Exos E 5U84 Legacy JBOD

GEM 5 SES-3 Addenda

205135700-00-A
March 2023

Revision History

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

Table of Contents

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 5U84 Legacy JBOD product with physical phy mapping enabled. 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.

- UD-3584-E12EBD
- SP-3584-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
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.
Noncritical 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
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
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	84
02h	Power Supply	2
03h	Cooling Element	10
04h	Temperature Sensor	22
05h	Door Lock Sensor	2
06h	Audible Alarm	1
07h	Enclosure Services Controller Electronics	2
0Eh	Enclosure	1
12h	Voltage Sensor	4
13h	Current Sensor	4
18h	SAS Expander	10
19h	SAS Connector	18
Vendor Specific SES Elements		
86h	SBB Midplane Interconnect	2
88h	Enclosure Power	1
89h	Enclosure Electronics Power	2
8Ah	Enclosure Settings	1
8Bh	Enclosure Electronics Diagnostics	2

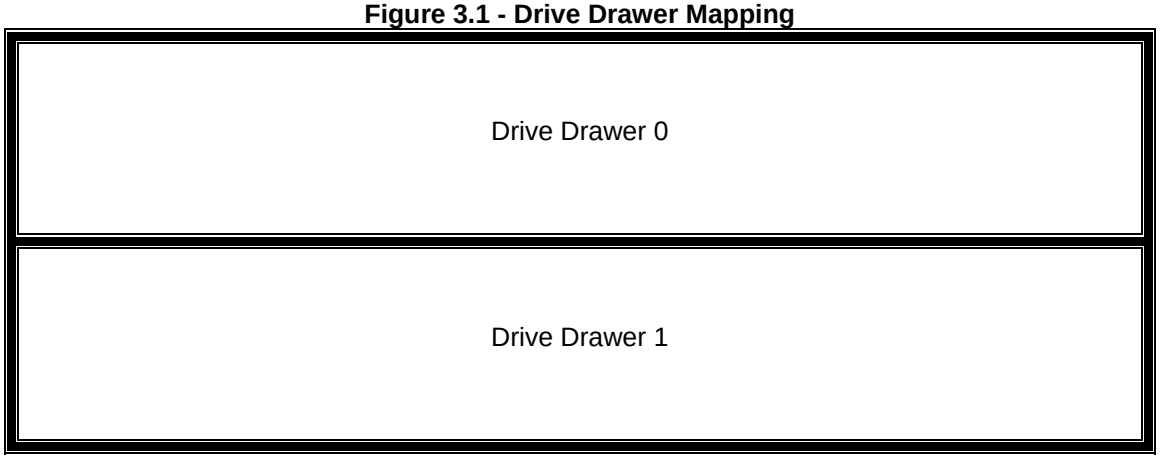
3 Element to Device Mapping

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 3.1 - Drive Drawer Mapping



3.1.2 Enclosure Top View

Figure 3.2 - Drive Bay numbering convention for drawer 0 (top drawer)

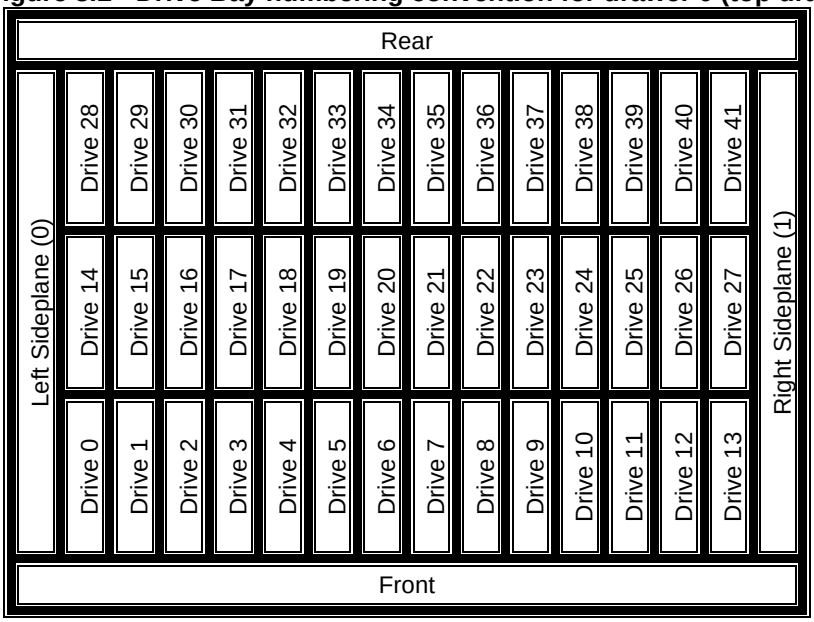
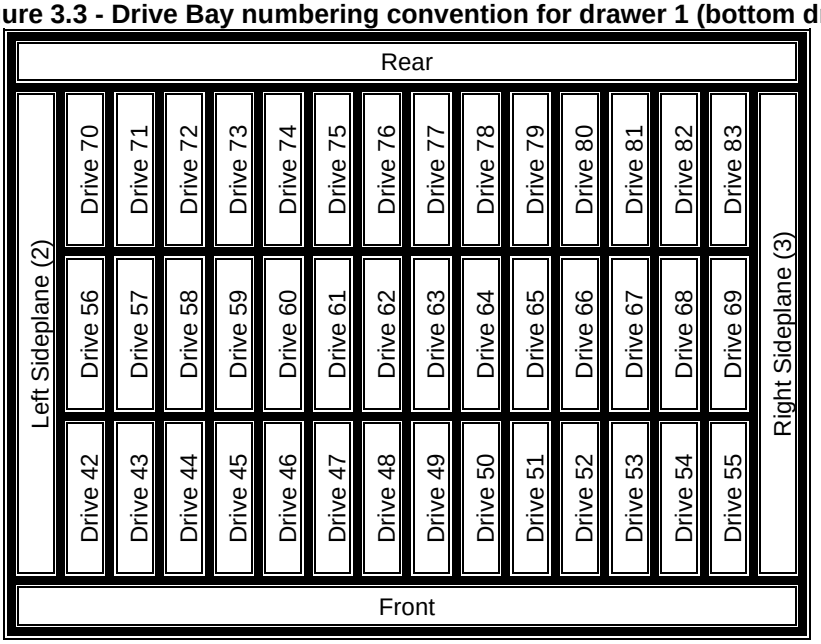
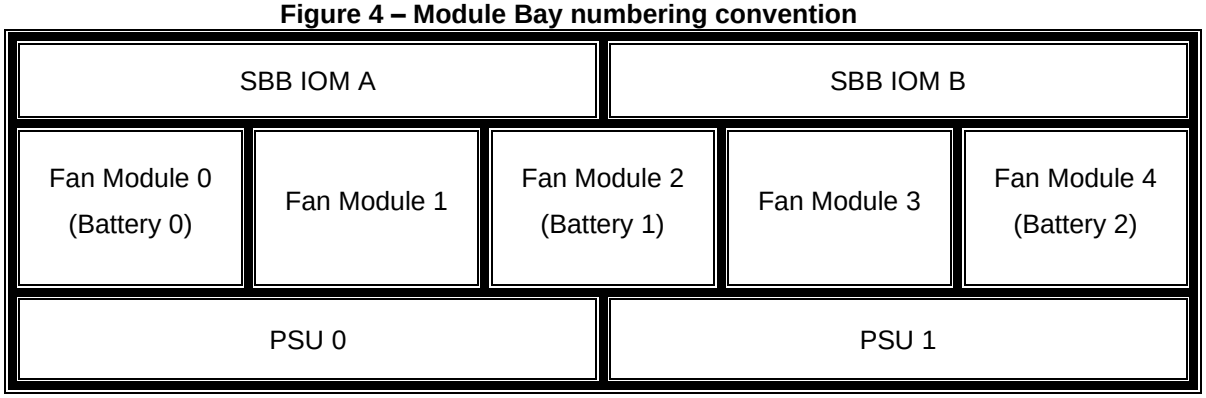


Figure 3.3 - Drive Bay numbering convention for drawer 1 (bottom drawer)



3.1.3 Enclosure Rear View

Figure 4 – 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
Array Device Elements			
0	0	Array Device element representing Disk Drive Bay 0	Drawer 0
…	…	…	…
41	41	Array Device element representing Disk Drive Bay 41	Drawer 0
42	42	Array Device element representing Disk Drive Bay 42	Drawer 1
…	…	…	…
83	83	Array Device element representing Disk Drive Bay 83	Drawer 1
Power Supply Elements			
84	0	Power Supply element representing PSU 0	PSU 0
85	1	Power Supply element representing PSU 1	PSU 1
Cooling Elements			
86	0	Cooling element representing Fan 0	Fan Module 0
87	1	Cooling element representing Fan 1	Fan Module 0
88	2	Cooling element representing Fan 2	Fan Module 1
89	3	Cooling element representing Fan 3	Fan Module 1
90	4	Cooling element representing Fan 4	Fan Module 2
91	5	Cooling element representing Fan 5	Fan Module 2
92	6	Cooling element representing Fan 6	Fan Module 3
93	7	Cooling element representing Fan 7	Fan Module 3
94	8	Cooling element representing Fan 8	Fan Module 4
95	9	Cooling element representing Fan 9	Fan Module 4
Temperature Sensor Elements			
96	0	Ambient Temperature Sensor 0	Sideplane 0
97	1	Ambient Temperature Sensor 2	Sideplane 2
98	2	Front-Right Baseplane Temperature Sensor	Drawer 0
99	3	Front-Right Baseplane Temperature Sensor	Drawer 1
100	4	Middle-Left Baseplane Temperature Sensor	Drawer 0
101	5	Middle -Left Baseplane Temperature Sensor	Drawer 1
102	6	Rear-Left Baseplane Temperature Sensor	Drawer 0
103	7	Rear-Left Baseplane Temperature Sensor	Drawer 1
104	8	Rear-Right Baseplane Temperature Sensor	Drawer 0
105	9	Rear-Right Baseplane Temperature Sensor	Drawer 1
106	10	24-port Expander Temperature Sensor	Sideplane 1
107	11	24-port Expander Temperature Sensor	Sideplane 3
108	12	24-port Expander Temperature Sensor	Sideplane 0
109	13	24-port Expander Temperature Sensor	Sideplane 2

Global Element Index	Relative Element Index	Description	Associated FRU
110	14	36-port Expander Temperature Sensor	Sideplane 0
111	15	36-port Expander Temperature Sensor	Sideplane 2
112	16	36-port Expander Temperature Sensor	Sideplane 1
113	17	36-port Expander Temperature Sensor	Sideplane 3
114	18	PSU Inlet Temperature Sensor	PSU 0
115	19	PSU Hotspot Temperature Sensor	PSU 0
116	20	PSU Inlet Temperature Sensor	PSU 1
117	21	PSU Hotspot Temperature Sensor	PSU 1
118	22	SBB IOM Inlet Temperature Sensor	SBB IOM A
119	23	SBB IOM Inlet Temperature Sensor	SBB IOM B
Door Lock Sensor Elements			
120	0	Drawer 0 Open Sensor	Drawer 0
121	1	Drawer 1 Open Sensor	Drawer 1
Audible Alarm Elements			
122	0	Ops Panel Buzzer State[1]	Enclosure
Enclosure Services Controller Electronics Elements			
123	0	Element associated with SEP device	SBB IOM A
124	1	Element associated with SEP device	SBB IOM B
Enclosure Elements			
125	0	Element representing the Enclosure	Enclosure
Voltage Sensor Elements			
126	0	+12V Rail Voltage Sensor	PSU 0
127	1	+5V Rail Voltage Sensor	PSU 0
128	2	+12V Rail Voltage Sensor	PSU 1
129	3	+5V Rail Voltage Sensor	PSU 1
Current Sensor Elements			
130	0	+12V Rail Current Sensor	PSU 0
131	1	+5V Rail Current Sensor	PSU 0
132	2	+12V Rail Current Sensor	PSU 1
133	3	+5V Rail Current Sensor	PSU 1
SAS Expander Elements			
134	0	36-port SAS Expander	Sideplane 0
135	1	24-port SAS Expander	Sideplane 0
136	2	36-port SAS Expander	Sideplane 1
137	3	24-port SAS Expander	Sideplane 1
138	4	36-port SAS Expander	Sideplane 2
139	5	24-port SAS Expander	Sideplane 2
140	6	36-port SAS Expander	Sideplane 3
141	7	24-port SAS Expander	Sideplane 3
142	8	SBB IOM SAS Expander	SBB IOM A
143	9	SBB IOM SAS Expander	SBB IOM B
SAS Connector Elements			
144	0	SAS Connector for IOM MiniSAS HD Port A	SBB IOM A

Global Element Index	Relative Element Index	Description	Associated FRU
145	1	SAS Connector for IOM MiniSAS HD Port B	SBB IOM A
146	2	SAS Connector for IOM MiniSAS HD Port C	SBB IOM A
147	3	SAS Connector for IOM MiniSAS HD Port A	SBB IOM B
148	4	SAS Connector for IOM MiniSAS HD Port B	SBB IOM B
149	5	SAS Connector for IOM MiniSAS HD Port C	SBB IOM B
150	6	SBB IOM A to Sideplane 1 36-port Expander SAS Connector A	SBB IOM A
151	7	SBB IOM A to Sideplane 1 36-port Expander SAS Connector B	SBB IOM A
152	8	SBB IOM A to Sideplane 1 24-port Expander SAS Connector A	SBB IOM A
153	9	SBB IOM A to Sideplane 3 24-port Expander SAS Connector A	SBB IOM A
154	10	SBB IOM A to Sideplane 3 36-port Expander SAS Connector A	SBB IOM A
155	11	SBB IOM A to Sideplane 3 36-port Expander SAS Connector B	SBB IOM A
156	12	SBB IOM B to Sideplane 0 24-port Expander SAS Connector A	SBB IOM B
157	13	SBB IOM B to Sideplane 0 36-port Expander SAS Connector B	SBB IOM B
158	14	SBB IOM B to Sideplane 0 36-port Expander SAS Connector A	SBB IOM B
159	15	SBB IOM B to Sideplane 2 36-port Expander SAS Connector A	SBB IOM B
160	16	SBB IOM B to Sideplane 2 36-port Expander SAS Connector B	SBB IOM B
161	17	SBB IOM B to Sideplane 2 24-port Expander SAS Connector A	SBB IOM B
SBB Midplane Interconnect Elements			
162	0	SBB IOM to Midplane Interconnect Electronics	SBB IOM A
163	1	SBB IOM to Midplane Interconnect Electronics	SBB IOM B
Enclosure Electronics Power Elements			
164	0	SBB IOM Power Status and Control	SBB IOM A
165	1	SBB IOM Power Status and Control	SBB IOM B
Enclosure Settings Elements			
166	0	Enclosure Ops Panel Settings	Enclosure
Enclosure Electronics Diagnostics Elements			
167	0	SEP Diagnostics status and Control	SBB IOM A
168	1	SEP Diagnostics status and Control	SBB IOM B

[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).

3.3 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 24-port Expander	*3,0,0*	*exp:1*
Sideplane 0 36-port Expander	*3,0,1*	*exp:0*
Sideplane 1 24-port Expander	*3,0,2*	*exp:3*
Sideplane 1 36-port Expander	*3,0,3*	*exp:2*
Sideplane 2 24-port Expander	*3,1,0*	*exp:5*
Sideplane 2 36-port Expander	*3,1,1*	*exp:4*
Sideplane 3 24-port Expander	*3,1,2*	*exp:7*
Sideplane 3 36-port Expander	*3,1,3*	*exp:6*

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 (**14**)						
3								(LSB)
4		SUPPORTED PAGE LIST (**00 01 02 03 05 07 0A 0E 84 85 90 91 92 94 h**)						
17								

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 (**267**)						
3								(LSB)
4	(MSB)	GENERATION CODE						
7								(LSB)
Enclosure Descriptor List[1]								
8	RSVD	RELATIVE ENCLOSURE SERVICES PROCESS ID (**1h**)			RSVD	NUMBER OF ENCLOSURE SERVICES PROCESSES (**2h**)		
9	SUBENCLOSURE IDENTIFIER (**00h**)							
10	NUMBER OF TYPE DESCRIPTOR HEADERS (**11h**)							
11	ENCLOSURE DESCRIPTOR LENGTH (**3Ch**)							
12	ENCLOSURE LOGICAL IDENTIFIER (**Determined by Midplane VPD**)							
19								
20	ENCLOSURE VENDOR IDENTIFICATION (“**SEAGATE** “)							
27								

Bit Byte	7	6	5	4	3	2	1	0
28	PRODUCT IDENTIFICATION (“**SP-3584-E12EBD** “)							
43								
44	PRODUCT REVISION LEVEL (**Determined by GEM firmware version**)							
47								
48	ENCLOSURE SERIAL NUMBER (**Determined by Midplane VPD**)							
62								
63	ENCLOSURE CONFIGURATION SETTINGS (**00h**)							
64	ENCLOSURE ID (**Determined by value of enclosure shelf ID**)							
66								
67	Reserved							
70								
71	ENCLOSURE OPTIONAL SETTINGS (**02h**)							
	Type Descriptor Header List[2]							
72	Array Device Descriptor (**17 54 00 00 h**)							
75								
76	Power Supply Descriptor (**02 02 00 00 h**)							
79								
80	Cooling Descriptor (**03 0A 00 00 h**)							
83								
84	Temperature Sensor Descriptor (**04 18 00 00 h**)							
87								
88	Door Lock Sensor Descriptor (**05 02 00 00 h**)							
91								
92	Audible Alarm Descriptor (**06 01 00 00 h**)							
95								
96	Enclosure Services Controller Electronics Descriptor (**07 02 00 00 h**)							
99								
100	Enclosure Descriptor (**0E 01 00 00 h**)							
103								
104	Voltage Sensor Descriptor (**12 04 00 00 h**)							
107								
108	Current Sensor Descriptor (**13 04 00 00 h**)							
111								
112	SAS Expander Descriptor (**18 0A 00 00 h**)							
115								
116	SAS Connector Descriptor (**19 12 00 00 h**)							
119								
120	SBB Midplane Interconnect Descriptor (**86 02 00 19 h**)							

Bit Byte	7	6	5	4	3	2	1	0
123								
124	Enclosure Power (**88 01 00 0F h**)							
127								
128	Enclosure Electronics Power Descriptor (**89 02 00 1B h**)							
131								
132	Enclosure Settings Descriptor (**8A 01 00 12 h**)							
135								
136	Enclosure Electronics Diagnostics Descriptor (**8B 02 00 21 h**)							
139								
140	Sideplane Descriptor (**90 04 00 09 h**)							
143								
Type Descriptor Text List[3]								
144	SBB Midplane Interconnect Text Descriptor (“**SBB Midplane Interconnect**”)							
168								
169	Enclosure Power Text Descriptor (“**Enclosure Power**”)							
183								
184	Enclosure Electronics Power Text Descriptor (“**Enclosure Electronics Power**”)							
210								
211	Enclosure Settings Text Descriptor (“**Enclosure Settings**”)							
228								
229	Enclosure Electronics Diagnostics Text Descriptor (“**Enclosure Electronics Diagnostics**”)							
261								
262	Sideplane Text Descriptor (“**Sideplane**”)							
270								

[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 (772)						
3								(LSB)
4	(MSB)	GENERATION CODE						
7								(LSB)
Status Descriptor List[2] (Page 02h) / Threshold Descriptor List[3] (Page 05h)								
8	Array Device Overall Element Descriptor							
11								
12	Array Device Element 0 Descriptor							
15								
	...							
344	Array Device Element 83 Descriptor							
347								
348	Power Supply Overall Element Descriptor							
351								
352	Power Supply Element 0 Descriptor							
355								
356	Power Supply Element 1 Descriptor							
359								
360	Cooling Overall Element Descriptor							
363								
364	Cooling Element 0 Descriptor							
367								
	...							
400	Cooling Element 9 Descriptor							
403								
404	Temperature Sensor Overall Element Descriptor							
407								
408	Temperature Sensor Element 0 Descriptor							
411								
	...							

Bit Byte	7	6	5	4	3	2	1	0
500	Temperature Sensor Element 23 Descriptor							
503								
504	Door Lock Sensor Overall Element Descriptor							
507								
508	Door Lock Sensor Element 0 Descriptor							
511								
512	Door Lock Sensor Element 1 Descriptor							
515								
516	Audible Alarm Overall Element Descriptor							
519								
520	Audible Alarm Element 0 Descriptor							
523								
524	Enclosure Services Controller Electronics Overall Element Descriptor							
527								
528	Enclosure Services Controller Electronics Element 0 Descriptor							
531								
532	Enclosure Services Controller Electronics Element 1 Descriptor							
535								
536	Enclosure Overall Element Descriptor							
539								
540	Enclosure Element 0 Descriptor							
543								
544	Voltage Sensor Overall Element Descriptor							
547								
548	Voltage Sensor Element 0 Descriptor							
551								
	...							
560	Voltage Sensor Element 3 Descriptor							
563								
564	Current Sensor Overall Element Status Descriptor							
567								
568	Current Sensor Element 0 Descriptor							
571								
	...							
580	Current Sensor Element 3 Descriptor							
583								
584	SAS Expander Overall Element Descriptor							
587								

Bit Byte	7	6	5	4	3	2	1	0
588	SAS Expander Element 0 Descriptor							
591								
	...							
624	SAS Expander Element 9 Descriptor							
627								
628	SAS Connector Overall Element Descriptor							
631								
632	SAS Connector Element 0 Descriptor							
635								
	...							
700	SAS Connector Element 17 Descriptor							
703								
704	SBB Midplane Interconnect Overall Element Descriptor							
707								
708	SBB Midplane Interconnect Element 0 Descriptor							
711								
712	SBB Midplane Interconnect Element 1 Descriptor							
715								
716	Enclosure Power Overall Element Descriptor							
719								
720	Enclosure Power Element Descriptor							
723								
724	Enclosure Electronics Power Overall Element Descriptor							
727								
728	Enclosure Electronics Power Element 0 Descriptor							
731								
732	Enclosure Electronics Power Element 1 Descriptor							
735								
736	Enclosure Settings Overall Element Descriptor							
739								
740	Enclosure Settings Element 0 Descriptor							
743								
744	Enclosure Electronics Diagnostics Overall Element Descriptor							
747								
748	Enclosure Electronics Diagnostics Element 0 Descriptor							
751								
752	Enclosure Electronics Diagnostics Element 1 Descriptor							
755								

Bit / Byte	7	6	5	4	3	2	1	0
756	Sideplane Overall Element Descriptor							
759								
760	Sideplane Element 0 Descriptor							
763								
	...							
772	Sideplane Element 3 Descriptor							
775								

[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

4.3.1 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 which element types are expected to 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 Power	No
Enclosure Electronics Power	No
Enclosure Settings	No
Enclosure Electronics Diagnostics	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 (**5175**)				
3								(LSB)
4	(MSB)			GENERATION CODE				
7								(LSB)
	Element Descriptor List							
8				Array Device Overall Element Descriptor (**00 00 00 00 h**)				
11								
12				Array Device Element 0 Descriptor (**00 00 00 00 h**)				
15								
	…							
344				Array Device Element 283 Descriptor (**00 00 00 00 h**)				
347								
348				Power Supply Overall Element Descriptor (**00 00 00 00 h**)				
351								
352				Power Supply Element 0 Descriptor (**00 00 00 49 h**)				
428				**73 bytes of descriptor data**[1]				
429				Power Supply Element 1 Descriptor (**00 00 00 49 h**)				
505				**73 bytes of descriptor data**[1]				
506				Cooling Overall Element Descriptor (**00 00 00 00 h**)				
509								
510				Cooling Element 0 Descriptor (**00 00 00 5B h**)				
604				**91 bytes of descriptor data**[1]				
	…							
1365	Cooling Element 9 Descriptor							

Bit Byte	7	6	5	4	3	2	1	0
1459	(**00 00 00 5B h**) **91 bytes of descriptor data**[1]							
1460	Temperature Sensor Overall Element Descriptor (**00 00 00 00 h**)							
1463								
1464	Temperature Sensor Element 0 Descriptor (**00 00 00 38 h**) **56 bytes of descriptor data**[1]							
1523								
	…							
2844	Temperature Sensor Element 23 Descriptor (**00 00 00 38 h**) **56 bytes of descriptor data**[1]							
2903								
2904	Door Lock Sensor Overall Element Descriptor (**00 00 00 00 h**)							
2907								
2908	Door Lock Sensor Element 0 Descriptor (**00 00 00 00 h**)							
2911								
2912	Door Lock Sensor Element 1 Descriptor (**00 00 00 00 h**)							
2915								
2916	Audible Alarm Overall Element Descriptor (**00 00 00 00 h**)							
2919								
2920	Audible Alarm Element 0 Descriptor (**00 00 00 00 h**)							
2923								
2924	Enclosure Services Controller Electronics Overall Element Descriptor (**00 00 00 00 h**)							
2927								
2928	Enclosure Services Controller Electronics Element 0 Descriptor (**00 00 00 7C h**) **124 bytes of descriptor data**[1]							
3055								
3056	Enclosure Services Controller Electronics Element 1 Descriptor (**00 00 00 7C h**) **124 bytes of descriptor data**[1]							
3183								
3184	Enclosure Overall Element Descriptor (**00 00 00 00 h**)							
3187								
3188	Enclosure Element 0 Descriptor (**00 00 00 47 h**) **71 bytes of descriptor data**[1]							
3262								
3263	Voltage Sensor Overall Element Descriptor (**00 00 00 00 h**)							
3266								
3267	Voltage Sensor Element 0 Descriptor (**00 00 00 38 h**) **56 bytes of descriptor data**[1]							
3326								
	…							
3447	Voltage Sensor Element 3 Descriptor (**00 00 00 38 h**) **56 bytes of descriptor data**[1]							
3506								
3507	Current Sensor Overall Element Status Descriptor (**00 00 00 00 h**)							
3510								

Bit Byte	7	6	5	4	3	2	1	0
3511	Current Sensor Element 0 Descriptor (**00 00 00 38 h**) **56 bytes of descriptor data**[1]							
3570								
	…							
3691	Current Sensor Element 3 Descriptor (**00 00 00 38 h**) **56 bytes of descriptor data**[1]							
3750								
3751	SAS Expander Overall Element Descriptor (**00 00 00 00 h**)							
3754								
3755	SAS Expander Element 0 Descriptor (**00 00 00 70 h**) **112 bytes of descriptor data**[1]							
3880								
	…							
4567	SAS Expander Element 7 Descriptor (**00 00 00 70 h**) **112 bytes of descriptor data**[1]							
4682								
4683	SAS Expander Element 8 Descriptor (**00 00 00 00 h**)							
4686								
4687	SAS Expander Element 9 Descriptor (**00 00 00 00 h**)							
4690								
4691	SAS Connector Overall Element Descriptor (**00 00 00 00 h**)							
4694								
4695	SAS Connector Element 0 Descriptor (**00 00 00 14 h**) **20 bytes of descriptor data**[1]							
4718								
	…							
5103	SAS Connector Element 17 Descriptor (**00 00 00 14 h**) **20 bytes of descriptor data**[1]							
5126								
5127	SBB Midplane Interconnect Overall Element Descriptor (**00 00 00 00 h**)							
5130								
5131	SBB Midplane Interconnect Element 0 Descriptor (**00 00 00 00 h**)							
5134								
5135	SBB Midplane Interconnect Element 1 Descriptor (**00 00 00 00 h**)							
5138								
5139	Enclosure Power Overall Element Descriptor (**00 00 00 00 h**)							
5142								
5143	Enclosure Power Element Descriptor (**00 00 00 00 h**)							
5146								
5147	Enclosure Electronics Power Overall Element Descriptor (**00 00 00 00 h**)							
5150								
5151	Enclosure Electronics Power Element 0 Descriptor (**00 00 00 00 h**)							
5154								
5155	Enclosure Electronics Power Element 1 Descriptor							

Bit Byte	7	6	5	4	3	2	1	0
5158	(**00 00 00 00 h**)							
5159	Enclosure Settings Overall Element Descriptor (**00 00 00 00 h**)							
5162								
5163	Enclosure Settings Element 0 Descriptor (**00 00 00 00 h**)							
5166								
5167	Enclosure Electronics Diagnostics Overall Element Descriptor (**00 00 00 00 h**)							
5170								
5171	Enclosure Electronics Diagnostics Element 0 Descriptor (**00 00 00 00 h**)							
5174								
5175	Enclosure Electronics Diagnostics Element 1 Descriptor (**00 00 00 00 h**)							
5178								

[1] See section 4.4.1 for descriptor string format, Descriptor length varies as per element value in run time

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;F3=XXXX;VR=XX; VC=XXXXXXXX;PN=XXXXXXXXXX;*
Cooling	*TP=XX;SN=XXXXXXXXXXXXXXX;CF=XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX;CC=XXXXXXXX;PN=XXXXXXXXXX;*
Temperature Sensor	*NM=XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX;LO=XXXXXXXXXXXXXXXX;*
Enclosure Services Controller Electronics	*TP=XX;SN=XXXXXXXXXXXXXXXXX;F1=XXXX;BL=XXXX;VR=XX;VC=XXXXXXXX;CR=XX;FR=XX;FC=XXXXXXXX;PN=XXXXXXXXXX;FF1=XXXXXXXXX;PC=XXXXXXXX;*
Enclosure	*SN=XXXXXXXXXXXXXXX;VR=XX;VC=XXXXXXXX;CR=XX; PN=XXXXXXXXXX;CM=XX;TP=XX;SN=XXXXXXXX;VR=XX;VC=XXXXXXXX;CR=XX;PN=XXXXXXXXXX*
Voltage Sensor	*NM=XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX;LO=XXXXXXXXXXXXXXXX;*
Current Sensor	*NM=XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX;LO=XXXXXXXXXXXXXXXX;*
SAS Expander	*BL=XXXX;FC=XXXXXXXX;VR=XX;VC=XXXXXXXX;CR=XX;PC=XXXXXXXX;F1=XXXX;FF1=XXXXXXXX;SN=XXXXXXXXXXXXXXX;PN=XXXXXXXXX;*
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. 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 11 - 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 (**3816**)						
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	Phy Descriptor for Device 0 (SBB IOM A phy)							
43								
	...							
Device Slot 83 Additional Status Descriptor								
2996	INVALID	Reserved			EIP (**1**)	PROTOCOL IDENTIFIER (**6**)		
2997	ADDITIONAL ELEMENT STATUS DESCRIPTOR LENGTH (**34**)							
2998	Reserved							EIIOE (**0**)
2999	ELEMENT INDEX (**83**)							
3000	NUM OF DEVICE PHY DESCRIPTORS (**1**)							
3001	DESC TYPE (**0**)		Reserved					NOT ALL PHYS (**1**)
3002	Reserved							
3003	DEVICE SLOT NUMBER (**83**)							
3004	Phy Descriptor for Device 83 (SBB IOM A phy)							
3031								

Bit Byte	7	6	5	4	3	2	1	0
Expander 0 Additional Status Descriptor								
3032	INVALID	Reserved		EIP (**1**)	PROTOCOL IDENTIFIER (**6**)			
3033	ADDITIONAL ELEMENT STATUS DESCRIPTOR LENGTH (**86**)							
3034	Reserved							EIIOE (**0**)
3035	ELEMENT INDEX (**134**)							
3036	NUM OF EXPANDER PHY DESCRIPTORS (**36**)							
3037	DESC TYPE (**1**)		Reserved					
3038	Reserved							
3039								
3040	EXPANDER SAS ADDRESS							
3047								
3048	Phy Descriptor 0 for Expander 0 (Sideplane 0)							
3049								
	…							
3118	Phy Descriptor 35 for Expander 0 (Sideplane 0)							
3119								
Expander 1 Additional Status Descriptor								
3120	INVALID	Reserved		EIP (**1**)	PROTOCOL IDENTIFIER (**6**)			
3121	ADDITIONAL ELEMENT STATUS DESCRIPTOR LENGTH (**162**)							
3122	Reserved							EIIOE (**0**)
3123	ELEMENT INDEX (**135**)							
3124	NUM OF EXPANDER PHY DESCRIPTORS (**24**)							
3125	DESC TYPE (**1**)		Reserved					
3126	Reserved							
3127								
3128	EXPANDER SAS ADDRESS							
3135								
3136	Phy Descriptor 0 for Expander 1 (Sideplane 0)							
3137								
	…							
3182	Phy Descriptor 23 for Expander 1 (Sideplane 0)							
3183								
Expander 2 Additional Status Descriptor								
3184	INVALID	Reserved		EIP (**1**)	PROTOCOL IDENTIFIER (**6**)			
3185	ADDITIONAL ELEMENT STATUS DESCRIPTOR LENGTH (**86**)							
3186	Reserved							EIIOE (**0**)
3187	ELEMENT INDEX (**136**)							

Bit Byte	7	6	5	4	3	2	1	0
3188	NUM OF EXPANDER PHY DESCRIPTORS (**36**)							
3189	DESC TYPE (**1**)		Reserved					
3190	Reserved							
3191								
3192	EXPANDER SAS ADDRESS							
3199								
3200	Phy Descriptor 0 for Expander 2 (Sideplane 1)							
3201								
	…							
3270	Phy Descriptor 35 for Expander 2 (Sideplane 1)							
3271								
Expander 3 Additional Status Descriptor								
3272	INVALID	Reserved		EIP (**1**)	PROTOCOL IDENTIFIER (**6**)			
3273	ADDITIONAL ELEMENT STATUS DESCRIPTOR LENGTH (**62**)							
3274	Reserved							EIIOE (**0**)
3275	ELEMENT INDEX (**137**)							
3276	NUM OF EXPANDER PHY DESCRIPTORS (**24**)							
3277	DESC TYPE (**1**)		Reserved					
3278	Reserved							
3279								
3280	EXPANDER SAS ADDRESS							
3287								
3288	Phy Descriptor 0 for Expander 3 (Sideplane 1)							
3289								
	…							
3334	Phy Descriptor 23 for Expander 3 (Sideplane 1)							
3335								
Expander 4 Additional Status Descriptor								
3336	INVALID	Reserved		EIP (**1**)	PROTOCOL IDENTIFIER (**6**)			
3337	ADDITIONAL ELEMENT STATUS DESCRIPTOR LENGTH (**86**)							
3338	Reserved							EIIOE (**0**)
3339	ELEMENT INDEX (**138**)							
3340	NUM OF EXPANDER PHY DESCRIPTORS (**36**)							
3341	DESC TYPE (**1**)		Reserved					
3342	Reserved							
3343								
3344	EXPANDER SAS ADDRESS							

Bit Byte	7	6	5	4	3	2	1	0
3351								
3352	Phy Descriptor 0 for Expander 4 (Sideplane 2)							
3353								
	…							
3422	Phy Descriptor 35 for Expander 4 (Sideplane 2)							
3423								
Expander 5 Additional Status Descriptor								
3424	INVALID	Reserved			EIP (**1**)	PROTOCOL IDENTIFIER (**6**)		
3425	ADDITIONAL ELEMENT STATUS DESCRIPTOR LENGTH (**62**)							
3426	Reserved							EIIOE (**0**)
3427	ELEMENT INDEX (**139**)							
3428	NUM OF EXPANDER PHY DESCRIPTORS (**24**)							
3429	DESC TYPE (**1**)		Reserved					
3430	Reserved							
3431								
3432	EXPANDER SAS ADDRESS							
3439								
3440	Phy Descriptor 0 for Expander 5 (Sideplane 2)							
3441								
	…							
3486	Phy Descriptor 23 for Expander 5 (Sideplane 2)							
3487								
Expander 6 Additional Status Descriptor								
3488	INVALID	Reserved			EIP (**1**)	PROTOCOL IDENTIFIER (**6**)		
3489	ADDITIONAL ELEMENT STATUS DESCRIPTOR LENGTH (**86**)							
3490	Reserved							EIIOE (**0**)
3491	ELEMENT INDEX (**140**)							
3492	NUM OF EXPANDER PHY DESCRIPTORS (**36**)							
3493	DESC TYPE (**1**)		Reserved					
3494	Reserved							
3495								
2496	EXPANDER SAS ADDRESS							
3503								
3504	Phy Descriptor 0 for Expander 6 (Sideplane 3)							
3505								
	…							
3574	Phy Descriptor 35 for Expander 6 (Sideplane 3)							

Bit / Byte	7	6	5	4	3	2	1	0
3575								
Expander 7 Additional Status Descriptor								
3576	INVALID	Reserved		EIP (**1**)	PROTOCOL IDENTIFIER (**6**)			
3577	ADDITIONAL ELEMENT STATUS DESCRIPTOR LENGTH (**62**)							
3578	Reserved							EIIOE (**0**)
3579	ELEMENT INDEX (**141**)							
3580	NUM OF EXPANDER PHY DESCRIPTORS (**24**)							
3581	DESC TYPE (**1**)			Reserved				
3582	Reserved							
3583								
3584	EXPANDER SAS ADDRESS							
3591								
3592	Phy Descriptor 0 for Expander 7 (Sideplane 3)							
3593								
	…							
3638	Phy Descriptor 23 for Expander 7 (Sideplane 3)							
3639								
Expander 8 Additional Status Descriptor								
3640	INVALID	Reserved		EIP (**1**)	PROTOCOL IDENTIFIER (**6**)			
3641	ADDITIONAL ELEMENT STATUS DESCRIPTOR LENGTH (**88**)							
3642	Reserved							EIIOE (**0**)
3643	ELEMENT INDEX (**142**)							
3644	NUM OF EXPANDER PHY DESCRIPTORS (**37**)							
3645	DESC TYPE (**1**)			Reserved				
3646	Reserved							
3647								
3648	EXPANDER SAS ADDRESS							
3655								
3656	Phy Descriptor 0 for Expander 8 (SBB IOM A)							
3657								
	…							
3728	Phy Descriptor 36 for Expander 8 (SBB IOM A)							
3729								
Expander 9 Additional Status Descriptor								
3730	INVALID	Reserved		EIP (**1**)	PROTOCOL IDENTIFIER (**6**)			
3731	ADDITIONAL ELEMENT STATUS DESCRIPTOR LENGTH (**88**)							
3732	Reserved							EIIOE (**0**)

Bit Byte	7	6	5	4	3	2	1	0
3733	ELEMENT INDEX (**143**)							
3734	NUM OF EXPANDER PHY DESCRIPTORS (**37**)							
3735	DESC TYPE (**1**)		Reserved					
3736	Reserved							
3737								
3738	EXPANDER SAS ADDRESS							
3745								
3746	Phy Descriptor 0 for Expander 9 (SBB IOM B)							
3747								
	...							
3818	Phy Descriptor 36 for Expander 9 (SBB IOM B)							
3819								

4.5.2 SES Page 0Ah Layout for SBB IOM B

Table 12 - 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 (**3816**)						
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	Phy Descriptor for Device 0 (SBB IOM B phy)							
43								
	...							
Device Slot 83 Additional Status Descriptor								
2996	INVALID	Reserved		EIP (**1**)	PROTOCOL IDENTIFIER (**6**)			
2997	ADDITIONAL ELEMENT STATUS DESCRIPTOR LENGTH (**34**)							
2998	Reserved							EIIOE (**0**)
2999	ELEMENT INDEX (**83**)							
3000	NUM OF DEVICE PHY DESCRIPTORS (**1**)							
3001	DESC TYPE (**0**)		Reserved					NOT ALL PHYS (**1**)
3002	Reserved							
3003	DEVICE SLOT NUMBER (**83**)							
3004	Phy Descriptor for Device 83 (SBB IOM B phy)							
3031								
Expander 0 Additional Status Descriptor								
3032	INVALID	Reserved		EIP (**1**)	PROTOCOL IDENTIFIER (**6**)			
3033	ADDITIONAL ELEMENT STATUS DESCRIPTOR LENGTH (**86**)							
3034	Reserved							EIIOE (**0**)
3035	ELEMENT INDEX (**185**)							

Bit / Byte	7	6	5	4	3	2	1	0
3036	NUM OF EXPANDER PHY DESCRIPTORS (**36**)							
3037	DESC TYPE (**1**)			Reserved				
3038	Reserved							
3039								
3040	EXPANDER SAS ADDRESS							
3047								
3048	Phy Descriptor 0 for Expander 0 (Sideplane 0)							
3049								
	…							
3118	Phy Descriptor 35 for Expander 0 (Sideplane 0)							
3119								
	Expander 1 Additional Status Descriptor							
3120	INVALID	Reserved		EIP (**1**)	PROTOCOL IDENTIFIER (**6**)			
3121	ADDITIONAL ELEMENT STATUS DESCRIPTOR LENGTH (**62**)							
3122	Reserved							EIIOE (**0**)
3123	ELEMENT INDEX (**186**)							
3124	NUM OF EXPANDER PHY DESCRIPTORS (**24**)							
3125	DESC TYPE (**1**)			Reserved				
3126	Reserved							
3127								
3128	EXPANDER SAS ADDRESS							
3135								
3136	Phy Descriptor 0 for Expander 1 (Sideplane 0)							
3137								
	…							
3182	Phy Descriptor 23 for Expander 1 (Sideplane 0)							
3183								
	Expander 2 Additional Status Descriptor							
3184	INVALID	Reserved		EIP (**1**)	PROTOCOL IDENTIFIER (**6**)			
3185	ADDITIONAL ELEMENT STATUS DESCRIPTOR LENGTH (**14**)							
3186	Reserved							EIIOE (**0**)
3187	ELEMENT INDEX (**187**)							
3188	NUM OF EXPANDER PHY DESCRIPTORS (**0**)							
3189	DESC TYPE (**1**)			Reserved				
3190	Reserved							
3191								
3192	EXPANDER SAS ADDRESS							

Bit Byte	7	6	5	4	3	2	1	0
3199								
3200	Phy Descriptor 0 for Expander 2 (Sideplane 1)							
3201								
	…							
3270	Phy Descriptor 35 for Expander 2 (Sideplane 1)							
3271								
Expander 3 Additional Status Descriptor								
3272	INVALID	Reserved			EIP (**1**)	PROTOCOL IDENTIFIER (**6**)		
3273	ADDITIONAL ELEMENT STATUS DESCRIPTOR LENGTH (**14**)							
3274	Reserved							EIIOE (**0**)
3275	ELEMENT INDEX (**188**)							
3276	NUM OF EXPANDER PHY DESCRIPTORS (**0**)							
3277	DESC TYPE (**1**)		Reserved					
3278	Reserved							
3279								
3280	EXPANDER SAS ADDRESS							
3287								
3288	Phy Descriptor 0 for Expander 3 (Sideplane 1)							
3289								
	…							
3334	Phy Descriptor 23 for Expander 3 (Sideplane 1)							
3335								
Expander 4 Additional Status Descriptor								
3336	INVALID	Reserved			EIP (**1**)	PROTOCOL IDENTIFIER (**6**)		
3337	ADDITIONAL ELEMENT STATUS DESCRIPTOR LENGTH (**86**)							
3338	Reserved							EIIOE (**0**)
3339	ELEMENT INDEX (1**89**)							
3340	NUM OF EXPANDER PHY DESCRIPTORS (**36**)							
3341	DESC TYPE (**1**)		Reserved					
3342	Reserved							
3343								
3344	EXPANDER SAS ADDRESS							
3351								
3352	Phy Descriptor 0 for Expander 4 (Sideplane 2)							
3353								
	…							
3422	Phy Descriptor 35 for Expander 4 (Sideplane 2)							

Bit / Byte	7	6	5	4	3	2	1	0
3423								
Expander 5 Additional Status Descriptor								
3424	INVALID	Reserved		EIP (**1**)	PROTOCOL IDENTIFIER (**6**)			
3425	ADDITIONAL ELEMENT STATUS DESCRIPTOR LENGTH (**62**)							
3426	Reserved							EIIOE (**0**)
3427	ELEMENT INDEX (**190**)							
3428	NUM OF EXPANDER PHY DESCRIPTORS (**24**)							
3429	DESC TYPE (**1**)			Reserved				
3430	Reserved							
3431								
3432	EXPANDER SAS ADDRESS							
3439								
3440	Phy Descriptor 0 for Expander 5 (Sideplane 2)							
3441								
	…							
3486	Phy Descriptor 23 for Expander 5 (Sideplane 2)							
3487								
Expander 6 Additional Status Descriptor								
3488	INVALID	Reserved		EIP (**1**)	PROTOCOL IDENTIFIER (**6**)			
3489	ADDITIONAL ELEMENT STATUS DESCRIPTOR LENGTH (**14**)							
3490	Reserved							EIIOE (**0**)
3491	ELEMENT INDEX (**191**)							
3492	NUM OF EXPANDER PHY DESCRIPTORS (**0**)							
3493	DESC TYPE (**1**)			Reserved				
3494	Reserved							
3495								
2496	EXPANDER SAS ADDRESS							
3503								
3504	Phy Descriptor 0 for Expander 6 (Sideplane 3)							
3505								
	…							
3574	Phy Descriptor 35 for Expander 6 (Sideplane 3)							
3575								
Expander 7 Additional Status Descriptor								
3576	INVALID	Reserved		EIP (**1**)	PROTOCOL IDENTIFIER (**6**)			
3577	ADDITIONAL ELEMENT STATUS DESCRIPTOR LENGTH (**14**)							
3578	Reserved							EIIOE (**0**)

Bit Byte	7	6	5	4	3	2	1	0
3579	ELEMENT INDEX (**192**)							
3580	NUM OF EXPANDER PHY DESCRIPTORS (**0**)							
3581	DESC TYPE (**1**)		Reserved					
3582	Reserved							
3583								
3584	EXPANDER SAS ADDRESS							
3591								
3592	Phy Descriptor 0 for Expander 7 (Sideplane 3)							
3593								
	…							
3638	Phy Descriptor 23 for Expander 7 (Sideplane 3)							
3639								
Expander 8 Additional Status Descriptor								
3640	INVALID	Reserved		EIP (**1**)	PROTOCOL IDENTIFIER (**6**)			
3641	ADDITIONAL ELEMENT STATUS DESCRIPTOR LENGTH (**14**)							
3642	Reserved							EIIOE (**0**)
3643	ELEMENT INDEX (**193**)							
3644	NUM OF EXPANDER PHY DESCRIPTORS (**0**)							
3645	DESC TYPE (**1**)		Reserved					
3646	Reserved							
3647								
3648	EXPANDER SAS ADDRESS							
3655								
3656	Phy Descriptor 0 for Expander 8 (SBB IOM B)							
3657								
	…							
3728	Phy Descriptor 36 for Expander 8 (SBB IOM B)							
3729								
Expander 9 Additional Status Descriptor								
3730	INVALID	Reserved		EIP (**1**)	PROTOCOL IDENTIFIER (**6**)			
3731	ADDITIONAL ELEMENT STATUS DESCRIPTOR LENGTH (**88**)							
3732	Reserved							EIIOE (**0**)
3733	ELEMENT INDEX (**194**)							
3734	NUM OF EXPANDER PHY DESCRIPTORS (**37**)							
3735	DESC TYPE (**1**)		Reserved					
3736	Reserved							
3737								

Bit Byte	7	6	5	4	3	2	1	0
3738	EXPANDER SAS ADDRESS							
3745								
3746	Phy Descriptor 0 for Expander 9 (SBB IOM A)							
3747								
	...							
3818	Phy Descriptor 36 for Expander 9 (SBB IOM A)							
3819								

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

Table 13 - SES Page 91h Layout

Bit / Byte	7	6	5	4	3	2	1	0
0	PAGE CODE (**91h**)							
1	Reserved							
2	(MSB)							
3	PAGE LENGTH (**8820**)							(LSB)
4	(MSB)							
7	GENERATION CODE							(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)							
14	EXPANDER CHANGE COUNT							(LSB)
15	Reserved							
16	Phy 0 Statistics Descriptor[1]							
43								
	...							
996	Phy 35 Statistics Descriptor[1]							
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 (**24**)							
1028	PHY STATISTICS DESCRIPTOR LENGTH (**28**)							
1029	(MSB)							
1030	EXPANDER CHANGE COUNT							(LSB)
1031	Reserved							
1032	Phy 0 Statistics Descriptor[1]							
1059								
	...							

Bit Byte	7	6	5	4	3	2	1	0
1676	Phy 23 Statistics Descriptor[1]							
1703								
	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	Phy 0 Statistics Descriptor[1]							
3739								
	...							
2692	Phy 35 Statistics Descriptor[1]							
2719								
	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	Phy 0 Statistics Descriptor[1]							
2756								
	...							
3372	Phy 23 Statistics Descriptor[1]							
3399								
	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						

Bit Byte	7	6	5	4	3	2	1	0
3406								(LSB)
3407	Reserved							
3408	Phy 0 Statistics Descriptor[1]							
3435								
	…							
3388	Phy 35 Statistics Descriptor[1]							
4415								
	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	Phy 0 Statistics Descriptor[1]							
4451								
	…							
5068	Phy 23 Statistics Descriptor[1]							
5095								
	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**)							
6001	(MSB) EXPANDER CHANGE COUNT							
6002								(LSB)
6003	Reserved							
6004	Phy 0 Statistics Descriptor[1]							
6031								
	…							
6084	Phy 35 Statistics Descriptor[1]							
6111								
	Expander 7 Phy Statistics Descriptor							
6112	ELEMENT TYPE CODE (**18h**)							

Bit / Byte	7	6	5	4	3	2	1	0
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	Phy 0 Statistics Descriptor[1]							
6147								
	…							
6764	Phy 23 Statistics Descriptor[1]							
6791								
	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 (**36**)							
6796	PHY STATISTICS DESCRIPTOR LENGTH (**28**)							
6797	(MSB)	EXPANDER CHANGE COUNT						
6798								(LSB)
6799	Reserved							
6800	Phy 0 Statistics Descriptor[1]							
6827								
	…							
7780	Phy 35 Statistics Descriptor[1]							
7807								
	Expander 9 Phy Statistics Descriptor							
7808	ELEMENT TYPE CODE (**18h**)							
7809	TYPE RELATIVE INDEX (**9**)							
7810	DESCRIPTOR FORMAT REVISION (**01h**)							
7811	NUMBER OF PHY STATISTICS DESCRIPTORS (**36**)							
7812	PHY STATISTICS DESCRIPTOR LENGTH (**28**)							
7813	(MSB)	EXPANDER CHANGE COUNT						
7814								(LSB)
7815	Reserved							
7816	Phy 0 Statistics Descriptor[1]							
7843								

Bit / Byte	7	6	5	4	3	2	1	0
	...							
8747	Phy 35 Statistics Descriptor[1]							
8823								

[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 14 - SES Page 92h Layout

Bit / Byte	7	6	5	4	3	2	1	0
0	PAGE CODE (**92h**)							
1	Reserved							
2	(MSB)			PAGE LENGTH (**3839**)				
3								(LSB)
4	(MSB)			GENERATION CODE				
7								(LSB)
	Extended Status Descriptor List							
8				Array Device Overall Element Descriptor (**00 00 00 00 h**)				
11								
12				Array Device Element 0 Descriptor (**00 00 00 00 h**)				
15								
	…							
344				Array Device Element 83 Descriptor (**00 00 00 00 h**)				
347								
348				Power Supply Overall Element Descriptor (**03 00 00 07 05 00 00 08 c1 00 03 h**)				
358				11 bytes of Descriptor data[1]				
359				Power Supply Element 0 Descriptor (**01 00 00 04 00 00 00 00 h**)				
366				8 bytes of Descriptor data[1]				
367				Power Supply Element 1 Descriptor (**01 00 00 04 00 00 00 00 h**)				
374				8 bytes of Descriptor data[1]				
375				Cooling Overall Element Descriptor (**00 00 00 00 h**)				
378								
379				Cooling Element 0 Descriptor (**00 00 00 00 h**)				
382								
	…							
415				Cooling Element 9 Descriptor (**00 00 00 00 h**)				
418								
419				Temperature Sensor Overall Element Descriptor (**00 00 00 00 h**)				
422								

Bit / Byte	7	6	5	4	3	2	1	0
423	Temperature Sensor Element 0 Descriptor (**00 00 00 00 h**)							
426								
	...							
515	Temperature Sensor Element 23 Descriptor (**00 00 00 00 h**)							
518								
519	Door Lock Sensor Overall Element Descriptor (**00 00 00 00 h**)							
522								
523	Door Lock Sensor Element 0 Descriptor (**00 00 00 00 h**)							
526								
527	Door Lock Sensor Element 1 Descriptor (**00 00 00 00 h**)							
530								
531	Audible Alarm Overall Element Descriptor (**00 00 00 00 h**)							
534								
535	Audible Alarm Element 0 Descriptor (**00 00 00 00 h**)							
538								
539	Enclosure Services Controller Electronics Overall Element Descriptor (**00 00 00 00 h**)							
542								
543	Enclosure Services Controller Electronics Element 0 Descriptor (**00 00 00 00 h**)							
546								
547	Enclosure Services Controller Electronics Element 1 Descriptor (**00 00 00 00 h**)							
550								
551	Enclosure Overall Element Descriptor (**00 00 00 00 h**)							
554								
555	Enclosure Element 0 Descriptor (**00 00 00 00 h**)							
558								
559	Voltage Sensor Overall Element Descriptor (**00 00 00 00 h**)							
562								
563	Voltage Sensor Element 0 Descriptor (**00 00 00 00 h**)							
566								
	...							
575	Voltage Sensor Element 3 Descriptor (**00 00 00 00 h**)							
578								
579	Current Sensor Overall Element Status Descriptor (**00 00 00 00 h**)							
582								
583	Current Sensor Element 0 Descriptor (**00 00 00 00 h**)							
586								
	...							
595	Current Sensor Element 35 Descriptor							

Bit / Byte	7	6	5	4	3	2	1	0
598	(**00 00 00 00 h**)							
592	SAS Expander Overall Element Descriptor (**00 00 00 00 h**)							
602								
603	SAS Expander Element 0 Descriptor (**00 00 00 00 h**)							
606								
	…							
639	SAS Expander Element 9 Descriptor (**00 00 00 00 h**)							
642								
643	SAS Connector Overall Element Descriptor (**00 00 00 00 h**)							
646								
647	SAS Connector Element 0 Descriptor (**01 00 02 00 … h**) 516 bytes of descriptor data[1]							
1162								
	…							
3227	SAS Connector Element 5 Descriptor (**01 00 02 00 … h**) 516 bytes of descriptor data[1]							
3742								
3743	SAS Connector Element 6 Descriptor (**00 00 00 00 h**)							
3746								
	…							
3777	SAS Connector Element 17 Descriptor (**00 00 00 00 h**)							
3790								
3791	SBB Midplane Interconnect Overall Element Descriptor (**00 00 00 00 h**)							
3794								
3795	SBB Midplane Interconnect Element 0 Descriptor (**00 00 00 00 h**)							
3798								
3799	SBB Midplane Interconnect Element 1 Descriptor (**00 00 00 00 h**)							
3802								
3803	Enclosure Power Overall Element Descriptor (**00 00 00 00 h**)							
3806								
3807	Enclosure Power Element 0 Descriptor (**00 00 00 00 h**)							
3810								
3811	Enclosure Electronics Power Overall Element Descriptor (**00 00 00 00 h**)							
3814								
3815	Enclosure Electronics Power Element 0 Descriptor (**00 00 00 00 h**)							
3818								
3819	Enclosure Electronics Power Element 1 Descriptor (**00 00 00 00 h**)							
3822								
3823	Enclosure Settings Overall Element Descriptor (**00 00 00 00 h**)							
3826								

Bit Byte	7	6	5	4	3	2	1	0
3827	Enclosure Settings Element 0 Descriptor (**00 00 00 00 h**)							
3830								
3831	Enclosure Electronics Diagnostics Overall Element Descriptor (**00 00 00 00 h**)							
3834								
3835	Enclosure Electronics Diagnostics Element 0 Descriptor (**00 00 00 00 h**)							
3838								
3839	Enclosure Electronics Diagnostics Element 1 Descriptor (**00 00 00 00 h**)							
3842								

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