within the enclosure may be able to continue normal operation.
Information condition	An enclosure condition that should be made known to the application client. The condition is not an error and does not reduce the capabilities of the devices in the enclosure.
Non-critical condition	An enclosure condition established when one or more elements inside the enclosure have failed or are operating outside of their specifications. The failure of the elements does not affect continued normal operation of the enclosure. All SCSI devices in the enclosure continue to operate according to their specifications. The ability of the devices to operate correctly if additional failures occur may be reduced by a noncritical condition.
Standalone ESP	An ESP that is also the device server.
Subenclosure	An enclosure accessed through a primary subenclosure's ESP.
Unrecoverable condition	An enclosure condition established when one or more elements inside the enclosure have failed and have disabled some functions of the enclosure. The enclosure may be incapable of recovering or bypassing the failure and requires repairs to correct the condition.

1.3 Notation Conventions

<value>h	Indicates a hexadecimal number, e.g., *23h*
<value>	A value without leading zeroes and no suffix indicates a decimal number, e.g., *34.*
[option0, option1]	Indicates possible options for this field.
[valueX..valueY]	Indicates options range from valueX to valueY.
[defaultX: valueX..valueY]	Indicates the default value "defaultX", with possible alternatives.
[XX]	Indicates variable values.

1.4 References

[1] T10 SES-3r10
[2] SCSI Primary Commands – 4 (SPC-4) Revision 36n
[3] GEM 5 ANSI SES-3 Specification
[4] GEM Command Line Interface Specification

2 Supported ANSI SES-3 Pages and Elements

Table 1 lists the ANSI SES pages and Vendor Unique SES pages supported by the enclosure. Table 2 lists the ANSI and Vendor Specific SES elements supported by the enclosure.

Table 1 – Supported SES Pages

Page Code	Description	Control/Status
ANSI SES Pages		
00h	Supported Diagnostics Pages Diagnostic Page	Status
01h	Configuration Diagnostic Page	Status
02h	Enclosure Diagnostic Page	Control and Status
05h	Threshold Out Diagnostic Page	Control and Status
07h	Element Descriptor Diagnostic Page	Status
0Ah	Additional Element Status Diagnostic Page	Status
0Eh	Download Microcode Control Diagnostic Page	Control and Status
Vendor Specific Pages		
84h/85h	In-band CLI Control Page	Control and Status
90h	Customer VPD Control Page	Control and Status
91h	Statistics Page	Status
92h	Extended Status Page	Status

Table 2 – Supported SES Elements

Element Code	Description	Element count
ANSI SES Elements		
17h	Array Device	106
02h	Power Supply	4
03h	Cooling Element	10
04h	Temperature Sensor	37
05h	Door Lock Sensor	2
06h	Audible Alarm	1
07h	Enclosure Services Controller Electronics	2
0Eh	Enclosure	1
12h	Voltage Sensor	8
13h	Current Sensor	8
18h	SAS Expander	12
19h	SAS Connector	18
Vendor Specific SES Elements		
86h	SBB Midplane Interconnect	2
89h	Enclosure Electronics Power	2
8Ah	Enclosure Settings	1
8Bh	Enclosure Electronics Diagnostics	2

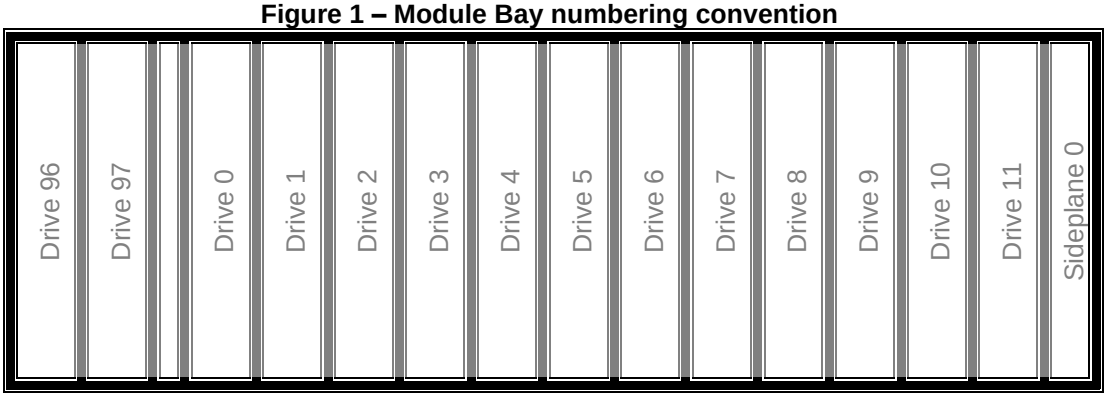
3 Element to Device Mapping

3.1 Enclosure FRU Layout

The layout of the enclosure with respect to physical FRU location is as follows.

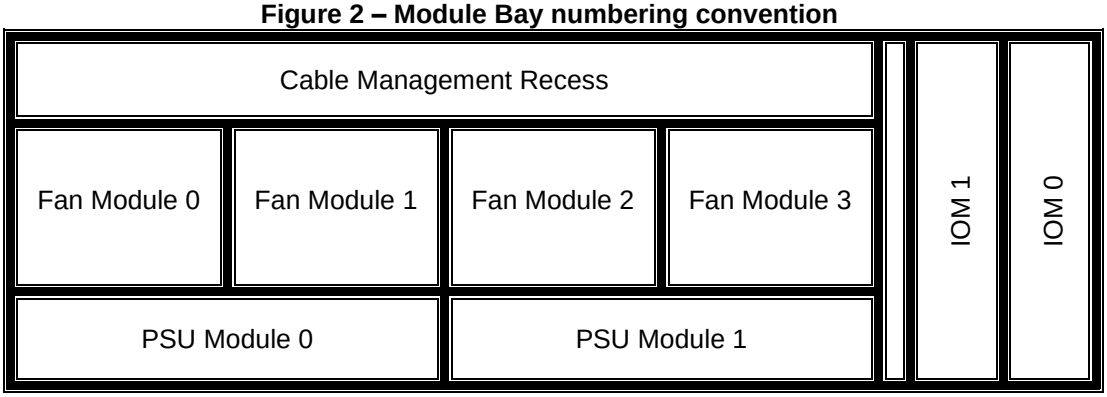
3.1.1 Enclosure Front View

Figure 1 – Module Bay numbering convention



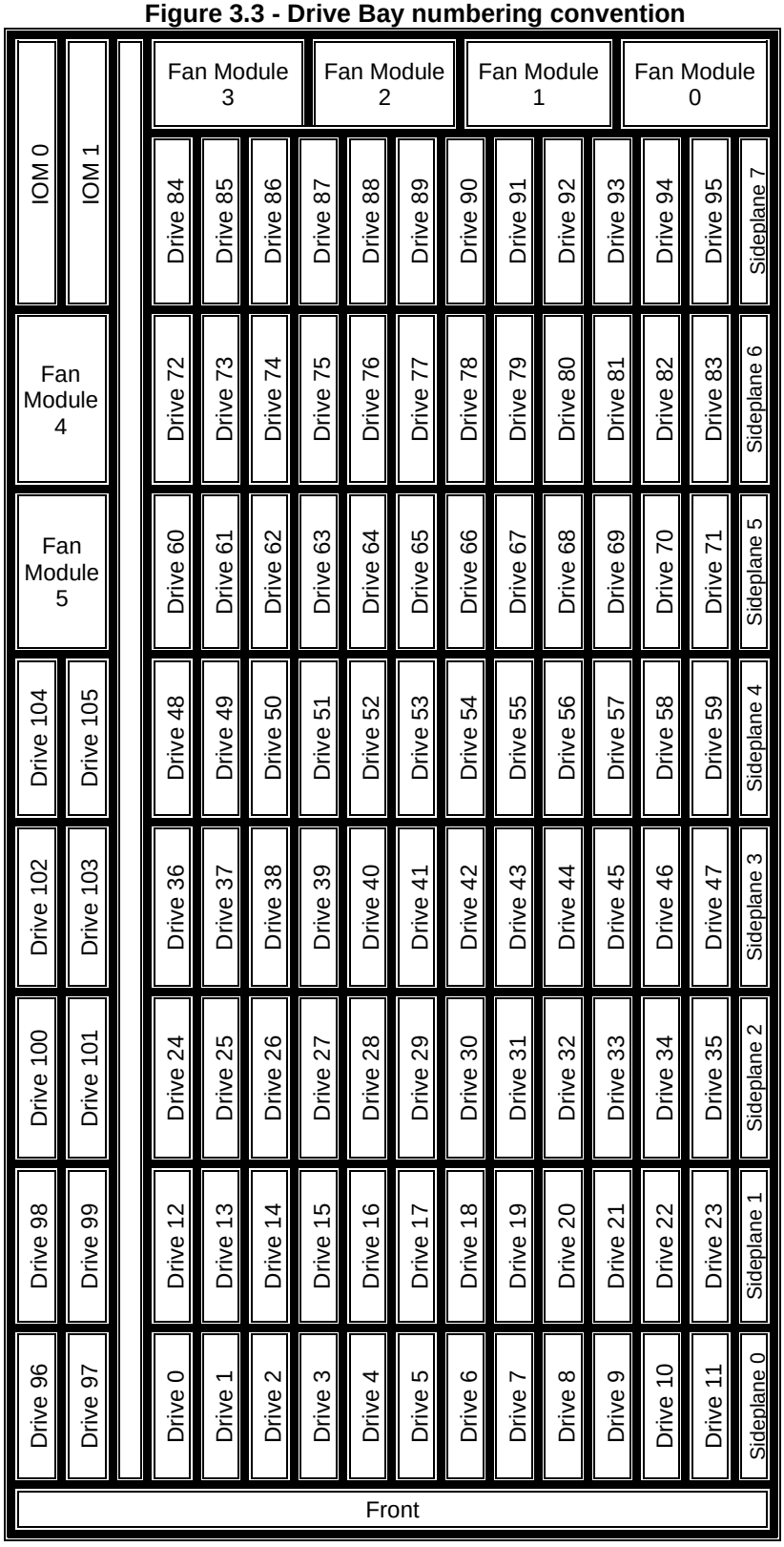
3.1.2 Enclosure Rear View

Figure 2 – Module Bay numbering convention



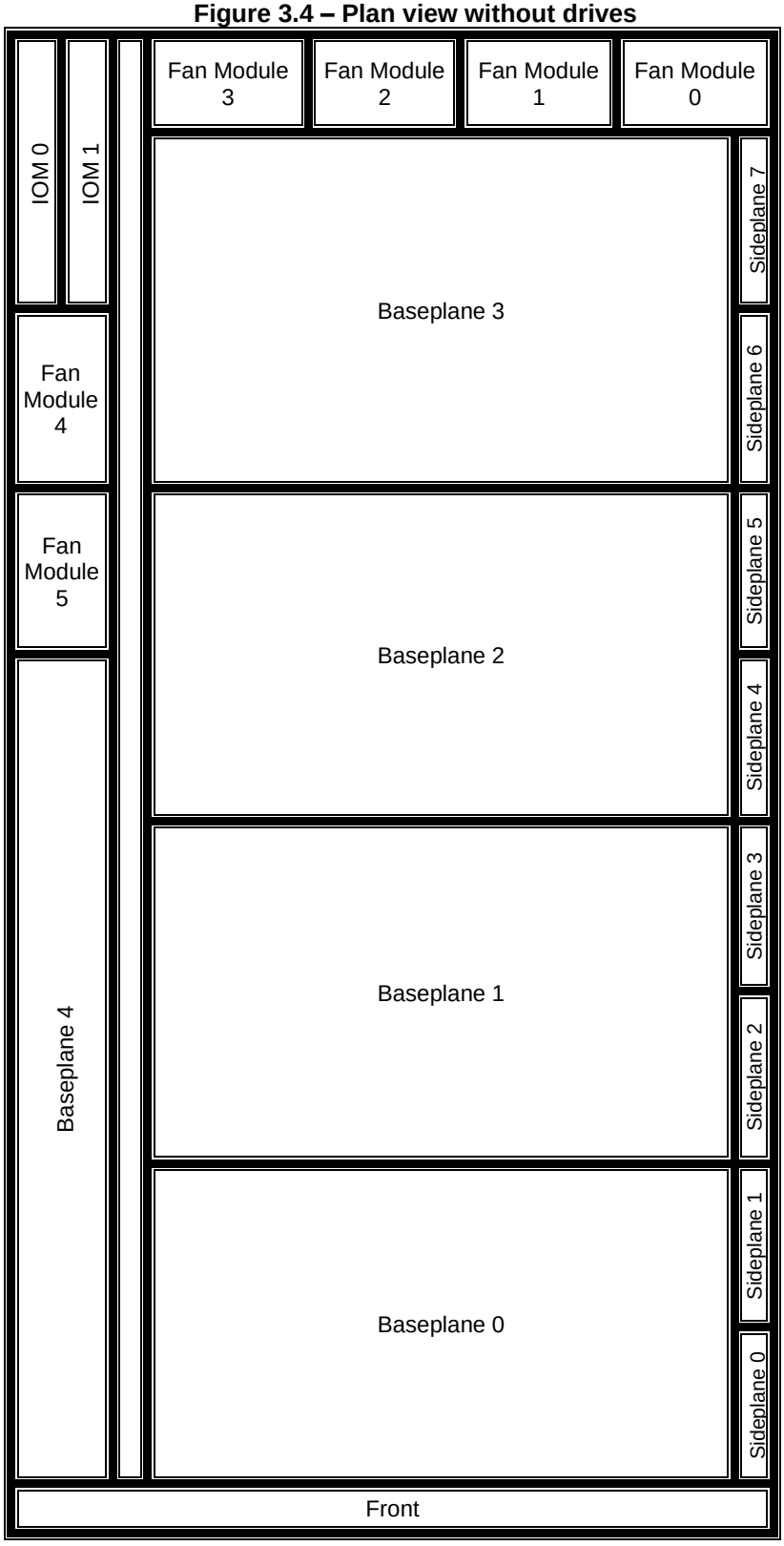
3.1.3 Enclosure Plan View (with drives)

Figure 3.3 - Drive Bay numbering convention



3.1.4 Enclosure Plan View (without drives)

Figure 3.4 – Plan view without drives



3.2 SES Element Mapping

For SES Pages 02h, 05h, 07h and 92h the element to physical device mapping is shown in Table 3.

Table 3 - SES Element Descriptions

Global Element Index	Relative Element Index	Description	Associated FRU
Array Device Elements			
0	0	Array Device element representing Disk Drive Bay 0	Enclosure
		…	
105	105	Array Device element representing Disk Drive Bay 105	Enclosure
Power Supply Elements			
106	0	Power Supply element representing PSU core 0	PSU Module 0
107	1	Power Supply element representing PSU core 1	PSU Module 0
108	2	Power Supply element representing PSU core 2	PSU Module 1
109	3	Power Supply element representing PSU core 3	PSU Module 1
Cooling Elements			
110	0	Cooling element representing Fan 0	Fan Module 0
111	1	Cooling element representing Fan 1	Fan Module 0
112	2	Cooling element representing Fan 2	Fan Module 1
113	3	Cooling element representing Fan 3	Fan Module 1
114	4	Cooling element representing Fan 4	Fan Module 2
115	5	Cooling element representing Fan 5	Fan Module 2
116	6	Cooling element representing Fan 6	Fan Module 3
117	7	Cooling element representing Fan 7	Fan Module 3
118	8	Cooling element representing Fan 8	Fan Module 4
119	9	Cooling element representing Fan 9	Fan Module 5
Temperature Sensor Elements			
120	0	Midplane 0 Temperature Sensor	Enclosure
121	1	Midplane 1 Temperature Sensor	Enclosure
122	2	Baseplane 4 Temperature Sensor	Enclosure
123	3	Baseplane 0 Temperature Sensor	Enclosure
124	4	Baseplane 0 Temperature Sensor	Enclosure
125	5	Baseplane 1 Temperature Sensor	Enclosure
126	6	Baseplane 1 Temperature Sensor	Enclosure
127	7	Baseplane 2 Temperature Sensor	Enclosure
128	8	Baseplane 2 Temperature Sensor	Enclosure
129	9	Baseplane 3 Temperature Sensor	Enclosure
130	10	Baseplane 3 Temperature Sensor	Enclosure
131	11	Sideplane 0 Expander Temperature Sensor	Sideplane 0
132	12	Sideplane 1 Expander Temperature Sensor	Sideplane 1
133	13	Sideplane 2 Expander Temperature Sensor	Sideplane 2

Global Element Index	Relative Element Index	Description	Associated FRU
134	14	Sideplane 3 Expander Temperature Sensor	Sideplane 3
135	15	Sideplane 4 Expander Temperature Sensor	Sideplane 4
136	16	Sideplane 5 Expander Temperature Sensor	Sideplane 5
137	17	Sideplane 6 Expander Temperature Sensor	Sideplane 6
138	18	Sideplane 7 Expander Temperature Sensor	Sideplane 7
139	19	PSU Core 0 Hotspot Temperature Sensor	PSU 0
140	20	PSU Core 0 Inlet Temperature Sensor	PSU 0
141	21	PSU Core 0 Exhaust Temperature Sensor	PSU 0
142	22	PSU Core 1 Hotspot Temperature Sensor	PSU 1
143	23	PSU Core 1 Inlet Temperature Sensor	PSU 1
144	24	PSU Core 1 Exhaust Temperature Sensor	PSU 1
145	25	PSU Core 2 Hotspot Temperature Sensor	PSU 2
146	26	PSU Core 2 Inlet Temperature Sensor	PSU 2
147	27	PSU Core 2 Exhaust Temperature Sensor	PSU 2
148	28	PSU Core 3 Hotspot Temperature Sensor	PSU 3
149	29	PSU Core 3 Inlet Temperature Sensor	PSU 3
150	30	PSU Core 3 Exhaust Temperature Sensor	PSU 3
151	31	IOM 0 Ambient Temperature Sensor	IOM 0
152	32	IOM 0 Primary Expander Temperature Sensor	IOM 0
153	33	IOM 0 Secondary Expander Temperature Sensor	IOM 0
154	34	IOM 1 Ambient Temperature Sensor	IOM 1
155	35	IOM 1 Primary Expander Temperature Sensor	IOM 1
156	36	IOM 1 Secondary Expander Temperature Sensor	IOM 1
Door Lock Sensor Elements			
157	0	Controller Channel Lid Removed Sensor	Enclosure
158	1	Main Lid Removed Sensor	Enclosure
Audible Alarm Elements			
159	0	Ops Panel Buzzer State[1]	Enclosure
Enclosure Services Controller Electronics Elements			
160	0	Element associated with SEP device	IOM 0
161	1	Element associated with SEP device	IOM 1
Enclosure Elements			
162	0	Element representing the Enclosure	Enclosure
Voltage Sensor Elements			
163	0	PSU Core 0 +12V Rail Voltage Sensor[2]	PSU Module 0
164	1	PSU Core 0 Input Rail Voltage Sensor[2]	PSU Module 0
165	2	PSU Core 1 +12V Rail Voltage Sensor[2]	PSU Module 0
166	3	PSU Core 1 Input Rail Voltage Sensor[2]	PSU Module 0
167	4	PSU Core 2 +12V Rail Voltage Sensor[2]	PSU Module 1
168	5	PSU Core 2 Input Rail Voltage Sensor[2]	PSU Module 1
169	6	PSU Core 3 +12V Rail Voltage Sensor[2]	PSU Module 1
170	7	PSU Core 3 Input Rail Voltage Sensor[2]	PSU Module 1
Current Sensor Elements			

Global Element Index	Relative Element Index	Description	Associated FRU
171	0	PSU Core 0 +12V Rail Current Sensor[2]	PSU Module 0
172	1	PSU Core 0 Input Rail Current Sensor[2]	PSU Module 0
173	2	PSU Core 1 +12V Rail Current Sensor[2]	PSU Module 0
174	3	PSU Core 1 Input Rail Current Sensor[2]	PSU Module 0
175	4	PSU Core 2 +12V Rail Current Sensor[2]	PSU Module 1
176	5	PSU Core 2 Input Rail Current Sensor[2]	PSU Module 1
177	6	PSU Core 3 +12V Rail Current Sensor[2]	PSU Module 1
178	7	PSU Core 3 Input Rail Current Sensor[2]	PSU Module 1
SAS Expander Elements			
179	0	Sideplane 0 (A Channel) Expander	Sideplane 0
180	1	Sideplane 1 (B Channel) Expander	Sideplane 1
181	2	Sideplane 2 (A Channel) Expander	Sideplane 2
182	3	Sideplane 3 (B Channel) Expander	Sideplane 3
183	4	Sideplane 4 (A Channel) Expander	Sideplane 4
184	5	Sideplane 5 (B Channel) Expander	Sideplane 5
185	6	Sideplane 6 (A Channel) Expander	Sideplane 6
186	7	Sideplane 7 (B Channel) Expander	Sideplane 7
187	8	IOM 0 (A Channel) Secondary Expander	IOM 0
188	9	IOM 1 (B Channel) Secondary Expander	IOM 1
189	10	IOM 0 (A Channel) Primary Expander	IOM 0
190	11	IOM 1 (B Channel) Primary Expander	IOM 1
SAS Connector Elements			
191	0	SAS Connector for IOM MiniSAS HD Port A	IOM 0
192	1	SAS Connector for IOM MiniSAS HD Port B	IOM 0
193	2	SAS Connector for IOM MiniSAS HD Port C	IOM 0
194	3	SAS Connector for IOM MiniSAS HD Port D	IOM 0
195	4	SAS Connector for IOM MiniSAS HD Port A	IOM 1
196	5	SAS Connector for IOM MiniSAS HD Port B	IOM 1
197	6	SAS Connector for IOM MiniSAS HD Port C	IOM 1
198	7	SAS Connector for IOM MiniSAS HD Port D	IOM 1
199	8	IOM 0 to Secondary 0 SAS Connector	IOM 0
207	9	Secondary 0 to Sideplane 7 SAS Connector	IOM 0
208	10	Secondary 0 to Sideplane 5 SAS Connector	IOM 0
209	11	Secondary 0 to Sideplane 3 SAS Connector	IOM 0
210	12	Secondary 0 to Sideplane 1 SAS Connector	IOM 0
211	13	IOM 1 to Secondary 1 SAS Connector	IOM 1
219	14	Secondary 1 to Sideplane 6 SAS Connector	IOM 1
220	15	Secondary 1 to Sideplane 4 SAS Connector	IOM 1
221	16	Secondary 1 to Sideplane 2 SAS Connector	IOM 1
222	17	Secondary 1 to Sideplane 0 SAS Connector	IOM 1
SBB Midplane Interconnect Elements			
223	0	IOM 0 Enclosure Interconnect Electronics	IOM 0
224	1	IOM 1 Enclosure Interconnect Electronics	IOM 1

Global Element Index	Relative Element Index	Description	Associated FRU
Enclosure Electronics Power Elements			
225	0	IOM Power Status and Control	IOM 0
226	1	IOM Power Status and Control	IOM 1
Enclosure Settings Elements			
227	0	Enclosure Ops Panel Settings[3]	Enclosure
Enclosure Electronics Diagnostics Elements			
228	0	SEP Diagnostics status and Control	IOM 0
229	1	SEP Diagnostics status and Control	IOM 1
Sideplane Elements			
230	0	Sideplane 0 Status and Control	Sideplane 0
231	1	Sideplane 1 Status and Control	Sideplane 1
232	2	Sideplane 2 Status and Control	Sideplane 2
233	3	Sideplane 3 Status and Control	Sideplane 3
234	4	Sideplane 4 Status and Control	Sideplane 4
235	5	Sideplane 5 Status and Control	Sideplane 5
236	6	Sideplane 6 Status and Control	Sideplane 6
237	7	Sideplane 7 Status and Control	Sideplane 7

[1]The ops panel buzzer is a “no fit” option on the enclosure. In the case a buzzer is not fitted, the audible alarm element will still be represented.

[2]Not available on all Power Supplies. If the sensor is not available on a specific power supply model, the SES Page 02h element status is set to NOT INSTALLED (05h).

[3]The enclosure does not support a display for the enclosure ID. However, this element is still provided to aid host side software in configuring/determining an enclosure’s position in a rack.

3.3 GEMNet Addresses

The *gncli* command is used to issue GEM CLI commands to the Sideplane expanders (see [4] for details). To target a specific expander, this command uses either SES expander IDs or GEMNet addresses. Table 4 shows the GEMNet address/Expander ID to use to target a specific Sideplane expander.

Table 4 - gncli Expander Addresses

Expander	GEMNet Address	Expander Address
Sideplane 0 Expander	*3,0,1*	*exp:0*
Sideplane 1 Expander	*3,0,0*	*exp:1*
Sideplane 2 Expander	*3,1,1*	*exp:2*
Sideplane 3 Expander	*3,1,0*	*exp:3*
Sideplane 4 Expander	*3,2,1*	*exp:4*
Sideplane 5 Expander	*3,2,0*	*exp:5*
Sideplane 6 Expander	*3,3,1*	*exp:6*
Sideplane 7 Expander	*3,3,0*	*exp:7*
IOM 0 Secondary Expander	*3,5,0*	*exp:8*
IOM 1 Secondary Expander	*3,6,0*	*exp:9*

4 Diagnostic Page Layouts

4.1 Diagnostic Page 00h

Diagnostics Page 00h lists all SES pages supported by the SEP. The page 00h response reported by the documented product is shown in Table 5.

Table 5 - Diagnostic Page 00h Layout

Bit / Byte	7	6	5	4	3	2	1	0
0	PAGE CODE (**00h**)							
1	Reserved							
2	(MSB)	PAGE LENGTH (**12**)						
3								(LSB)
4		SUPPORTED PAGE LIST (**00 01 02 05 07 0A 0E 84 85 90 91 92 h**)						
15								

4.2 SES Page 01h

SES Page 01h provides information on enclosure identification and element layout in SES pages 02h, 05h, 07h and 92h.
Table 6 covers the layout of Page 01h for the enclosure documented within this addendum.

Table 6 - SES Page 01h Layout

Bit / Byte	7	6	5	4	3	2	1	0
0	PAGE CODE (**01h**)							
1	NUMBER OF SECONDARY SUBENCLOSURES (**00h**)							
2	(MSB)	PAGE LENGTH (**248**)						
3								(LSB)
4	(MSB)	GENERATION CODE						
7								(LSB)
Enclosure Descriptor List[1]								
8	RSVD	RELATIVE ENCLOSURE SERVICES PROCESS ID			RSVD	NUMBER OF ENCLOSURE SERVICES PROCESSES (**2h**)		
9	SUBENCLOSURE IDENTIFIER (**00h**)							
10	NUMBER OF TYPE DESCRIPTOR HEADERS (**0Dh**)							
11	ENCLOSURE DESCRIPTOR LENGTH (**60**)							
12	(MSB)	ENCLOSURE LOGICAL IDENTIFIER (**Determined by Midplane VPD**)						
19								(LSB)

Bit / Byte	7	6	5	4	3	2	1	0
20	(MSB)	ENCLOSURE VENDOR IDENTIFICATION (“**SEAGATE** “)						
27								(LSB)
28	(MSB)	PRODUCT IDENTIFICATION (“**SP-34106**”)						
43								(LSB)
44	(MSB)	PRODUCT REVISION LEVEL (**Determined by GEM firmware version**)						
47								(LSB)
48	(MSB)	ENCLOSURE SERIAL NUMBER (**Determined by Midplane VPD**)						
62								(LSB)
63	ENCLOSURE CONFIGURATION SETTINGS (**00h**)							
64	(MSB)	ENCLOSURE ID (**Determined by value of enclosure shelf ID**)						
66								(LSB)
67		Reserved						
70								
71	ENCLOSURE OPTIONAL SETTINGS (**00h**)							
Type Descriptor Header List[2]								
72	(MSB)	Array Device Descriptor (**17 6A 00 00 h**)						
75								(LSB)
76	(MSB)	Power Supply Descriptor (**02 04 00 00 h**)						
79								(LSB)
80	(MSB)	Cooling Descriptor (**03 0A 00 00 h**)						
83								(LSB)
84	(MSB)	Temperature Sensor Descriptor (**04 25 00 00 h**)						
87								(LSB)
88	(MSB)	Door Lock Sensor Descriptor (**05 02 00 00 h**)						
91								(LSB)
92	(MSB)	Audible Alarm Descriptor (**06 01 00 00 h**)						
95								(LSB)
96	(MSB)	Enclosure Services Controller Electronics Descriptor (**07 02 00 00 h**)						
99								(LSB)
100	(MSB)	Enclosure Descriptor (**0E 01 00 00 h**)						
103								(LSB)
104	(MSB)	Voltage Sensor Descriptor (**12 08 00 00 h**)						
107								(LSB)
108	(MSB)	Current Sensor Descriptor (**13 08 00 00 h**)						
111								(LSB)
112	(MSB)	SAS Expander Descriptor (**18 0C 00 00 h**)						
115								(LSB)
116	(MSB)	SAS Connector Descriptor (**19 20 00 00 h**)						

Bit Byte	7	6	5	4	3	2	1	0
119								(LSB)
120	(MSB)	SBB Midplane Interconnect Descriptor (**86 02 00 19 h**)						
123								(LSB)
124	(MSB)	Enclosure Electronics Power Descriptor (**89 02 00 1B h**)						
127								(LSB)
128	(MSB)	Enclosure Settings Descriptor (**8A 01 00 12 h**)						
131								(LSB)
132	(MSB)	Enclosure Electronics Diagnostics Descriptor (**8B 02 00 21 h**)						
135								(LSB)
136	(MSB)	Sideplane Descriptor (**90 08 00 09 h**)						
139								(LSB)
Type Descriptor Text List[3]								
140	(MSB)	SBB Midplane Interconnect Text Descriptor (“**SBB Midplane Interconnect**”)						
164								(LSB)
165	(MSB)	Enclosure Electronics Power Text Descriptor (“**Enclosure Electronics Power**”)						
191								(LSB)
192	(MSB)	Enclosure Settings Text Descriptor (“**Enclosure Settings**”)						
209								(LSB)
210	(MSB)	Enclosure Electronics Diagnostics Text Descriptor (“**Enclosure Electronics Diagnostics**”)						
242								(LSB)
243	(MSB)	Sideplane Text Descriptor (“**Sideplane**”)						
251								(LSB)

[1] See sections 6.2.1 – 6.2.3 in [3] for further details
[2] See section 6.2.4 in [3] for further details on the element descriptor format
[3] See section 6.2.5 in [3] for further details

4.3 SES Page 02h and Page 05h Layout

SES Page 02h and SES Page 05h both conform to the same overall page layout, with 4 byte elements listed in the same order as defined by SES Page 01h. As such, both page structures are defined in Table 7.

Table 7 - SES Page 02h and SES Page 05h Layout

Bit / Byte	7	6	5	4	3	2	1	0
0	PAGE CODE (**02h/05h**)							
1	SHORT STATUS[1] (Page 02h) / Reserved (Page 05h)							
2	(MSB)	PAGE LENGTH (**968**)						
3								(LSB)
4	(MSB)	GENERATION CODE						
7								(LSB)
Status Descriptor List[2] (Page 02h) / Threshold Descriptor List[3] (Page 05h)								
8	(MSB)	Array Device Overall Element Descriptor						
11								(LSB)
12	(MSB)	Array Device Element 0 Descriptor						
15								(LSB)
	...							
432	(MSB)	Array Device Element 105 Descriptor						
435								(LSB)
436	(MSB)	Power Supply Overall Element Descriptor						
439								(LSB)
440	(MSB)	Power Supply Element 0 Descriptor						
443								(LSB)
	...							
452	(MSB)	Power Supply Element 3 Descriptor						
455								(LSB)
456	(MSB)	Cooling Overall Element Descriptor						
459								(LSB)
460	(MSB)	Cooling Element 0 Descriptor						
463								(LSB)
	...							
496	(MSB)	Cooling Element 9 Descriptor						
499								(LSB)
500	(MSB)	Temperature Sensor Overall Element Descriptor						
503								(LSB)
504	(MSB)	Temperature Sensor Element 0 Descriptor						

Byte \ Bit	7	6	5	4	3	2	1	0
509								(LSB)
	...							
644	(MSB)	Temperature Sensor Element 36 Descriptor						
647								(LSB)
652	(MSB)	Door Lock Sensor Overall Element Descriptor						
655								(LSB)
656	(MSB)	Door Lock Sensor Element 0 Descriptor						
659								(LSB)
660	(MSB)	Door Lock Sensor Element 1 Descriptor						
663								(LSB)
664	(MSB)	Audible Alarm Overall Element Descriptor						
667								(LSB)
668	(MSB)	Audible Alarm Element 0 Descriptor						
671								(LSB)
672	(MSB)	Enclosure Services Controller Electronics Overall Element Descriptor						
675								(LSB)
676	(MSB)	Enclosure Services Controller Electronics Element 0 Descriptor						
679								(LSB)
680	(MSB)	Enclosure Services Controller Electronics Element 1 Descriptor						
683								(LSB)
684	(MSB)	Enclosure Overall Element Descriptor						
687								(LSB)
688	(MSB)	Enclosure Element 0 Descriptor						
691								(LSB)
692	(MSB)	Voltage Sensor Overall Element Descriptor						
695								(LSB)
696	(MSB)	Voltage Sensor Element 0 Descriptor						
699								(LSB)
	...							
724	(MSB)	Voltage Sensor Element 7 Descriptor						
727								(LSB)
728	(MSB)	Current Sensor Overall Element Status Descriptor						
731								(LSB)
732	(MSB)	Current Sensor Element 0 Descriptor						
735								(LSB)
	...							
760	(MSB)	Current Sensor Element 7 Descriptor						

Bit / Byte	7	6	5	4	3	2	1	0
763								(LSB)
764	(MSB)	SAS Expander Overall Element Descriptor						
767								(LSB)
768	(MSB)	SAS Expander Element 0 Descriptor						
771								(LSB)
	...							
812	(MSB)	SAS Expander Element 11 Descriptor						
815								(LSB)
816	(MSB)	SAS Connector[4] Overall Element Descriptor						
819								(LSB)
820	(MSB)	SAS Connector Element 0 Descriptor						
823								(LSB)
	...							
888	(MSB)	SAS Connector Element 17 Descriptor						
891								(LSB)
892	(MSB)	SBB Midplane Interconnect Overall Element Descriptor						
895								(LSB)
896	(MSB)	SBB Midplane Interconnect Element 0 Descriptor						
899								(LSB)
900	(MSB)	SBB Midplane Interconnect Element 1 Descriptor						
903								(LSB)
904	(MSB)	Enclosure Electronics Power Overall Element Descriptor						
907								(LSB)
908	(MSB)	Enclosure Electronics Power Element 0 Descriptor						
911								(LSB)
912	(MSB)	Enclosure Electronics Power Element1 Descriptor						
915								(LSB)
916	(MSB)	Enclosure Settings Overall Element Descriptor						
919								(LSB)
920	(MSB)	Enclosure Settings Element 0 Descriptor						
923								(LSB)
924	(MSB)	Enclosure Electronics Diagnostics Overall Element Descriptor						
927								(LSB)
928	(MSB)	Enclosure Electronics Diagnostics Element 0 Descriptor						
931								(LSB)
932	(MSB)	Enclosure Electronics Diagnostics Element1 Descriptor						
935								(LSB)
936	Sideplane Overall Element Descriptor							

Bit / Byte	7	6	5	4	3	2	1	0
939								(LSB)
940	(MSB)			Sideplane Element 0 Descriptor				
943								(LSB)
	...							
968	(MSB)			Sideplane Element 7 Descriptor				
971								(LSB)

[1] See section 6.3.2.1 in [3] for details on the SHORT STATUS format
[2] See section 7 of [3] for status descriptor format details for each element type
[3] See [3] for threshold descriptor format details
[4] See Section 3.2, Table-3 (Global Element Index 191-222) for SAS Connector element to physical device mapping.

4.3.1 SES Page 05h Threshold Support

Not all SES element types support SES Page 05h threshold status or control descriptors. Where an element does not support a threshold descriptor, it shall set its status descriptor to all zeros, i.e., [00 00 00 00 h]. Table 8 shows the element types that support a threshold.

Table 8 - Threshold Descriptor Support

Element Type	Threshold Descriptor Support
Array Device	No
Power Supply	No
Cooling Element	No
Temperature Sensor	Yes
Door Lock Sensor	No
Audible Alarm	No
Enclosure Services Controller Electronics	No
Enclosure	No
Voltage Sensor	No
Current Sensor	No
SAS Expander	No
SAS Connector	No
SBB Midplane Interconnect	No
Enclosure Electronics Power	No
Enclosure Settings	No
Enclosure Electronics Diagnostics	No
Sideplane	No
All Overall Elements	No

4.4 SES Page 07h Layout

Table 9 shows the page 07h layout implemented by the documented product.

GEM uses SES Page 07h to report version and serialization information for each of the enclosure FRUs. It may also provide supplemental information with regards to physical element location within the enclosure. Not all elements provide a descriptor string. Where this is the case, 00h will be reported for the descriptor length.

Please note the example below provides a typical representation of the page output. To allow for variation in output, it is recommended that any client should fully parse the page content and not rely on fixed offsets. For example, the temperature sensor element descriptors will only be reported if the associated FRU is present. The descriptor headers will always be present and report a non-zero value if there is data available to read and parse.

Table 9 - SES Page 07h Layout

Bit / Byte	7	6	5	4	3	2	1	0
0	PAGE CODE (**07h**)							
1	Reserved							
2	(MSB)	PAGE LENGTH (**6125**[1])						
3								(LSB)
4	(MSB)	GENERATION CODE						
7								(LSB)
Element Descriptor List								
8	(MSB)	Array Device Overall Element Descriptor **(00 00 00 00 h)**						
11								(LSB)
12	(MSB)	Array Device Element 0 Descriptor **(00 00 00 00 h)**						
15								(LSB)
	…							
432	(MSB)	Array Device Element 105 Descriptor **(00 00 00 00 h)**						
435								(LSB)
436	(MSB)	Power Supply Overall Element Descriptor **(00 00 00 00 h)**						
439								(LSB)
440	(MSB)	Power Supply Element 0 Descriptor **(00 00 00 4C h)** **76 Bytes of descriptor data**[1]						
519								(LSB)
	…							
680	(MSB)	Power Supply Element 3 Descriptor **(00 00 00 4C h)** **76 Bytes of descriptor data**[1]						
759								(LSB)
760	(MSB)	Cooling Overall Element Descriptor **(00 00 00 00 h)**						
763								(LSB)
764	(MSB)	Cooling Element 0 Descriptor **(00 00 00 5B h)** **91 Bytes of descriptor data**[1]						
858								(LSB)
	…							

Bit / Byte	7	6	5	4	3	2	1	0
1619	(MSB)	Cooling Element 9 Descriptor **(00 00 00 5B h)** **91 Bytes of descriptor data[1]**						
1713								(LSB)
1714		Temperature Sensor Overall Element Descriptor **(00 00 00 00 h)**						
1717								(LSB)
1718	(MSB)	Temperature Sensor Element 0 Descriptor **(00 00 00 2A h)** **42 Bytes of descriptor data[1]**						
1763								(LSB)
	…							
3374	(MSB)	Temperature Sensor Element 36 Descriptor **(00 00 00 2A h)** **42 Bytes of descriptor data[1]**						
3419								(LSB)
3420	(MSB)	Door Lock Sensor Overall Element Descriptor **(00 00 00 00 h)**						
3423								(LSB)
3424	(MSB)	Door Lock Sensor Element 0 Descriptor **(00 00 00 00 h)**						
3427								(LSB)
3428	(MSB)	Door Lock Sensor Element 1 Descriptor **(00 00 00 00 h)**						
3431								(LSB)
3432	(MSB)	Audible Alarm Overall Element Descriptor **(00 00 00 00 h)**						
3435								(LSB)
3436	(MSB)	Audible Alarm Element 0 Descriptor **(00 00 00 00 h)**						
3439								(LSB)
3440	(MSB)	Enclosure Services Controller Electronics Overall Element Descriptor **(00 00 00 00 h)**						
3443								(LSB)
3444	(MSB)	Enclosure Services Controller Electronics Element 0 Descriptor **(00 00 00 7E h)** **126 Bytes of descriptor data[1]**						
3573								(LSB)
3574	(MSB)	Enclosure Services Controller Electronics Element 1 Descriptor **(00 00 00 7E h)** **126 Bytes of descriptor data[1]**						
3703								(LSB)
3704	(MSB)	Enclosure Overall Element Descriptor **(00 00 00 00 h)**						
3707								(LSB)
3708	(MSB)	Enclosure Element 0 Descriptor **(00 00 00 49 h)** **73 Bytes of descriptor data[1]**						
3784								(LSB)
3785	(MSB)	Voltage Sensor Overall Element Descriptor **(00 00 00 00 h)**						
3788								(LSB)
3789	(MSB)	Voltage Sensor Element 0 Descriptor **(00 00 00 2A h)** **42 Bytes of descriptor data[1]**						
3834								(LSB)
	…							
3927	(MSB)	Voltage Sensor Element 3 Descriptor **(00 00 00 2A h)** **42 Bytes of descriptor data[1]**						
3972								(LSB)
3973	(MSB)	Current Sensor Overall Element Status Descriptor **(00 00 00 00 h)**						
3976								(LSB)

Bit / Byte	7	6	5	4	3	2	1	0
3977	(MSB)	Current Sensor Element 0 Descriptor **(00 00 00 2A h)** **42 Bytes of descriptor data[1]**						
3978								(LSB)
	…							
4115	(MSB)	Current Sensor Element 3 Descriptor **(00 00 00 2A h)** **42 Bytes of descriptor data[1]**						
4160								(LSB)
4161	(MSB)	SAS Expander Overall Element Descriptor **(00 00 00 00 h)**						
4164								(LSB)
4165	(MSB)	SAS Expander Element 0 Descriptor **(00 00 00 8C h)** **140 Bytes of descriptor data[1]**						
4168								(LSB)
	…							
5461	(MSB)	SAS Expander Element 9 Descriptor **(00 00 00 8C h)** **140 Bytes of descriptor data[1]**						
5604								(LSB)
5605	(MSB)	SAS Expander Element 10 Descriptor[3] **(00 00 00 00 h)**						
5608								(LSB)
5609	(MSB)	SAS Expander Element 11 Descriptor[3] **(00 00 00 00 h)**						
5612								(LSB)
5613	(MSB)	SAS Connector[2] Overall Element Descriptor **(00 00 00 00 h)**						
5616								(LSB)
5617	(MSB)	SAS Connector Element 0 Descriptor **(00 00 00 14 h)** **20 Bytes of descriptor data[1]**						
5640								(LSB)
	…							
6025	(MSB)	SAS Connector Element 17 Descriptor **(00 00 00 14 h)** **20 Bytes of descriptor data[1]**						
6048								(LSB)
6049	(MSB)	SBB Midplane Interconnect Overall Element Descriptor **(00 00 00 00 h)**						
6052								(LSB)
6053	(MSB)	SBB Midplane Interconnect Element 0 Descriptor **(00 00 00 00 h)**						
6056								(LSB)
6057	(MSB)	SBB Midplane Interconnect Element1 Descriptor **(00 00 00 00 h)**						
6060								(LSB)
6061	(MSB)	Enclosure Electronics Power Overall Element Descriptor **(00 00 00 00 h)**						
6064								(LSB)
6065	(MSB)	Enclosure Electronics Power Element 0 Descriptor **(00 00 00 00 h)**						
6068								(LSB)
6069	(MSB)	Enclosure Electronics Power Element1 Descriptor **(00 00 00 00 h)**						
6072								(LSB)
6073	(MSB)	Enclosure Settings Overall Element Descriptor **(00 00 00 00 h)**						
6076								(LSB)
6077	(MSB)	Enclosure Settings Element 0 Descriptor						

Bit / Byte	7	6	5	4	3	2	1	0
6080								(LSB)
6081	(MSB)	Enclosure Electronics Diagnostics Overall Element Descriptor **(00 00 00 00 h)**						
6084								(LSB)
6085	(MSB)	Enclosure Electronics Diagnostics Element 0 Descriptor **(00 00 00 00 h)**						
6088								(LSB)
6089	(MSB)	Enclosure Electronics Diagnostics Element 1 Descriptor **(00 00 00 00 h)**						
6092								(LSB)
6093	(MSB)	Sideplane Overall Element Descriptor **(00 00 00 00 h)**						
6096								(LSB)
6097	(MSB)	Sideplane Element 0 Descriptor **(00 00 00 00 h)**						
6100								(LSB)
	...							
6125	(MSB)	Sideplane Element 7 Descriptor **(00 00 00 00 h)**						
6128								(LSB)

[1] See section 4.4.1 for descriptor string format. Descriptor content and length may vary between FRU types.
[2] See Section 3.2, Table-3 (Global Element Index 191-222) for SAS Connector element to physical device mapping.
[3] SAS Expander elements 10 and 11, associated with the IOM primary expanders, do not report descriptor data. Instead information regarding the IOM is populated in the Enclosure Services Controller Electronics element.

4.4.1 Page 07h Descriptor Strings

The descriptor string formats used by each element that supports them are shown in Table 10. Note that the string formats may be subject to change over time as new FRUs are supported by the enclosure or additional information becomes available. Refer to [3] for full details on descriptor string decoding.

Table 10 - FRU Descriptor string formats

Element Type	Descriptor String
Power Supply	*TP=XX;SN=XXXXXXXXXXXXXXX;F1=XXXX;F2=XXXX;VR=XX;VC=XXXXXXXX;PN=XXXXXXXXXX;*
Cooling	*CF=XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX;CC=XXXXXXXXXXXX;*
Temperature Sensor	*NM=XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX;LO=XXXXXXXXXXXXXXXX;*
Enclosure Services Controller Electronics	*TP=XX;SN=XXXXXXXXXXXXXXX;F1=XXXX;BL=XXXX;VR=XX;VC=XXXXXXXX;CR=XXXX;FR=XX;FC=XXXXXXXX;PN=XXXXXXXXXX;FF1=XXXXXXXX;PC=XXXXXXX;*
Enclosure	*SN=XXXXXXXXXXXXXXX;VR=XX;VC=XXXXXXXX;CR=XXXX;PN=XXXXXXXXXX;CM=XX;TP=XX;*
Voltage Sensor	*NM=XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX;LO=XXXXXXXXXXXXXXXX;*
Current Sensor	*NM=XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX;LO=XXXXXXXXXXXXXXXX;*
SAS Expander	*BL=XXXX;FC=XXXXXXXX;VR=XX;VC=XXXXXXXX;CR=XXXX;PC=XXXXXXXX;F1=XXXX;FF1=XXXXXXXX;SN=XXXXXXXXXXXXXXX;PN=XXXXXXXXXX;TP=XX;BR=XX;BC=XXXXXXXX;*
SAS Connector	*WN=XXXXXXXXXXXXXXXX;*

4.5 SES Page 0Ah Layout

By default, SES Page 0Ah only reports phy descriptor data for elements that belong to the directly queried IOM.

4.5.1 SES Page 0Ah Layout

Table 11 - SES Page 0Ah Layout

Bit / Byte	7	6	5	4	3	2	1	0
0	PAGE CODE (**0Ah**)							
1	Reserved							
2	(MSB)	PAGE LENGTH (**4984**)						
3								(LSB)
4	(MSB)	GENERATION CODE						
7								(LSB)
Device Slot 0 Additional Status Descriptor								
8	INVALID	Reserved			EIP (**1**)	PROTOCOL IDENTIFIER (**6**)		
9	ADDITIONAL ELEMENT STATUS DESCRIPTOR LENGTH (**34**)							
10	Reserved							EIIOE (**0**)
11	ELEMENT INDEX (**0**)							
12	NUM OF DEVICE PHY DESCRIPTORS (**1**)							
13	DESC TYPE (**0**)		Reserved					NOT ALL PHYS (**1**)
14	Reserved							
15	DEVICE SLOT NUMBER (**0**)							
16	(MSB)	Phy Descriptor for Device 0 (SBB IOM phy)						
43								(LSB)
	...							
Device Slot 105 Additional Status Descriptor								
3788	INVALID	Reserved			EIP (**1**)	PROTOCOL IDENTIFIER (**6**)		
3789	ADDITIONAL ELEMENT STATUS DESCRIPTOR LENGTH (**34**)							
3790	Reserved							EIIOE (**0**)
3791	ELEMENT INDEX (**105**)							
3792	NUM OF DEVICE PHY DESCRIPTORS (**1**)							
3793	DESC TYPE (**0**)		Reserved					NOT ALL PHYS (**1**)
3794	Reserved							
3795	DEVICE SLOT NUMBER (**105**)							
3796		Phy Descriptor for Device 105 (SBB IOM phy)						
3823								
Expander 0 Additional Status Descriptor								

Bit / Byte	7	6	5	4	3	2	1	0
3824	INVALID	Reserved		EIP (**1**)	PROTOCOL IDENTIFIER (**6**)			
3825	ADDITIONAL ELEMENT STATUS DESCRIPTOR LENGTH (**86**)							
3826	Reserved							EIIOE (**0**)
3827	ELEMENT INDEX (**176**)							
3828	NUM OF EXPANDER PHY DESCRIPTORS (**36**)							
3829	DESC TYPE (**1**)		Reserved					
3830	Reserved							
3831								
3832	(MSB)	EXPANDER SAS ADDRESS						
3839								(LSB)
3840	(MSB)	Phy Descriptor 0 for Expander 0 (Sideplane 0)						
3841								(LSB)
	…							
3910	(MSB)	Phy Descriptor 35 for Expander 0 (Sideplane 0)						
3911								(LSB)
Expander 1 Additional Status Descriptor								
3912	INVALID	Reserved		EIP (**1**)	PROTOCOL IDENTIFIER (**6**)			
3913	ADDITIONAL ELEMENT STATUS DESCRIPTOR LENGTH (**86**)							
3914	Reserved							EIIOE (**0**)
3915	ELEMENT INDEX (**177**)							
3916	NUM OF EXPANDER PHY DESCRIPTORS (**36**)							
3917	DESC TYPE (**1**)		Reserved					
3918	Reserved							
3919								
3920	(MSB)	EXPANDER SAS ADDRESS						
3927								(LSB)
3928	(MSB)	Phy Descriptor 0 for Expander 1 (Sideplane 1)						
3929								(LSB)
	…							
3998	(MSB)	Phy Descriptor 35 for Expander 1 (Sideplane 1)						
3999								(LSB)
Expander 2 Additional Status Descriptor								
4000	INVALID	Reserved		EIP (**1**)	PROTOCOL IDENTIFIER (**6**)			
4001	ADDITIONAL ELEMENT STATUS DESCRIPTOR LENGTH (**86**)							
4002	Reserved							EIIOE (**0**)
4003	ELEMENT INDEX (**178**)							
4004	NUM OF EXPANDER PHY DESCRIPTORS (**36**)							

Bit / Byte	7	6	5	4	3	2	1	0
4005	DESC TYPE (**1**)		Reserved					
4006	Reserved							
4007								
4008	(MSB)	EXPANDER SAS ADDRESS						
4015								(LSB)
4016	(MSB)	Phy Descriptor 0 for Expander 2 (Sideplane 2)						
								(LSB)
	…							
4086	(MSB)	Phy Descriptor 35 for Expander 2 (Sideplane 2)						
4087								(LSB)
Expander 3 Additional Status Descriptor								
4088	INVALID	Reserved		EIP (**1**)	PROTOCOL IDENTIFIER (**6**)			
4089	ADDITIONAL ELEMENT STATUS DESCRIPTOR LENGTH (**86**)							
4090	Reserved							EIIOE (**0**)
4091	ELEMENT INDEX (**179**)							
4092	NUM OF EXPANDER PHY DESCRIPTORS (**36**)							
4093	DESC TYPE (**1**)		Reserved					
4094	Reserved							
4095								
4096	(MSB)	EXPANDER SAS ADDRESS						
4103								(LSB)
4104	(MSB)	Phy Descriptor 0 for Expander 3 (Sideplane 3)						
4105								(LSB)
	…							
4174	(MSB)	Phy Descriptor 35 for Expander 3 (Sideplane 3)						
4175								(LSB)
Expander 4 Additional Status Descriptor								
4176	INVALID	Reserved		EIP (**1**)	PROTOCOL IDENTIFIER (**6**)			
4177	ADDITIONAL ELEMENT STATUS DESCRIPTOR LENGTH (**86**)							
4178	Reserved							EIIOE (**0**)
4179	ELEMENT INDEX (**180**)							
4180	NUM OF EXPANDER PHY DESCRIPTORS (**36**)							
4181	DESC TYPE (**1**)		Reserved					
4182	Reserved							
4183								
4184	(MSB)	EXPANDER SAS ADDRESS						
4191								(LSB)

Bit / Byte	7	6	5	4	3	2	1	0
4192	(MSB)							
4193	Phy Descriptor 0 for Expander 4 (Sideplane 4)							(LSB)
	…							
4262	(MSB)							
4263	Phy Descriptor 35 for Expander 4 (Sideplane 4)							(LSB)
Expander 5 Additional Status Descriptor								
4264	INVALID	Reserved		EIP (**1**)	PROTOCOL IDENTIFIER (**6**)			
4265	ADDITIONAL ELEMENT STATUS DESCRIPTOR LENGTH (**86**)							
4266	Reserved							EIIOE (**0**)
4267	ELEMENT INDEX (**181**)							
4268	NUM OF EXPANDER PHY DESCRIPTORS (**36**)							
4269	DESC TYPE (**1**)		Reserved					
4270								
4271	Reserved							
4272	(MSB)							
4279	EXPANDER SAS ADDRESS							(LSB)
4280	(MSB)							
4281	Phy Descriptor 0 for Expander 5 (Sideplane 5)							(LSB)
	…							
4350	(MSB)							
4351	Phy Descriptor 35 for Expander 5 (Sideplane 5)							(LSB)
Expander 6 Additional Status Descriptor								
4352	INVALID	Reserved		EIP (**1**)	PROTOCOL IDENTIFIER (**6**)			
4353	ADDITIONAL ELEMENT STATUS DESCRIPTOR LENGTH (**86**)							
4354	Reserved							EIIOE (**0**)
4355	ELEMENT INDEX (**182**)							
4356	NUM OF EXPANDER PHY DESCRIPTORS (**36**)							
4357	DESC TYPE (**1**)		Reserved					
4358								
4359	Reserved							
4360	(MSB)							
4367	EXPANDER SAS ADDRESS							(LSB)
4368	(MSB)							
4369	Phy Descriptor 0 for Expander 6 (Sideplane 6)							(LSB)
	…							
4438	(MSB)							
4439	Phy Descriptor 35 for Expander 6 (Sideplane 6)							(LSB)

Bit / Byte	7	6	5	4	3	2	1	0
Expander 7 Additional Status Descriptor								
4440	INVALID	Reserved		EIP (**1**)	PROTOCOL IDENTIFIER (**6**)			
4441	ADDITIONAL ELEMENT STATUS DESCRIPTOR LENGTH (**86**)							
4442	Reserved							EIIOE (**0**)
4443	ELEMENT INDEX (**183**)							
4444	NUM OF EXPANDER PHY DESCRIPTORS (**36**)							
4445	DESC TYPE (**1**)		Reserved					
4446	Reserved							
4447								
4448	(MSB)	EXPANDER SAS ADDRESS						
4455								(LSB)
4456	(MSB)	Phy Descriptor 0 for Expander 7 (Sideplane 7)						
4457								(LSB)
	…							
4526	(MSB)	Phy Descriptor 35 for Expander 7 (Sideplane 7)						
4527								(LSB)
Expander 8 Additional Status Descriptor								
4528	INVALID	Reserved		EIP (**1**)	PROTOCOL IDENTIFIER (**6**)			
4529	ADDITIONAL ELEMENT STATUS DESCRIPTOR LENGTH (**86**)							
4530	Reserved							EIIOE (**0**)
4531	ELEMENT INDEX (**184**)							
4532	NUM OF EXPANDER PHY DESCRIPTORS (48)							
4533	DESC TYPE (**1**)		Reserved					
4534	Reserved							
4535								
4536	(MSB)	EXPANDER SAS ADDRESS						
4543								(LSB)
4544	(MSB)	Phy Descriptor 0 for Expander 8 (Secondary 0)						
4545								(LSB)
	…							
4638	(MSB)	Phy Descriptor 47 for Expander 8 (Secondary 0)						
4639								(LSB)
Expander 9 Additional Status Descriptor								
4640	INVALID	Reserved		EIP (**1**)	PROTOCOL IDENTIFIER (**6**)			
4641	ADDITIONAL ELEMENT STATUS DESCRIPTOR LENGTH (**86**)							
4642	Reserved							EIIOE (**0**)
4643	ELEMENT INDEX (**185**)							

Bit / Byte	7	6	5	4	3	2	1	0
4644	NUM OF EXPANDER PHY DESCRIPTORS (48)							
4645	DESC TYPE (**1**)		Reserved					
4646	Reserved							
4647								
4648	(MSB)	EXPANDER SAS ADDRESS						
4655								(LSB)
4656	(MSB)	Phy Descriptor 0 for Expander 9 (Secondary 1)						
4657								(LSB)
	...							
4750	(MSB)	Phy Descriptor 47 for Expander 9 (Secondary 1)						
4571								(LSB)
Expander 10 Additional Status Descriptor								
4752	INVALID	Reserved		EIP (**1**)	PROTOCOL IDENTIFIER (**6**)			
4753	ADDITIONAL ELEMENT STATUS DESCRIPTOR LENGTH (**86**)							
4754	Reserved							EIIOE (**0**)
4755	ELEMENT INDEX (**186**)							
4756	NUM OF EXPANDER PHY DESCRIPTORS (**51**)							
4757	DESC TYPE (**1**)		Reserved					
4758	Reserved							
4759								
4760	(MSB)	EXPANDER SAS ADDRESS						
4767								(LSB)
4768	(MSB)	Phy Descriptor 0 for Expander 10 (Primary 0)						
4769								(LSB)
	...							
4867	(MSB)	Phy Descriptor 50 for Expander 10 (Primary 0)						
4869								(LSB)
Expander 11 Additional Status Descriptor								
4870	INVALID	Reserved		EIP (**1**)	PROTOCOL IDENTIFIER (**6**)			
4871	ADDITIONAL ELEMENT STATUS DESCRIPTOR LENGTH (**86**)							
4872	Reserved							EIIOE (**0**)
4873	ELEMENT INDEX (**187**)							
4874	NUM OF EXPANDER PHY DESCRIPTORS (**51**)							
4875	DESC TYPE (**1**)		Reserved					
4876	Reserved							
4877								
4878	(MSB)	EXPANDER SAS ADDRESS						

Bit / Byte	7	6	5	4	3	2	1	0
4885								
4886	(MSB)			Phy Descriptor 0 for Expander 11 (Primary 1)				
7887								(LSB)
	...							
4986	(MSB)			Phy Descriptor 50 for Expander 11 (Primary 1)				
4987								(LSB)

4.6 Vendor Unique Page 91h Layout

Vendor unique Page 91h is used to report enclosure statistics counters. The layouts of the control and status pages are identical, however, the bit definitions within the descriptors vary (see [3] for details). Table covers the basic layout of page 91h for the documented product.

Table 14 - SES Page 91h Layout

Bit / Byte	7	6	5	4	3	2	1	0
0	PAGE CODE (**91h**)							
1	Reserved							
2	(MSB)			PAGE LENGTH (**8820**)				
3								(LSB)
4	(MSB)			GENERATION CODE				
7								(LSB)
	Expander 0 Phy Statistics Descriptor							
8	ELEMENT TYPE CODE (**18h**)							
9	TYPE RELATIVE INDEX (**0**)							
10	DESCRIPTOR FORMAT REVISION (**01h**)							
11	NUMBER OF PHY STATISTICS DESCRIPTORS (**36**)							
12	PHY STATISTICS DESCRIPTOR LENGTH (**28**)							
13	(MSB)			EXPANDER CHANGE COUNT				
14								(LSB)
15	Reserved							
16	(MSB)			Phy 0 Statistics Descriptor[1]				
43								(LSB)
	...							
996	(MSB)			Phy 35 Statistics Descriptor[1]				
1023								(LSB)
	Expander 1 Phy Statistics Descriptor							
1024	ELEMENT TYPE CODE (**18h**)							

Bit / Byte	7	6	5	4	3	2	1	0
1025	TYPE RELATIVE INDEX (**1**)							
1026	DESCRIPTOR FORMAT REVISION (**01h**)							
1027	NUMBER OF PHY STATISTICS DESCRIPTORS (**24**)							
1028	PHY STATISTICS DESCRIPTOR LENGTH (**28**)							
1029	(MSB)	EXPANDER CHANGE COUNT						
1030								(LSB)
1031	Reserved							
1032	(MSB)	Phy 0 Statistics Descriptor[1]						
1059								(LSB)
	...							
1676	(MSB)	Phy 23 Statistics Descriptor[1]						
1703								(LSB)
	Expander 2 Phy Statistics Descriptor							
1704	ELEMENT TYPE CODE (**18h**)							
1705	TYPE RELATIVE INDEX (**2**)							
1706	DESCRIPTOR FORMAT REVISION (**01h**)							
1707	NUMBER OF PHY STATISTICS DESCRIPTORS (**36**)							
1708	PHY STATISTICS DESCRIPTOR LENGTH (**28**)							
1709	(MSB)	EXPANDER CHANGE COUNT						
1710								(LSB)
1711	Reserved							
1712	(MSB)	Phy 0 Statistics Descriptor[1]						
3739								(LSB)
	...							
2692	(MSB)	Phy 35 Statistics Descriptor[1]						
2719								(LSB)
	Expander 3 Phy Statistics Descriptor							
2720	ELEMENT TYPE CODE (**18h**)							
2721	TYPE RELATIVE INDEX (**3**)							
2722	DESCRIPTOR FORMAT REVISION (**01h**)							
2723	NUMBER OF PHY STATISTICS DESCRIPTORS (**24**)							
2724	PHY STATISTICS DESCRIPTOR LENGTH (**28**)							
2725	(MSB)	EXPANDER CHANGE COUNT						
2726								(LSB)
2727	Reserved							
2728	(MSB)	Phy 0 Statistics Descriptor[1]						
2756								(LSB)

Bit / Byte	7	6	5	4	3	2	1	0
	...							
3372	(MSB)			Phy 23 Statistics Descriptor[1]				
3399								(LSB)
	Expander 4 Phy Statistics Descriptor							
3400	ELEMENT TYPE CODE (**18h**)							
3401	TYPE RELATIVE INDEX (**4**)							
3402	DESCRIPTOR FORMAT REVISION (**01h**)							
3403	NUMBER OF PHY STATISTICS DESCRIPTORS (**36**)							
3404	PHY STATISTICS DESCRIPTOR LENGTH (**28**)							
3405	(MSB)			EXPANDER CHANGE COUNT				
3406								(LSB)
3407	Reserved							
3408	(MSB)			Phy 0 Statistics Descriptor[1]				
3435								(LSB)
	...							
3388	(MSB)			Phy 35 Statistics Descriptor[1]				
4415								(LSB)
	Expander 5 Phy Statistics Descriptor							
4416	ELEMENT TYPE CODE (**18h**)							
4417	TYPE RELATIVE INDEX (**5**)							
4418	DESCRIPTOR FORMAT REVISION (**01h**)							
4419	NUMBER OF PHY STATISTICS DESCRIPTORS (**24**)							
4420	PHY STATISTICS DESCRIPTOR LENGTH (**28**)							
4421	(MSB)			EXPANDER CHANGE COUNT				
4422								(LSB)
4423	Reserved							
4424	(MSB)			Phy 0 Statistics Descriptor[1]				
4451								(LSB)
	...							
5068	(MSB)			Phy 23 Statistics Descriptor[1]				
5095								(LSB)
	Expander 6 Phy Statistics Descriptor							
5096	ELEMENT TYPE CODE (**18h**)							
5097	TYPE RELATIVE INDEX (**6**)							
5098	DESCRIPTOR FORMAT REVISION (**01h**)							
5099	NUMBER OF PHY STATISTICS DESCRIPTORS (**36**)							
6000	PHY STATISTICS DESCRIPTOR LENGTH (**28**)							

Bit / Byte	7	6	5	4	3	2	1	0
6001	(MSB)			EXPANDER CHANGE COUNT				
6002								(LSB)
6003	Reserved							
6004	(MSB)			Phy 0 Statistics Descriptor[1]				
6031								(LSB)
	...							
6084	(MSB)			Phy 35 Statistics Descriptor[1]				
6111								(LSB)
	Expander 7 Phy Statistics Descriptor							
6112	ELEMENT TYPE CODE (**18h**)							
6113	TYPE RELATIVE INDEX (**7**)							
6114	DESCRIPTOR FORMAT REVISION (**01h**)							
6115	NUMBER OF PHY STATISTICS DESCRIPTORS (**24**)							
6116	PHY STATISTICS DESCRIPTOR LENGTH (**28**)							
6117	(MSB)			EXPANDER CHANGE COUNT				
6118								(LSB)
6119	Reserved							
6120	(MSB)			Phy 0 Statistics Descriptor[1]				
6147								(LSB)
	...							
6764	(MSB)			Phy 23 Statistics Descriptor[1]				
6791								(LSB)
	Expander 8 Phy Statistics Descriptor							
6792	ELEMENT TYPE CODE (**18h**)							
6793	TYPE RELATIVE INDEX (**8**)							
6794	DESCRIPTOR FORMAT REVISION (**01h**)							
6795	NUMBER OF PHY STATISTICS DESCRIPTORS (**37**)							
6796	PHY STATISTICS DESCRIPTOR LENGTH (**28**)							
6797	(MSB)			EXPANDER CHANGE COUNT				
6798								(LSB)
6799	Reserved							
6800	(MSB)			Phy 0 Statistics Descriptor[1]				
6827								(LSB)
	...							
7780	(MSB)			Phy 35 Statistics Descriptor[1]				
7807								(LSB)
	Expander 9 Phy Statistics Descriptor							

Bit / Byte	7	6	5	4	3	2	1	0
7808	ELEMENT TYPE CODE (**18h**)							
7809	TYPE RELATIVE INDEX (**9**)							
7810	DESCRIPTOR FORMAT REVISION (**01h**)							
7811	NUMBER OF PHY STATISTICS DESCRIPTORS (**37**)							
7812	PHY STATISTICS DESCRIPTOR LENGTH (**28**)							
7813	(MSB)	EXPANDER CHANGE COUNT						
7814								(LSB)
7815	Reserved							
7816	(MSB)	Phy 0 Statistics Descriptor[1]						
7843								(LSB)
	...							
8747	(MSB)	Phy 35 Statistics Descriptor[1]						
8823								(LSB)

[1] See [3] for full details on the format of the Phy Statistics status/control descriptor

4.7 Vendor Unique Page 92h Layout

Vendor unique Page 92h extends the status that can be represented in page 02h for each element. The page structure itself resembles that of page 07h with descriptor headers used to advertise the size of additional status data available for each element. Not all elements provide page 92h descriptors and where this is the case the descriptor length will be set to 0.

As with Page 07h, the example Page 92h output provided below is subject to change based on FRUs and cables that may or may not be present at the time of capture. The descriptor header will indicate if there is any data to be read.

Table 15 - SES Page 92h Layout

Bit / Byte	7	6	5	4	3	2	1	0
0	PAGE CODE (**92h**)							
1	Reserved							
2	(MSB)	PAGE LENGTH (**4659**)						
3								(LSB)
4	(MSB)	GENERATION CODE						
7								(LSB)
Extended Status Descriptor List								
8	(MSB)	Array Device Overall Element Descriptor (**00 00 00 00 h**)						
11								(LSB)
12	(MSB)	Array Device Element 0 Descriptor (**00 00 00 00 h**)						
15								(LSB)
	...							
16	(MSB)	Array Device Element 105 Descriptor (**00 00 00 00 h**)						
19								(LSB)
20	(MSB)	Power Supply Overall Element Descriptor (**00 00 00 07 h**) 7 bytes of Descriptor data[1]						
30								(LSB)
31	(MSB)	Power Supply Element 0 Descriptor (**00 00 00 04 h**) 4 bytes of Descriptor data[1]						
38								(LSB)
	…							
59	(MSB)	Power Supply Element 3 Descriptor (**00 00 00 04 h**) 4 bytes of Descriptor data[1]						
62								(LSB)
63	(MSB)	Cooling Overall Element Descriptor (**00 00 00 00 h**)						
66								(LSB)
67	(MSB)	Cooling Element 0 Descriptor (**00 00 00 00 h**)						
70								(LSB)
	...							
103	(MSB)	Cooling Element 9 Descriptor (**00 00 00 00 h**)						
106								(LSB)

Bit / Byte	7	6	5	4	3	2	1	0
107	(MSB)	Temperature Sensor Overall Element Descriptor (**00 00 00 00 h**)						
110								(LSB)
111		Temperature Sensor Element 0 Descriptor (**00 00 00 00 h**)						
114								(LSB)
	…							
255	(MSB)	Temperature Sensor Element 36 Descriptor (**00 00 00 00 h**)						
258								(LSB)
259	(MSB)	Door Lock Sensor Overall Element Descriptor (**00 00 00 00 h**)						
262								(LSB)
263	(MSB)	Door Lock Sensor Element 0 Descriptor (**00 00 00 00 h**)						
266								(LSB)
267	(MSB)	Door Lock Sensor Element 1 Descriptor (**00 00 00 00 h**)						
270								(LSB)
271	(MSB)	Audible Alarm Overall Element Descriptor (**00 00 00 00 h**)						
274								(LSB)
275	(MSB)	Audible Alarm Element 0 Descriptor (**00 00 00 00 h**)						
278								(LSB)
279	(MSB)	Enclosure Services Controller Electronics Overall Element Descriptor (**00 00 00 00 h**)						
282								(LSB)
283	(MSB)	Enclosure Services Controller Electronics Element 0 Descriptor (**00 00 00 00 h**)						
286								(LSB)
287	(MSB)	Enclosure Services Controller Electronics Element 1 Descriptor (**00 00 00 00 h**)						
290								(LSB)
291	(MSB)	Enclosure Overall Element Descriptor (**00 00 00 00 h**)						
294								(LSB)
295	(MSB)	Enclosure Element 0 Descriptor (**00 00 00 00 h**)						
298								(LSB)
299	(MSB)	Voltage Sensor Overall Element Descriptor (**00 00 00 00 h**)						
302								(LSB)
303	(MSB)	Voltage Sensor Element 0 Descriptor (**00 00 00 00 h**)						
305								(LSB)
	…							
331	(MSB)	Voltage Sensor Element 7 Descriptor (**00 00 00 00 h**)						
334								(LSB)
335	(MSB)	Current Sensor Overall Element Status Descriptor (**00 00 00 00 h**)						
338								(LSB)
339	(MSB)	Current Sensor Element 0 Descriptor (**00 00 00 00 h**)						
342								(LSB)

Bit / Byte	7	6	5	4	3	2	1	0
	...							
367	(MSB)	Current Sensor Element 7 Descriptor (**00 00 00 00 h**)						
370								(LSB)
371	(MSB)	SAS Expander Overall Element Descriptor (**00 00 00 00 h**)						
374								(LSB)
375	(MSB)	SAS Expander Element 0 Descriptor (**00 00 00 00 h**)						
								(LSB)
	...							
419	(MSB)	SAS Expander Element 11 Descriptor (**00 00 00 00 h**)						
422								(LSB)
423	(MSB)	SAS Connector Overall Element Descriptor (**00 00 00 00 h**)						
426								(LSB)
427	(MSB)	SAS Connector Element 0 Descriptor (**01 00 02 00 h**) 512 bytes of descriptor data[1]						
942								(LSB)
	...							
4025	(MSB)	SAS Connector Element 7 Descriptor (**00 00 02 00 h**) 512 bytes of descriptor data[1]						
4538								(LSB)
4539	(MSB)	SAS Connector Element 8 Descriptor (**00 00 00 00 h**)						
4542								(LSB)
4579	(MSB)	SAS Connector Element 17 Descriptor (**00 00 00 00 h**)						
4582								(LSB)
4583	(MSB)	SBB Midplane Interconnect Overall Element Descriptor (**00 00 00 00 h**)						
4586								(LSB)
4587	(MSB)	SBB Midplane Interconnect Element 0 Descriptor (**00 00 00 00 h**)						
4590								(LSB)
4591	(MSB)	SBB Midplane Interconnect Element1 Descriptor (**00 00 00 00 h**)						
4594								(LSB)
4595	(MSB)	Enclosure Electronics Power Overall Element Descriptor (**00 00 00 00 h**)						
4598								(LSB)
4599	(MSB)	Enclosure Electronics Power Element 0 Descriptor (**00 00 00 00 h**)						
4602								(LSB)
4603	(MSB)	Enclosure Electronics Power Element1 Descriptor (**00 00 00 00 h**)						
4606								(LSB)
4607	(MSB)	Enclosure Settings Overall Element Descriptor (**00 00 00 00 h**)						
4610								(LSB)
4611	(MSB)	Enclosure Settings Element 0 Descriptor (**00 00 00 00 h**)						
4614								(LSB)

Bit / Byte	7	6	5	4	3	2	1	0
4615	(MSB)	Enclosure Electronics Diagnostics Overall Element Descriptor (**00 00 00 00 h**)						
4618								(LSB)
4619	(MSB)	Enclosure Electronics Diagnostics Element 0 Descriptor (**00 00 00 00 h**)						
4622								(LSB)
4623	(MSB)	Enclosure Electronics Diagnostics Element1 Descriptor (**00 00 00 00 h**)						
4626								(LSB)
4627	(MSB)	Sideplane Overall Element Descriptor (**00 00 00 00 h**)						
4630								(LSB)
4631	(MSB)	Sideplane Element 0 Descriptor (**00 00 00 00 h**)						
4634								(LSB)
	…							
4659	(MSB)	Sideplane Element 7 Descriptor (**00 00 00 00 h**)						
4662								(LSB)

[1] See [3] for extended status descriptor format for SAS connectors