



# Exos E 2U24 JBOD

## GEM 5 SES-3 Addenda

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## Revision History

Revision	Date	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 2U24 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.

- EB-2425-E12EBD
- SP-3224-E12EBD
- SP-3224A-E12EBD

## 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
EIP	Element Index Present
EIIOE	Element Index Includes Overall Element
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., <i>23h</i>
<value>	A value without leading zeroes and no suffix indicates a decimal number, e.g., <i>34</i> .
[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] ANSI T10 SES-3 Revision 6
- [2] SCSI Primary Commands - 4 (SPC-4) Revision 36n
- [3] GEM 5 ANSI SES-3 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
<b>ANSI SES Pages</b>		
00h	Supported Diagnostics Pages Diagnostic Page	Status
01h	Configuration Diagnostic Page	Status
02h	Enclosure Diagnostic Page	Control and Status
03h	Help Text Diagnostic Page	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
<b>Vendor Specific Pages</b>		
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
94h	Phy Management Diagnostic Page	Control and Status

**Table 2 - Supported SES Elements**

Element Code	Description	Element count
<b>ANSI SES Elements</b>		
17h	Array Device	24
02h	Power Supply	2
03h	Cooling Element	4
04h	Temperature Sensor	8
06h	Audible Alarm	1
07h	Enclosure Services Controller Electronics	2
0Eh	Enclosure	1
12h	Voltage Sensor	4
13h	Current Sensor	4
18h	SAS Expander	2
19h	SAS Connector	6
<b>Vendor Specific SES Elements</b>		
86h	SBB Midplane Interconnect	2
89h	Enclosure Electronics Power	2
8Ah	Enclosure Settings	1
8Bh	Enclosure Electronics Diagnostics	2

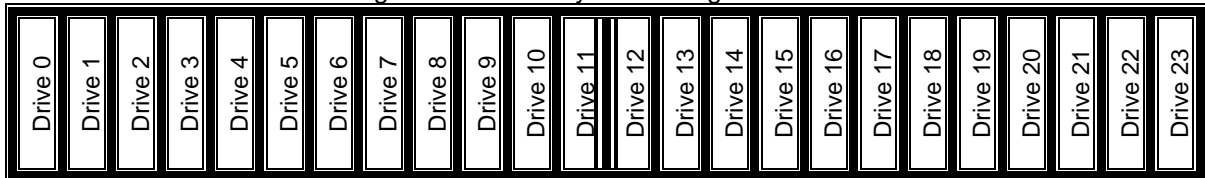
## 3 Element to Device Mapping

### 3.1 Enclosure FRU Layout

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

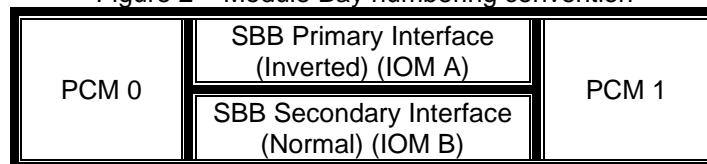
#### 3.1.1 Enclosure Front View

Figure 1 - Drive Bay numbering convention



#### 3.1.2 Enclosure Rear View

Figure 2 – Module Bay numbering convention



## 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
<b>Array Device Elements</b>			
0	0	Array Device element representing Disk Drive Bay 0	Enclosure
...	...	...	...
23	23	Array Device element representing Disk Drive Bay 23	Enclosure
<b>Power Supply Elements</b>			
24	0	Power Supply element representing PCM 0	PCM 0
25	1	Power Supply element representing PCM 1	PCM 1
<b>Cooling Elements</b>			
26	0	Cooling element representing PCM Fan 0	PCM 0
27	1	Cooling element representing PCM Fan 1	PCM 0
28	2	Cooling element representing PCM Fan 0	PCM 1
29	3	Cooling element representing PCM Fan 1	PCM 1
<b>Temperature Sensor Elements</b>			
30	0	Ops Panel Ambient Temperature Sensor	Enclosure
31	1	Midplane Temperature Sensor	Enclosure
32	2	PCM Inlet Temperature Sensor	PCM 0
33	3	PCM Hotspot Temperature Sensor	PCM 0
34	4	PCM Inlet Temperature Sensor	PCM 1
35	5	PCM Hotspot Temperature Sensor	PCM 1
36	6	SBB IOM Inlet Temperature Sensor	SBB IOM A
37	7	SBB IOM Inlet Temperature Sensor	SBB IOM B
<b>Audible Alarm Elements</b>			
38	0	Ops Panel Buzzer State <sup>1</sup>	Enclosure
<b>Enclosure Services Controller Electronics Elements</b>			
39	0	Element associated with SEP device	SBB IOM A
40	1	Element associated with SEP device	SBB IOM B
<b>Enclosure Elements</b>			
41	0	Element representing the Enclosure	Enclosure
<b>Voltage Sensor Elements</b>			
42	0	+12V Rail Voltage Sensor	PCM 0
43	1	+5V Rail Voltage Sensor	PCM 0
44	2	+12V Rail Voltage Sensor	PCM 1
45	3	+5V Rail Voltage Sensor	PCM 1
<b>Current Sensor Elements</b>			
46	0	+12V Rail Current Sensor	PCM 0
47	1	+5V Rail Current Sensor	PCM 0



Global Element Index	Relative Element Index	Description	Associated FRU
48	2	+12V Rail Current Sensor	PCM 1
49	3	+5V Rail Current Sensor	PCM 1
<b>SAS Expander Elements</b>			
50	0	SBB IOM SAS Expander	SBB IOM A
51	1	SBB IOM SAS Expander	SBB IOM B
<b>SAS Connector Elements</b>			
52	0	SAS Connector for IOM MiniSAS HD Port A	SBB IOM A
53	1	SAS Connector for IOM MiniSAS HD Port B	SBB IOM A
54	2	SAS Connector for IOM MiniSAS HD Port C	SBB IOM A
55	3	SAS Connector for IOM MiniSAS HD Port A	SBB IOM B
56	4	SAS Connector for IOM MiniSAS HD Port B	SBB IOM B
57	5	SAS Connector for IOM MiniSAS HD Port C	SBB IOM B
<b>SBB Midplane Interconnect Elements</b>			
58	0	SBB IOM to Midplane Interconnect Electronics	SBB IOM A
59	1	SBB IOM to Midplane Interconnect Electronics	SBB IOM B
<b>Enclosure Electronics Power Elements</b>			
60	0	SBB IOM Power Status and Control	SBB IOM A
61	1	SBB IOM Power Status and Control	SBB IOM B
<b>Enclosure Settings Elements</b>			
62	0	Enclosure Ops Panel Settings	Enclosure
<b>Enclosure Electronics Diagnostics Elements</b>			
63	0	SEP Diagnostics status and Control	SBB IOM A
64	1	SEP Diagnostics status and Control	SBB IOM B
<p><sup>1</sup>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.</p> <p><sup>2</sup>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).</p>			

## 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 4.

**Table 4 - Diagnostic Page 00h Layout**

Bit Byte	7	6	5	4	3	2	1	0
0	PAGE CODE (00h)							
1	Reserved							
2	(MSB)	PAGE LENGTH (14)						(LSB)
3								
4	SUPPORTED PAGE LIST							
17	(00 01 02 03 05 07 0A 0E 84 85 90 91 92 94 h)							

### 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 5 covers the layout of Page 01h for the enclosure documented within this addendum.

**Table 5 - 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 (231)						(LSB)
3								
4	(MSB)	GENERATION CODE						(LSB)
7								
Enclosure Descriptor List <sup>1</sup>								
8	RSVD	RELATIVE ENCLOSURE SERVICES PROCESS ID (0h)			RSVD	NUMBER OF ENCLOSURE SERVICES PROCESSES (0h)		
9	SUBENCLOSURE IDENTIFIER (00h)							
10	NUMBER OF TYPE DESCRIPTOR HEADERS (0Fh)							
11	ENCLOSURE DESCRIPTOR LENGTH (60)							
12	ENCLOSURE LOGICAL IDENTIFIER							
19	(Determined by Midplane VPD)							
20	ENCLOSURE VENDOR IDENTIFICATION ("SEAGATE ")							
27								

Bit Byte	7	6	5	4	3	2	1	0
28	PRODUCT IDENTIFICATION ("EB-2425-E12EBD ")							
43	PRODUCT IDENTIFICATION ("EB-2425-E12EBD ")							
44	PRODUCT REVISION LEVEL							
47	(Determined by GEM firmware version)							
48	ENCLOSURE SERIAL NUMBER							
62	(Determined by Midplane VPD)							
63	ENCLOSURE CONFIGURATION SETTINGS (00h)							
64	ENCLOSURE ID							
66	(Determined by value of enclosure shelf ID)							
67	Reserved							
70	Reserved							
71	ENCLOSURE OPTIONAL SETTINGS (02h)							
Type Descriptor Header List <sup>2</sup>								
72	Array Device Descriptor (17 18 00 00 h)							
75	Array Device Descriptor (17 18 00 00 h)							
76	Power Supply Descriptor (02 02 00 00 h)							
79	Power Supply Descriptor (02 02 00 00 h)							
80	Cooling Descriptor (03 04 00 00 h)							
83	Cooling Descriptor (03 04 00 00 h)							
84	Temperature Sensor Descriptor (04 08 00 00 h)							
87	Temperature Sensor Descriptor (04 08 00 00 h)							
88	Audible Alarm Descriptor (06 01 00 00 h)							
91	Audible Alarm Descriptor (06 01 00 00 h)							
92	Enclosure Services Controller Electronics Descriptor (07 02 00 00 h)							
95	Enclosure Services Controller Electronics Descriptor (07 02 00 00 h)							
96	Enclosure Descriptor (0E 01 00 00 h)							
99	Enclosure Descriptor (0E 01 00 00 h)							
100	Voltage Sensor Descriptor (12 04 00 00 h)							
103	Voltage Sensor Descriptor (12 04 00 00 h)							
104	Current Sensor Descriptor (13 04 00 00 h)							
107	Current Sensor Descriptor (13 04 00 00 h)							
108	SAS Expander Descriptor (18 02 00 00 h)							
111	SAS Expander Descriptor (18 02 00 00 h)							
112	SAS Connector Descriptor (19 06 00 00 h)							
115	SAS Connector Descriptor (19 06 00 00 h)							
116	SBB Midplane Interconnect Descriptor (86 02 00 19 h)							
119	SBB Midplane Interconnect Descriptor (86 02 00 19 h)							
120	Enclosure Electronics Power Descriptor (89 02 00 1B h)							
123	Enclosure Electronics Power Descriptor (89 02 00 1B h)							

Bit Byte	7	6	5	4	3	2	1	0
124	Enclosure Settings Descriptor ( <b>8A 01 00 12 h</b> )							
127								
128	Enclosure Electronics Diagnostics Descriptor ( <b>8B 02 00 21 h</b> )							
131								
Type Descriptor Text List <sup>3</sup>								
132	SBB Midplane Interconnect Text Descriptor ("SBB Midplane Interconnect")							
156								
157	Enclosure Electronics Power Text Descriptor ("Enclosure Electronics Power")							
183								
184	Enclosure Settings Text Descriptor ("Enclosure Settings")							
201								
202	Enclosure Electronics Diagnostics Text Descriptor ("Enclosure Electronics Diagnostics")							
234								
<sup>1</sup> See sections 6.2.1 – 6.2.3 in [3] for further details <sup>2</sup> See section 6.2.4 in [3] for further details on the element descriptor format <sup>3</sup> 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 6.

**Table 6 - 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 <sup>1</sup> (Page 02h) / Reserved (Page 05h)							
2	(MSB)	PAGE LENGTH (324)						(LSB)
3								
4	(MSB)	GENERATION CODE						(LSB)
7								
Status Descriptor List <sup>2</sup> (Page 02h) / Threshold Descriptor List <sup>3</sup> (Page 05h)								
8	Array Device Overall Element Descriptor							
11								
12	Array Device Element 0 Descriptor							
15								
...	...							
104	Array Device Element 23 Descriptor							
107								
108	Power Supply Overall Element Descriptor							
111								
112	Power Supply Element 0 Descriptor							
115								
116	Power Supply Element 1 Descriptor							
119								
120	Cooling Overall Element Descriptor							
123								
124	Cooling Element 0 Descriptor							
127								
...	...							
136	Cooling Element 3 Descriptor							
139								
140	Temperature Sensor Overall Element Descriptor							
143								
144	Temperature Sensor Element 0 Descriptor							
147								
...	...							

Bit Byte	7	6	5	4	3	2	1	0
172	Temperature Sensor Element 7 Descriptor							
175								
176	Audible Alarm Overall Element Descriptor							
179								
180	Audible Alarm Element 0 Descriptor							
183								
184	Enclosure Services Controller Electronics Overall Element Descriptor							
187								
188	Enclosure Services Controller Electronics Element 0 Descriptor							
191								
192	Enclosure Services Controller Electronics Element 1 Descriptor							
195								
196	Enclosure Overall Element Descriptor							
199								
200	Enclosure Element 0 Descriptor							
203								
204	Voltage Sensor Overall Element Descriptor							
207								
208	Voltage Sensor Element 0 Descriptor							
211								
...	...							
220	Voltage Sensor Element 3 Descriptor							
223								
224	Current Sensor Overall Element Status Descriptor							
227								
228	Current Sensor Element 0 Descriptor							
231								
...	...							
240	Current Sensor Element 3 Descriptor							
243								
244	SAS Expander Overall Element Descriptor							
247								
248	SAS Expander Element 0 Descriptor							
251								
252	SAS Expander Element 1 Descriptor							
255								
256	SAS Connector Overall Element Descriptor							

Bit Byte	7	6	5	4	3	2	1	0
259								
260								
263			SAS Connector Element 0 Descriptor					
...								
280								
283			SAS Connector Element 5 Descriptor					
284								
287			SBB Midplane Interconnect Overall Element Descriptor					
288								
291			SBB Midplane Interconnect Element 0 Descriptor					
292								
295			SBB Midplane Interconnect Element1 Descriptor					
296								
299			Enclosure Electronics Power Overall Element Descriptor					
300								
303			Enclosure Electronics Power Element 0 Descriptor					
304								
307			Enclosure Electronics Power Element1 Descriptor					
308								
311			Enclosure Settings Overall Element Descriptor					
312								
315			Enclosure Settings Element 0 Descriptor					
316								
319			Enclosure Electronics Diagnostics Overall Element Descriptor					
320								
323			Enclosure Electronics Diagnostics Element 0 Descriptor					
324								
327			Enclosure Electronics Diagnostics Element1 Descriptor					
<sup>1</sup> See section 6.3.2.1 in [3] for details on the SHORT STATUS format <sup>2</sup> See section 7 of [3] for status descriptor format details for each element type <sup>3</sup> See [3] for threshold descriptor format details								

### 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 7 shows which element types are expected to support a threshold.

**Table 7 - Threshold Descriptor Support**

<b>Element Type</b>	<b>Threshold Descriptor Support</b>
Array Device	No
Power Supply	No
Cooling Element	No
Temperature Sensor	Yes
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
All Overall Elements	No



## 4.4 SES Page 07h Layout

Table 8 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 8 - SES Page 07h Layout**

Bit Byte	7	6	5	4	3	2	1	0
0	PAGE CODE (07h)							
1	Reserved							
2	(MSB)	PAGE LENGTH (1759)						(LSB)
3								
4	(MSB)	GENERATION CODE						(LSB)
7								
Element Descriptor List								
8	Array Device Overall Element Descriptor							
11	(00 00 00 00 h)							
12	Array Device Element 0 Descriptor							
15	(00 00 00 00 h)							
...	...							
104	Array Device Element 23 Descriptor							
107	(00 00 00 00 h)							
108	Power Supply Overall Element Descriptor							
111	(00 00 00 00 h)							
112	Power Supply Element 0 Descriptor							
188	(00 00 00 49 h)							
189	73 bytes of descriptor data <sup>1</sup>							
189	Power Supply Element 1 Descriptor							
265	(00 00 00 49 h)							
265	73 bytes of descriptor data <sup>1</sup>							
266	Cooling Overall Element Descriptor							
269	(00 00 00 00 h)							
270	Cooling Element 0 Descriptor							
273	(00 00 00 00 h)							
...	...							
282	Cooling Element 3 Descriptor							

Bit Byte	7	6	5	4	3	2	1	0
285	(00 00 00 00 h)							
286	Temperature Sensor Overall Element Descriptor							
289	(00 00 00 00 h)							
290	Temperature Sensor Element 0 Descriptor							
349	(00 00 00 38 h) 56 bytes of descriptor data <sup>1</sup>							
...	...							
710	Temperature Sensor Element 7 Descriptor							
769	(00 00 00 38 h) 56 bytes of descriptor data <sup>1</sup>							
770	Audible Alarm Overall Element Descriptor							
773	(00 00 00 00 h)							
774	Audible Alarm Element 0 Descriptor							
777	(00 00 00 00 h)							
778	Enclosure Services Controller Electronics Overall Element Descriptor							
781	(00 00 00 00 h)							
782	Enclosure Services Controller Electronics Element 0 Descriptor							
907	(00 00 00 7A h) 122 bytes of descriptor data <sup>1</sup>							
908	Enclosure Services Controller Electronics Element 1 Descriptor							
1034	(00 00 00 7A h) 122 bytes of descriptor data <sup>1</sup>							
1035	Enclosure Overall Element Descriptor							
1037	(00 00 00 00 h)							
1038	Enclosure Element 0 Descriptor							
1110	(00 00 00 45 h) 69 bytes of descriptor data <sup>1</sup>							
1111	Voltage Sensor Overall Element Descriptor							
1114	(00 00 00 00 h)							
1115	Voltage Sensor Element 0 Descriptor							
1174	(00 00 00 38 h) 56 bytes of descriptor data <sup>1</sup>							
...	...							
1295	Voltage Sensor Element 3 Descriptor							
1354	(00 00 00 38 h) 56 bytes of descriptor data <sup>1</sup>							
1355	Current Sensor Overall Element Status Descriptor							
1358	(00 00 00 00 h)							
1359	Current Sensor Element 0 Descriptor							
1418	(00 00 00 38 h) 56 bytes of descriptor data <sup>1</sup>							
...	...							
1539	Current Sensor Element 3 Descriptor							
1598	(00 00 00 38 h) 56 bytes of descriptor data <sup>1</sup>							
1599	SAS Expander Overall Element Descriptor							

Bit Byte	7	6	5	4	3	2	1	0
1602	(00 00 00 00 h)							
1603	SAS Expander Element 0 Descriptor							
1606	(00 00 00 00 h)							
1607	SAS Expander Element 1 Descriptor							
1610	(00 00 00 00 h)							
1611	SAS Connector Overall Element Descriptor							
1614	(00 00 00 00 h)							
1615	SAS Connector Element 0 Descriptor							
1638	(00 00 00 14 h)							
	20 bytes of descriptor data <sup>1</sup>							
...	...							
1695	SAS Connector Element 5 Descriptor							
1718	(00 00 00 14 h)							
	20 bytes of descriptor data <sup>1</sup>							
1719	SBB Midplane Interconnect Overall Element Descriptor							
1722	(00 00 00 00 h)							
1723	SBB Midplane Interconnect Element 0 Descriptor							
1726	(00 00 00 00 h)							
1727	SBB Midplane Interconnect Element 1 Descriptor							
1730	(00 00 00 00 h)							
1731	Enclosure Electronics Power Overall Element Descriptor							
1734	(00 00 00 00 h)							
1735	Enclosure Electronics Power Element 0 Descriptor							
1738	(00 00 00 00 h)							
1739	Enclosure Electronics Power Element 1 Descriptor							
1742	(00 00 00 00 h)							
1743	Enclosure Settings Overall Element Descriptor							
1746	(00 00 00 00 h)							
1747	Enclosure Settings Element 0 Descriptor							
1750	(00 00 00 00 h)							
1751	Enclosure Electronics Diagnostics Overall Element Descriptor							
1754	(00 00 00 00 h)							
1755	Enclosure Electronics Diagnostics Element 0 Descriptor							
1758	(00 00 00 00 h)							
1759	Enclosure Electronics Diagnostics Element 1 Descriptor							
1762	(00 00 00 00 h)							
<sup>1</sup> See section 4.4.1 for descriptor string format								

#### 4.4.1 Page 07h Descriptor Strings

The descriptor string formats used by each element that supports them are shown in Table 9. 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 9 - FRU Descriptor string formats**

Element Type	Descriptor String
Power Supply	<i>TP=XX;SN=XXXXXXXXXXXXXXXXXX;F1=XXXX;F2=XXXX;VR=XX;VC=XXXX XXXX;PN=XXXXXXXXXX;</i>
Temperature Sensor	<i>NM=XX;LO=XXXXXXXXXXXX XXXX;</i>
Enclosure Services Controller Electronics	<i>TP=XX;SN=XXXXXXXXXXXXXXXXXX;F1=XXXX;BL=XXXX;VR=XX;VC=XXXX XXXX;CR=XX;FR=XX;FC=XXXXXXXX;PN=XXXXXXXXXX;FF1=XXXXXXXX X;PC=XXXXXXXX;</i>
Enclosure	<i>SN=XXXXXXXXXXXXXXXXXX;VR=XX;VC=XXXXXXXX;CR=XX;PN=XXXXXX XXX;CM=XX;TP=XX;</i>
Voltage Sensor	<i>NM=XX;LO=XXXXXXXXXXXX XXXX;</i>
Current Sensor	<i>NM=XX;LO=XXXXXXXXXXXX XXXX;</i>
SAS Connector	<i>WN=XXXXXXXXXXXXXXXXXX;</i>

## 4.5 SES Page 0Ah Layout

SES Page 0Ah only reports phy descriptor data for elements that belong to the directly queried IOM. As such, the page layout differs when queried from IOM A or IOM B. Both page formats are shown in the sections below.

### 4.5.1 SES Page 0Ah Layout for SBB IOM A

**Table 10 - SES Page 0Ah Layout for SBB IOM A**

Bit Byte	7	6	5	4	3	2	1	0
0	PAGE CODE (0Ah)							
1	Reserved							
2	(MSB)	PAGE LENGTH (974)						(LSB)
3								
4	(MSB)	GENERATION CODE						(LSB)
7								
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	Phy Descriptor for Device 0 (SBB IOM A phy)							
43								
...								
Device Slot 23 Additional Status Descriptor								
836	INVALID	Reserved	EIP (1)	PROTOCOL IDENTIFIER (6)				
837	ADDITIONAL ELEMENT STATUS DESCRIPTOR LENGTH (34)							
838	Reserved							EIIOE (0)
839	ELEMENT INDEX (23)							
840	NUM OF DEVICE PHY DESCRIPTORS (1)							
841	DESC TYPE (0)	Reserved					NOT ALL PHYS (1)	
842	Reserved							
843	DEVICE SLOT NUMBER (23)							
844	Phy Descriptor for Device 23 (SBB IOM A phy)							
871								

Bit Byte	7	6	5	4	3	2	1	0
Expander 0 Additional Status Descriptor								
872	INVALID	Reserved		EIP (1)	PROTOCOL IDENTIFIER (6)			
873	ADDITIONAL ELEMENT STATUS DESCRIPTOR LENGTH (88)							
874	Reserved							EIIOE (0)
875	ELEMENT INDEX (54)							
876	NUM OF EXPANDER PHY DESCRIPTORS (37)							
877	DESC TYPE (1)		Reserved					
878	Reserved							
879	Reserved							
880	EXPANDER SAS ADDRESS							
887	EXPANDER SAS ADDRESS							
888	Phy Descriptor 0 for Expander 0 (SBB IOM A)							
889	Phy Descriptor 0 for Expander 0 (SBB IOM A)							
	...							
960	Phy Descriptor 36 for Expander 0 (SBB IOM A)							
961	Phy Descriptor 36 for Expander 0 (SBB IOM A)							
Expander 1 Additional Status Descriptor								
962	INVALID	Reserved		EIP (1)	PROTOCOL IDENTIFIER (6)			
963	ADDITIONAL ELEMENT STATUS DESCRIPTOR LENGTH (14)							
964	Reserved							EIIOE (0)
965	ELEMENT INDEX (55)							
966	NUM OF EXPANDER PHY DESCRIPTORS (0)							
967	DESC TYPE (1)		Reserved					
968	Reserved							
969	Reserved							
970	EXPANDER SAS ADDRESS							
977	EXPANDER SAS ADDRESS							

## 4.5.2 SES Page 0Ah Layout for SBB IOM B

**Table 11 - SES Page 0Ah Layout for SBB IOM B**

Bit Byte	7	6	5	4	3	2	1	0
0	PAGE CODE (0Ah)							
1	Reserved							
2	(MSB)	PAGE LENGTH (974)						(LSB)
3								
4	(MSB)	GENERATION CODE						(LSB)
7								
Device Slot 0 Additional Status Descriptor								
8	INVALID	Reserved	EIP (1)	PROTOCOL IDENTIFIER (6)				
9	ADDITIONAL ELEMENT STATUS DESCRIPTOR LENGTH (34)							
10	Reserved							EII OE (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	Phy Descriptor for Device 0 (SBB IOM B phy)							
43								
...								
Device Slot 23 Additional Status Descriptor								
836	INVALID	Reserved	EIP (1)	PROTOCOL IDENTIFIER (6)				
837	ADDITIONAL ELEMENT STATUS DESCRIPTOR LENGTH (34)							
838	Reserved							EII OE (0)
839	ELEMENT INDEX (23)							
840	NUM OF DEVICE PHY DESCRIPTORS (1)							
841	DESC TYPE (0)	Reserved						NOT ALL PHYS (1)
842	Reserved							
843	DEVICE SLOT NUMBER (23)							
844	Phy Descriptor for Device 23 (SBB IOM B phy)							
871								
Expander 0 Additional Status Descriptor								
872	INVALID	Reserved	EIP (1)	PROTOCOL IDENTIFIER (6)				
873	ADDITIONAL ELEMENT STATUS DESCRIPTOR LENGTH (14)							
874	Reserved							EII OE (0)
875	ELEMENT INDEX (54)							

Bit Byte	7	6	5	4	3	2	1	0
876	NUM OF EXPANDER PHY DESCRIPTORS (0)							
877	DESC TYPE (1)		Reserved					
878	Reserved							
879	Reserved							
880	EXPANDER SAS ADDRESS							
887	EXPANDER SAS ADDRESS							
Expander 1 Additional Status Descriptor								
888	INVALID	Reserved	EIP (1)	PROTOCOL IDENTIFIER (6)				
889	ADDITIONAL ELEMENT STATUS DESCRIPTOR LENGTH (88)							
890	Reserved							EIIOE (0)
891	ELEMENT INDEX (55)							
892	NUM OF EXPANDER PHY DESCRIPTORS (37)							
893	DESC TYPE (1)		Reserved					
894	Reserved							
895	Reserved							
896	EXPANDER SAS ADDRESS							
903	EXPANDER SAS ADDRESS							
904	Phy Descriptor 0 for Expander 0 (SBB IOM B)							
905	Phy Descriptor 0 for Expander 0 (SBB IOM B)							
	...							
976	Phy Descriptor 36 for Expander 0 (SBB IOM B)							
977	Phy Descriptor 36 for Expander 0 (SBB IOM B)							



## 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 12 covers the basic layout of page 91h for the documented product.

**Table 12 - SES Page 91h Layout**

Bit Byte	7	6	5	4	3	2	1	0
0	PAGE CODE (91h)							
1	Reserved							
2	(MSB)	PAGE LENGTH (2036)						(LSB)
3								
4	(MSB)	GENERATION CODE						(LSB)
7								
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						(LSB)
14								
15	Reserved							
16								
43	Phy 0 Statistics Descriptor <sup>1</sup>							
...	...							
996	Phy 35 Statistics Descriptor <sup>1</sup>							
1023								
Expander 1 Phy Statistics Descriptor								
1024	ELEMENT TYPE CODE (18h)							
1025	TYPE RELATIVE INDEX (1)							
1026	DESCRIPTOR FORMAT REVISION (01h)							
1027	NUMBER OF PHY STATISTICS DESCRIPTORS (37)							
1028	PHY STATISTICS DESCRIPTOR LENGTH (28)							
1029	(MSB)	EXPANDER CHANGE COUNT						(LSB)
1030								
1031	Reserved							
1032								
1059	Phy 0 Statistics Descriptor <sup>1</sup>							
...	...							

<b>Bit Byte</b>	7	6	5	4	3	2	1	0
2012	Phy 36 Statistics Descriptor <sup>1</sup>							
2039								
<sup>1</sup> 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 mimics 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 13 - SES Page 92h Layout**

Bit Byte	7	6	5	4	3	2	1	0
0	PAGE CODE (92h)							
1	Reserved							
2	(MSB)	PAGE LENGTH (3411)						(LSB)
3								
4	(MSB)	GENERATION CODE						(LSB)
7								
Extended Status Descriptor List								
8	Array Device Overall Element Descriptor							
11	(00 00 00 00 h)							
12	Array Device Element 0 Descriptor							
15	(00 00 00 00 h)							
...	...							
104	Array Device Element 23 Descriptor							
107	(00 00 00 00 h)							
108	Power Supply Overall Element Descriptor							
118	(03 00 00 07 h) 11 bytes of descriptor data							
119	Power Supply Element 0 Descriptor							
126	(01 00 00 04 h) 8 bytes of descriptor data							
127	Power Supply Element 1 Descriptor							
134	(01 00 00 04 h) 8 bytes of descriptor data							
135	Cooling Overall Element Descriptor							
138	(00 00 00 00 h)							
139	Cooling Element 0 Descriptor							
142	(00 00 00 00 h)							
...	...							
151	Cooling Element 3 Descriptor							
154	(00 00 00 00 h)							
155	Temperature Sensor Overall Element Descriptor							

Bit Byte	7	6	5	4	3	2	1	0
158	(00 00 00 00 h)							
159	Temperature Sensor Element 0 Descriptor							
162	(00 00 00 00 h)							
...	...							
187	Temperature Sensor Element 7 Descriptor							
190	(00 00 00 00 h)							
191	Audible Alarm Overall Element Descriptor							
194	(00 00 00 00 h)							
195	Audible Alarm Element 0 Descriptor							
198	(00 00 00 00 h)							
199	Enclosure Services Controller Electronics Overall Element Descriptor							
202	(00 00 00 00 h)							
203	Enclosure Services Controller Electronics Element 0 Descriptor							
206	(00 00 00 00 h)							
207	Enclosure Services Controller Electronics Element 1 Descriptor							
210	(00 00 00 00 h)							
211	Enclosure Overall Element Descriptor							
214	(00 00 00 00 h)							
215	Enclosure Element 0 Descriptor							
218	(00 00 00 00 h)							
219	Voltage Sensor Overall Element Descriptor							
222	(00 00 00 00 h)							
223	Voltage Sensor Element 0 Descriptor							
226	(00 00 00 00 h)							
...	...							
235	Voltage Sensor Element 3 Descriptor							
238	(00 00 00 00 h)							
239	Current Sensor Overall Element Status Descriptor							
242	(00 00 00 00 h)							
243	Current Sensor Element 0 Descriptor							
246	(00 00 00 00 h)							
...	...							
255	Current Sensor Element 3 Descriptor							
258	(00 00 00 00 h)							
259	SAS Expander Overall Element Descriptor							
262	(00 00 00 00 h)							
263	SAS Expander Element 0 Descriptor							
266	(00 00 00 00 h)							

Bit Byte	7	6	5	4	3	2	1	0
267	SAS Expander Element 1 Descriptor							
270	(00 00 00 00 h)							
271	SAS Connector Overall Element Descriptor							
274	(00 00 00 00 h)							
275	SAS Connector Element 0 Descriptor							
790	(01 00 XX XX h)							
	512 bytes of descriptor data <sup>1</sup>							
	...							
2855	SAS Connector Element 5 Descriptor							
3370	(01 00 XX XX h)							
	512 bytes of descriptor data <sup>1</sup>							
3371	SBB Midplane Interconnect Overall Element Descriptor							
3374	(00 00 00 00 h)							
3375	SBB Midplane Interconnect Element 0 Descriptor							
3378	(00 00 00 00 h)							
3379	SBB Midplane Interconnect Element 1 Descriptor							
3382	(00 00 00 00 h)							
3383	Enclosure Electronics Power Overall Element Descriptor							
3386	(00 00 00 00 h)							
3387	Enclosure Electronics Power Element 0 Descriptor							
3390	(00 00 00 00 h)							
3391	Enclosure Electronics Power Element 1 Descriptor							
3394	(00 00 00 00 h)							
3395	Enclosure Settings Overall Element Descriptor							
3398	(00 00 00 00 h)							
3399	Enclosure Settings Element 0 Descriptor							
3402	(00 00 00 00 h)							
3403	Enclosure Electronics Diagnostics Overall Element Descriptor							
3406	(00 00 00 00 h)							
3407	Enclosure Electronics Diagnostics Element 0 Descriptor							
3410	(00 00 00 00 h)							
3411	Enclosure Electronics Diagnostics Element 1 Descriptor							
3414	(00 00 00 00 h)							
<sup>1</sup> See [3] for extended status descriptor format for SAS connectors								

## 4.8 Vendor Unique Page 94h Layout

Vendor unique Page 94h is used to report enclosure phy status and perform phy management control. The layouts of the control and status pages are identical, however, the bit definitions within the descriptors vary (see [3] for details). Table 14 covers the basic layout of page 94h for the documented product.

**Table 14 - SES Page 94h Layout**

Bit Byte	7	6	5	4	3	2	1	0
0	PAGE CODE (94h)							
1	Reserved							
2	(MSB)	PAGE LENGTH (884)						(LSB)
3								
4	(MSB)	GENERATION CODE						(LSB)
7								
Expander 0 Phy Management Descriptor								
8	ELEMENT TYPE CODE (18h)							
9	TYPE RELATIVE INDEX (0)							
10	DESCRIPTOR FORMAT REVISION (01h)							
11	NUMBER OF PHY MANAGEMENT DESCRIPTORS (36)							
12	PHY MANAGEMENT DESCRIPTOR LENGTH (12)							
13	Reserved-Status/RQST ENB -Control							
14	Reserved							
15								
16	Phy 0 Management Descriptor <sup>1</sup>							
27								
...								
436	Phy 35 Management Descriptor <sup>1</sup>							
447								
Expander 1 Phy Management Descriptor								
448	ELEMENT TYPE CODE (18h)							
449	TYPE RELATIVE INDEX (1)							
450	DESCRIPTOR FORMAT REVISION (01h)							
451	NUMBER OF PHY MANAGEMENT DESCRIPTORS (36)							
452	PHY MANAGEMENT DESCRIPTOR LENGTH (12)							
453	Reserved-Status/RQST ENB -Control							
454	Reserved							
455								
456	Phy 0 Management Descriptor <sup>1</sup>							
467								
...								

<b>Bit Byte</b>	7	6	5	4	3	2	1	0
876								
887	Phy 35 Management Descriptor <sup>1</sup>							
<sup>1</sup> See [3] for full details on the format of the Phy Management status/control descriptor								