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Information technology - SCSI Enclosure Services - 3 (SES-3)

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American National Standards
for Information Technology

SCSI Enclosure Services - 3 (SES-3)

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ABSTRACT

This standard describes a model for Small Computer System Interface (SCSI) access to services within an enclosure containing one or more SCSI devices. A SCSI command set is defined for managing various non-SCSI elements contained within the enclosure.

This standard maintains a high degree of compatibility with the SCSI Enclosure Services - 2 (SES-2) command set, INCITS 448-2008, and while providing additional functions, is not intended to require changes to presently installed devices or existing software.

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Foreword (This foreword is not part of this standard)

Requests for interpretation, suggestions for improvement and addenda, or defect reports are welcome. They should be sent to the INCITS Secretariat, International Committee for Information Technology Standards, Information Technology Institute, 1101 K Street, NW Suite 610, Washington, DC 20005-3922.

This standard was processed and approved for submittal to ANSI by the International Committee for Information Technology Standards (INCITS). Committee approval of the standard does not necessarily imply that all committee members voted for approval. At the time it approved this standard, INCITS had the following members:

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INCITS Technical Committee T10 - SCSI Storage Interfaces, which developed and reviewed this standard, had the following members:

Ralph Weber, Chair William Martin, Vice-Chair John Geldman, Secretary

Introduction

This standard is divided into the following clauses:

Clause 1 (Scope) describes the relationship of this standard to the SCSI family of standards.
Clause 2 (Normative references) provides references to other standards and documents.
Clause 3 (Definitions, symbols, abbreviations, and conventions) describes terms and conventions used throughout this standard.
Clause 4 (SCSI enclosure services model) describes the model for SCSI enclosure services peripheral devices, both standalone and attached.
Clause 5 (Commands for enclosure services peripheral devices) defines the command set for a SCSI enclosure services peripheral device.
Clause 6 (Parameters for enclosure services devices) defines diagnostic pages, log pages, and mode parameters and pages specific to SCSI enclosure services peripheral devices.
Clause 7 (Element definitions) defines elements used by several of the diagnostic pages.

SCSI Standards family

Figure 1 shows the relationship of this standard to the other standards and related projects in the SCSI family of standards. It is intended to show the general structure of SCSI standards, and is not intended to imply a relationship such as a hierarchy, protocol stack, or system architecture.

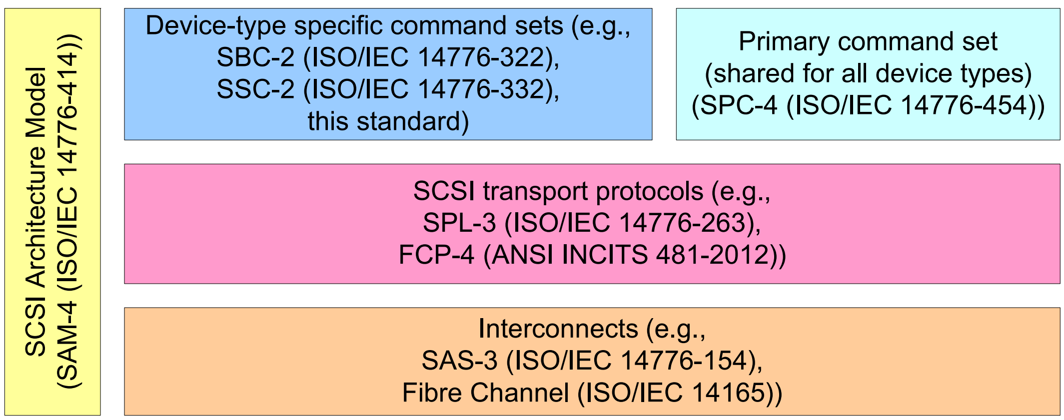

Figure 1 — SCSI document relationships

The set of SCSI standards specifies the interfaces, functions, and operations necessary to ensure interoperability between conforming SCSI implementations. This standard is a functional description. Conforming implementations may employ any design technique that does not violate interoperability.

American National Standard
for Information Technology -

SCSI Enclosure Services - 3 (SES-3)

1 Scope

This standard documents the commands and parameters necessary to manage and sense the state of the power supplies, cooling devices, displays, indicators, individual drives, and other non-SCSI elements installed in an enclosure. The command set uses the SCSI SEND DIAGNOSTIC and RECEIVE DIAGNOSTIC RESULTS commands (see SPC-5) to obtain configuration information for the enclosure and to set and sense standard bits for each type of element that may be installed in the enclosure.

The following concepts from previous versions of this standard are made obsolete by this standard:

a) Array Control and Array Status diagnostic pages (page code 06h); and
b) secondary subenclosure support in the Help Text, String Out, and String In diagnostic pages.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 639-1:2002, *Codes for the representation of names of languages - Part 1: Alpha-2 code*

ISO/IEC 8859-1:1998, *Information technology - 8-bit single-byte coded graphic character sets - Part 1: Latin alphabet No. 1*

ISO/IEC 10646:2003, *Information technology - Universal Multiple-Octet Coded Character Set (UCS)*

ISO/IEC 14165-122, *Fibre Channel Arbitrated Loop - 2 (FC-AL-2)* [ANSI INCITS 332-1999]

ISO/IEC 14776-152, *Serial Attached SCSI - 2 (SAS-2)* [ANSI INCITS 457-2010]

ISO/IEC 14776-372, *SCSI Enclosure Services - 2 (SES-2)* [ANSI INCITS 448-2008]

ISO/IEC 14776-342, *SCSI Controller Commands - 2 (SCC-2)* [ANSI INCITS 318-1998]

IEC 60027-2, *Letter symbols to be used in electrical technology - Part 2: Telecommunications and electronics*

ANSI INCITS 4-1986 (R2002), *Information Systems - Coded Character Sets - 7-Bit American National Standard Code for Information Interchange (7-Bit ASCII)*

ANSI INCITS 481-2012, *Fibre Channel Protocol - 4 (FCP-4) (planned as ISO/IEC 14776-224)*

ANSI INCITS 515-2016, *SCSI Architecture Model - 5 (SAM-5)* (planned as ISO/IEC 14776-415)

T10/BSR INCITS 502, *SCSI Primary Commands - 5 (SPC-5)* (planned as ISO/IEC 14776-455)

T10/BSR INCITS 506, *SCSI Block Commands 4 (SBC-4) (planned as ISO/IEC 14776-324)*

T10/BSR INCITS 534, *Serial Attached SCSI - 4* (SAS-4) (planned as ISO/IEC 14776-155)

T10/BSR INCITS 538, *SAS Protocol Layer - 4 (SPL-4)* (planned as ISO/IEC 14776-264)

NVM Express Specification (NVMe) Revision 1.1, October 11, 2012

NOTE 1 - For more information on the current status of NVM Express documents, contact NVM Express Inc. (see http://www.nvmexpress.org).

PCI Local Bus Specification (PCI) Revision 3.0, February 3, 2004

PCI Express Base Specification (PCIe) Revision 3.0, November 10, 2010

NOTE 2 - For more information on the current status of PCI documents, contact the PCI-SIG (see http://www.pcisig.com).

Serial ATA Revision 3.2 Specification (SATA). 7 August 2013

NOTE 3 - For information on the current status of Serial ATA documents, see the Serial ATA International Organization at http://www.sata-io.org.

SFF-8067, *Specification for 40-pin SCA-2 Connector w/Bidirectional ESI*

SFF-8087, *Compact Multilane Series: Unshielded*

SFF-8088, *Compact Multilane Series: Shielded*

SFF-8470, *Shielded High Speed Multilane Copper Connector*

SFF-8482, *Unshielded Dual Port Serial Attachment Connector*

SFF-8484, *Multi-Lane Unshielded Serial Attachment Connectors*

SFF-8639, *Multifunction 12Gb/s 6X Unshielded Connector*

SFF-8680, *Serial Attachment 12Gb/s 2x Unshielded connector*

NOTE 4 - For more information on the current status of the SFF documents, contact the SFF Committee at 408-867-6630 (phone), or 408-867-2115 (fax). To obtain copies of these documents, contact the SFF Committee at 14426 Black Walnut Court, Saratoga, CA 95070 at 408-867-6630 (phone) or 408-741-1600 (fax) or see http://www.sffcommittee.org.

3 Definitions, symbols, abbreviations, and conventions

3.1 Definitions

3.1.1 application client
class whose objects are, or an object that is, the source of commands (see 3.1.6) and task management function (see 3.1.40) requests

Note 1 to entry: See SAM-5.

3.1.2 ASCII string
string of US-ASCII characters each encoded in 8 bits per ISO/IEC 8859-1 containing only graphic characters (i.e., code values 20h through 7Eh)

Note 1 to entry: ASCII strings do not contain the NUL character (i.e., 00h).

3.1.3 attached enclosure services process
enclosure services process (see 3.1.17) that is attached to a device server (see 3.1.11) in another SCSI target device (see 3.1.33)

Note 1 to entry: See 4.1.3.

3.1.4 byte (B)
sequence of eight contiguous bits considered as a unit

3.1.5 class
description of a set of objects (see 3.1.26) that share the same characteristics

Note 1 to entry: See SAM-5.

3.1.6 command
request describing a unit of work to be performed by a device server (see 3.1.11)

Note 1 to entry: See SAM-5.

3.1.7 command descriptor block (CDB)
structure used to communicate a command (see 3.1.6) from an application client (see 3.1.1) to a device server (see 3.1.11)

Note 1 to entry: See SAM-5.

3.1.8 control element
data structure used to access an element (see 3.1.13) via the Enclosure Control diagnostic page (see 6.1.3)

Note 1 to entry: See clause 7.

3.1.9 critical condition
enclosure condition established if one or more elements inside the enclosure have failed or are operating outside of their specifications

Note 1 to entry: 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.

3.1.10 device
mechanical, electrical, or electronic contrivance with a specific purpose

3.1.11 device server
class whose objects process, or an object that processes, commands (see 3.1.6)

Note 1 to entry: See SAM-5.

3.1.12 device slot
position into which a SCSI device may be inserted in an enclosure

Note 1 to entry: The position provides appropriate power, signal, and control connections to the SCSI device. The position may also provide mechanical protection, locking capability, automatic insertion, visual device status indicators, and other features to manage the SCSI device in the enclosure.

3.1.13 element
portion of an enclosure (see 3.1.15) that is controlled, interrogated, or described by the enclosure services process (see 3.1.17)

3.1.14 element type
type or kind of element (see 3.1.13)(e.g., Array Device Slot, Power Supply, or Cooling)

Note 1 to entry: See clause 7.

3.1.15 enclosure
box, rack, or set of boxes providing the powering, cooling, mechanical protection, and external electronic interfaces for one or more SCSI devices

3.1.16 enclosure services (ES)
services that establish the mechanical environment, electrical environment, and external indicators and controls for the proper operation and maintenance of devices within an enclosure

3.1.17 enclosure services process
process that manages and implements enclosure services and is either a standalone enclosure services process (see 3.1.37) or an attached enclosure services process (see 3.1.3)

Note 1 to entry: See 4.1.

3.1.18 field
group of one or more contiguous bits

3.1.19 hard reset
condition resulting from the events defined by SAM-5 in which the SCSI device performs the hard reset operations described in SAM-5, this standard, and other applicable command standards (see table 8 in clause 5)

3.1.20 I_T nexus loss
condition resulting from the events defined by SAM-5 in which the SCSI device performs the I_T nexus loss operations described in SAM-5, this standard, and other applicable command standards (see table 8 in clause 5)

3.1.21 information condition
enclosure condition that should be made known to the application client (see 3.1.1)

Note 1 to entry: The condition is not an error and does not reduce the capabilities of the devices in the enclosure.

3.1.22 logical unit
class whose objects implement, or an object that implements, a device model that manages and processes commands (see 3.1.6) sent by an application client (see 3.1.1)

Note 1 to entry: See SAM-5.

3.1.23 logical unit number (LUN)
identifier for a logical unit

Note 1 to entry: See SAM-5.

3.1.24 logical unit reset
condition resulting from the events defined by SAM-5 in which the logical unit performs the logical unit reset operations described in SAM-5, this standard, and other applicable command standards (see table 8 in clause 5)

3.1.25 noncritical condition
enclosure condition established if one or more elements inside the enclosure have failed or are operating outside of their specifications

Note 1 to entry: 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.

3.1.26 object
entity with a well-defined boundary and identity that encapsulates state and behavior

Note 1 to entry: See SAM-5.

3.1.27 power on
condition resulting from the events defined by SAM-5 in which the SCSI device performs the power on operations described in SAM-5, this standard, and other applicable command standards (see table 8 in clause 5)

3.1.28 primary subenclosure
subenclosure (see 3.1.39) whose enclosure services process (see 3.1.17) provides access to the enclosure services information of all the subenclosures in an enclosure (see 3.1.15)

Note 1 to entry: See 4.3.

3.1.29 redundancy
presence in an enclosure of one or more elements capable of automatically taking over the functions of an element that has failed

3.1.30 SCSI initiator device
class whose objects originate, or an object that originates, device service and task management requests to be processed by a SCSI target device (see 3.1.33) and receives device service and task management responses from SCSI target devices

Note 1 to entry: See SAM-5.

3.1.31 SCSI initiator port
class whose objects act, or an object that acts, as the connection between application clients (see 3.1.1) and a service delivery subsystem through which requests, indications, responses, and confirmations are routed

Note 1 to entry: See SAM-5.

3.1.32 SCSI port
class whose objects connect, or an object that connects, the application client (see 3.1.1), device server (see 3.1.11), or task manager (see 3.1.41) to a service delivery subsystem

Note 1 to entry: A SCSI port is one of a SCSI initiator port (see 3.1.31) or a SCSI target port (see 3.1.34).

Note 2 to entry: See SAM-5.

3.1.33 SCSI target device
class whose objects receive, or an object that receives, device service and task management requests from SCSI initiator devices (see 3.1.33) for processing and sends device service and task management responses to SCSI initiator devices

Note 1 to entry: See SAM-5.

3.1.34 SCSI target port
class whose objects act, or an object that acts, as the connection between device servers (see 3.1.11) and task managers (see 3.1.41) and a service delivery subsystem through which requests, indications, responses, and confirmations are routed

Note 1 to entry: See SAM-5.

3.1.35 secondary subenclosure
subenclosure (see 3.1.39) whose enclosure services process (see 3.1.17) does not provide access to the enclosure services information of all the subenclosures in an enclosure (see 3.1.15)

Note 1 to entry: See 4.3.

3.1.36 simple subenclosure
subenclosure (see 3.1.39) that does not support any SES diagnostic page (see 6.1.1) except the Short Enclosure Status diagnostic page (see 6.1.11)

Note 1 to entry: See 4.3.3.

3.1.37 standalone enclosure services process
enclosure services process (see 3.1.17) that is also the device server (see 3.1.11)

Note 1 to entry: See 4.1.2.

3.1.38 status element
data structure used to access an element (see 3.1.13) via the Enclosure Status diagnostic page (see 6.1.4)

Note 1 to entry: See clause 7.

3.1.39 subenclosure
portion of an enclosure (see 3.1.15) accessed through a primary subenclosure's (see 3.1.28) enclosure services process (see 3.1.17)

Note 1 to entry: See 4.3.

3.1.40 task management function
task manager (see 3.1.41) service capable of being requested by an application client (see 3.1.1) to affect the processing of one or more commands (see 3.1.6)

Note 1 to entry: See SAM-5.

3.1.41 task manager
class whose objects control, or an object that controls the sequencing of commands (see 3.1.6) and processes task management functions (see 3.1.40)

Note 1 to entry: See SAM-5.

3.1.42 text string
string of characters using the character encoding and language indicated by the Language element (see 7.3.18) containing only graphic characters

Note 1 to entry: Text strings do not contain the NULL character (i.e., 00h or 0000h).

3.1.43 threshold control element
data structure used to access an element (see 3.1.13) via the Threshold Out diagnostic page (see 6.1.8)

Note 1 to entry: See clause 7.

3.1.44 threshold status element
data structure used to access an element (see 3.1.13) via the Threshold In diagnostic page (see 6.1.9)

Note 1 to entry: See clause 7.

3.1.45 type descriptor
type descriptor header (see 3.1.46) and corresponding type descriptor text, if any, accessed via the Configuration diagnostic page (see 6.1.2)

3.1.46 type descriptor header
data structure in the Configuration diagnostic page (see 6.1.2) defining a set of elements (see 3.1.13) sharing the same element type (see 3.1.14) and type descriptor text (see 3.1.47)

3.1.47 type descriptor text
text string (see 3.1.42) reported in the Configuration diagnostic page (see 6.1.2) describing the elements (see 3.1.13) defined by a type descriptor (see 3.1.45)

3.1.48 unrecoverable condition
enclosure condition established if one or more elements inside the enclosure have failed and have disabled some functions of the enclosure

Note 1 to entry: The enclosure may be incapable of recovering or bypassing the failure and requires repairs to correct the condition.

3.1.49 wrapping counter
counter that wraps back to zero after reaching its maximum value

3.2 Symbols and abbreviations

3.2.1 Abbreviations

Abbreviations used in this standard:

Abbreviation	Meaning
A.C.	alternating current
CDB	command descriptor block (see 3.1.7)
D.C.	direct current
ES	enclosure services (see 3.1.16)
ESI	enclosure services interface (see SFF-8067)
FCP	Fibre Channel Protocol standard (any version)(see clause 2)
FCP-4	Fibre Channel Protocol - 4 standard (see clause 2)

GPIO	general purpose input/output
LED	light emitting diode
LSB	least significant bit
LUN	logical unit number (see 3.1.23)
MSB	most significant bit
NVMe	Non-Volatile Memory Express (see NVM Express)
PCI	Peripheral Component Interconnect (see PCIe)
PCIe	PCI Express (see PCIe)
RMS	root mean squared
ROM	read only memory
SAM-5	SCSI Architecture Model - 5 standard (see clause 2)
SAS	Serial Attached SCSI standard (any version) (see clause 2)
SAS-2	Serial Attached SCSI - 2 standard (see clause 2)
SAS-4	Serial Attached SCSI - 4 standard (see clause 2)
SATA	Serial ATA (see clause 2)
SBC-4	SCSI Block Commands - 4 standard (see clause 2)
SCA-2	Single Connector Attach connector (see SFF-8067)
SCC	SCSI Controller Commands standard (any version) (see clause 2)
SCC-2	SCSI Controller Commands - 2 standard (see clause 2)
SCSI	Small Computer System Interface family of standards
SES-2	SCSI Enclosure Services - 2 standard (see clause 2)
SPC-4	SCSI Primary Commands - 4 standard (see clause 2)
SPC-5	SCSI Primary Commands - 5 standard (see clause 2)
SPL-4	SAS Protocol Layer - 4 standard (see clause 2)
SSP	Serial SCSI Protocol (see SPL-4)

3.2.2 Units

Units used in this standard:

Units	**Meaning**
A	ampere (i.e., unit of current)
^{o} C	degree celsius (i.e., unit of temperature)
mA	milliampere (i.e., 10^{-3} amperes)
mV	millivolt (i.e., 10^{-3} volts)
rpm	revolutions per minute
%	percent
s	second (i.e., a unit of time)
V	volt

3.2.3 Mathematical operators

Mathematical operators used in this standard:

Operator	**Meaning**
=	equal
+	addition
-	subtraction

3.3 Keywords

3.3.1 invalid

keyword used to describe an illegal or unsupported bit, byte, word, field or code value

Note 1 to entry: Receipt of an invalid bit, byte, word, field or code value shall be reported as an error.

3.3.2 mandatory
keyword indicating an item that is required to be implemented as defined in this standard

3.3.3 may
keyword that indicates flexibility of choice with no implied preference

Note 1 to entry: May is synonymous with the phrase “may or may not”.

3.3.4 may not
keywords that indicates flexibility of choice with no implied preference

Note 1 to entry: May not is synonymous with the phrase “may or may not”.

3.3.5 obsolete
keyword indicating that an item was defined in prior standards but has been removed from this standard

3.3.6 option, optional
keywords that describes features that are not required to be implemented by this standard

Note 1 to entry: If any optional feature defined in this standard is implemented, it shall be implemented as defined in this standard.

3.3.7 prohibited
keyword used to describe a feature, function, or coded value that is defined in a non-SCSI standard (i.e., a standard that is not a member of the SCSI family of standards) to which this standard makes a normative reference where the use of said feature, function, or coded value is not allowed for implementations of this standard

3.3.8 reserved
keyword referring to bits, bytes, words, fields and code values that are set aside for future standardization

Note 1 to entry: A reserved bit, byte, word or field shall be set to zero, or in accordance with a future extension to this standard.

Note 2 to entry: Recipients are not required to check reserved bits, bytes, words or fields for zero values. Receipt of reserved code values in defined fields shall be reported as an error.

3.3.9 shall
keyword indicating a mandatory requirement

Note 1 to entry: Designers are required to implement all such mandatory requirements to ensure interoperability with other products that conform to this standard.

3.3.10 should
keyword indicating flexibility of choice with a strongly preferred alternative

Note 1 to entry: Equivalent to the phrase “it is strongly recommended”.

3.3.11 vendor specific
specification of the referenced item is determined by the SCSI device vendor

Note 1 to entry: Specification of the referenced item is determined by the SCSI device vendor and may be used differently in various implementations.

3.4 Editorial conventions

Certain words and terms used in this standard have a specific meaning beyond the normal English meaning. These words and terms are defined either in clause 3 or in the text where they first appear.

Names of SCSI commands, statuses, sense keys, and additional sense codes are in all uppercase (e.g., SEND DIAGNOSTIC command).

Names of SCSI diagnostic pages, mode pages, log pages, and elements are in mixed case (e.g., Disconnect-Reconnect mode page).

Names of fields are in small uppercase (e.g., PAGE LENGTH). Normal case is used when the contents of a field are being discussed. Fields containing only one bit are usually referred to as the NAME bit instead of the NAME field.

Normal case is used for words having the normal English meaning.

Lists sequenced by lowercase or uppercase letters show no ordering relationship between the listed items.

EXAMPLE 1 -The following list shows no relationship between the colors named:

a) red (i.e., one of the following colors):
   A) crimson; or
   B) amber;
b) blue; or
c) green.

Lists sequenced by numbers show an ordering relationship between the listed items.

EXAMPLE 2 -The following list shows an ordered relationship between the named items:

1) top;
2) middle; and
3) bottom.

In the event of conflicting information the precedence for requirements defined in this standard is text; then tables; and finally figures. Not all tables or figures are fully described in the text. Tables show data format and values.

Notes do not constitute any requirements for implementors and notes are numbered consecutively throughout this standard.

3.5 Numeric and character conventions

3.5.1 Numeric conventions

A binary number is represented in this standard by any sequence of digits comprised of only the Arabic numerals 0 and 1 immediately followed by a lower-case b (e.g., 0101b). Underscores or spaces may be included in binary number representations to increase readability or delineate field boundaries (e.g., 0 0101 1010b or 0_0101_1010b).

A hexadecimal number is represented in this standard by any sequence of digits comprised of only the Arabic numerals 0 through 9 and/or the upper-case English letters A through F immediately followed by a lower-case h (e.g., FA23h). Underscores or spaces may be included in hexadecimal number representations to increase readability or delineate field boundaries (e.g., B FD8C FA23h or B_FD8C_FA23h).

A decimal number is represented in this standard by any sequence of digits comprised of only the Arabic numerals 0 through 9 not immediately followed by a lower-case b or lower-case h (e.g., 25).

A range of numeric values is represented in this standard in the form “a to z”, where a is the first value included in the range, all values between a and z are included in the range, and z is the last value included in the range (e.g., the representation “0h to 3h” includes the values 0h, 1h, 2h, and 3h).

This standard uses the following conventions for representing decimal numbers:

a) the decimal separator (i.e., separating the integer and fractional portions of the number) is a period;
b) the thousands separator (i.e., separating groups of three digits in a portion of the number) is a space;
c) the thousands separator is used in both the integer portion and the fraction portion of a number; and
d) the decimal representation for a year is 1999 not 1 999.

Table 1 shows some examples of decimal numbers represented using various conventions.

Table 1 — Numbering conventions examples

French	English	This standard
0,6	0.6	0.6
3,141 592 65	3.14159265	3.141 592 65
1 000	1,000	1 000
1 323 462,95	1,323,462.95	1 323 462.95

A decimal number represented in this standard with an overline over one or more digits following the decimal point is a number where the overlined digits are infinitely repeating (e.g., $666.\overline{6}$ means 666.666 666… or 666 2/3 and $12.\overline{142\ 857}$ means 12.142 857 142 857… or 12 1/7).

3.5.2 Units of measure

This standard represents values using both decimal units of measure and binary units of measure. Values are represented by the following formats:

a) for values based on decimal units of measure:
   1) numerical value (e.g., 100);
   2) space;
   3) prefix symbol and unit:
      1) decimal prefix symbol (e.g., M) (see table 2); and
      2) unit abbreviation (e.g., B);

   and
b) for values based on binary units of measure:
   1) numerical value (e.g., 1 024);
   2) space;
   3) prefix symbol and unit:
      1) binary prefix symbol (e.g., Gi) (see table 2); and
      2) unit abbreviation (e.g., b).

Table 2 compares the prefix, symbols, and power of the binary and decimal units.

Table 2 — Comparison of decimal prefixes and binary prefixes

Decimal			Binary		
Prefix name	Prefix symbol	Power (base-10)	Prefix name	Prefix symbol	Power (base-2)
kilo	k	10^3	kibi	Ki	2^{10}
mega	M	10^6	mebi	Mi	2^{20}
giga	G	10^9	gibi	Gi	2^{30}
tera	T	10^{12}	tebi	Ti	2^{40}
peta	P	10^{15}	pebi	Pi	2^{50}
exa	E	10^{18}	exbi	Ei	2^{60}
zetta	Z	10^{21}	zebi	Zi	2^{70}
yotta	Y	10^{24}	yobi	Yi	2^{80}

3.5.3 Byte encoded character strings conventions

When this standard requires one or more bytes to contain specific encoded characters, the specific characters are enclosed in single quotation marks. The single quotation marks identify the start and end of the characters that are required to be encoded but are not themselves to be encoded. The characters that are to be encoded are shown in the case that is to be encoded.

An ASCII space character (i.e., 20h) may be represented in a string by the character '¬' (e.g., 'SCSI¬device').

The encoded characters and the single quotation marks that enclose them are preceded by text that specifies the character encoding methodology and the number of characters required to be encoded.

EXAMPLE - Using the notation described in this subclause, stating that the eleven ASCII characters 'SCSI device' represent encoded characters is the same as writing out the following sequence of byte values: 53h 43h 53h 49h 20h 64h 65h 76h 69h 63h 65h.

3.6 Bit and byte ordering

In this standard, data structures may be defined by a table. A table defines a complete ordering of elements (i.e., bits, bytes, fields, and dwords) within the structure. The ordering of elements within a table does not in itself constrain the order of storage or transmission of the data structure, but in combination with other normative text in this standard, may constrain the order of storage or transmission of the structure.

Tables defining data structures are shown with one row per byte and one column per bit. The lowest byte offset is at the top and the highest byte offset is at the bottom. The least significant bit (LSB) of each byte is numbered 0 and is shown on the right, and the most significant bit (MSB) of each byte is numbered 7 and shown on the left.

In a field in a table consisting of more than one bit that contains a single value (e.g., a number), the least significant bit (LSB) is shown on the right and the most significant bit (MSB) is shown on the left (e.g., in a byte, bit 7 is the MSB and is shown on the left, bit 0 is the LSB and is shown on the right). The MSB and LSB are not labeled if the field consists of eight or fewer bits and is contained within one row. The MSB and LSB are labeled if the field consists of more than eight bits, crosses a row, and has no internal structure defined.

In a big-endian field, the byte containing the MSB is at the lowest byte offset and the byte containing the LSB is at the highest byte offset. The bits in big-endian fields are not shaded.

In a little-endian field, the byte containing the MSB is at the highest byte offset and the byte containing the LSB is at the lowest byte offset. The bits in little-endian fields are shaded.

In a field in a table consisting of more than one byte that contains multiple fields each with their own values (e.g., a descriptor), there is no MSB and LSB of the field itself and thus there are no MSB and LSB labels for that field. The MSB and LSB of each subfield may be shown in another table.

In a field containing a text string (e.g., ASCII or UTF-8), only the MSB of the first character and the LSB of the last character are labeled.

Multiple byte fields are represented with three rows, with the non-sequentially increasing byte numbers separated by a row labeled '...'.

Table 3 shows how this standard depicts a 32-bit big-endian field.

Table 3 — Example of a 32-bit big-endian field

Bit / Byte	7	6	5	4	3	2	1	0
•••	Other field(s), if any							
n	(MSB)							
•••	Field name							
n + 3								(LSB)
•••	Other field(s), if any							

Table 4 shows the bit numbers for the field shown in table 3.

Table 4 — Bit assignments in a 32-bit big-endian field

Bit / Byte	7	6	5	4	3	2	1	0
•••	Other field(s), if any							
n	(MSB) Bit 31	Bit 30	Bit 29	Bit 28	Bit 27	Bit 26	Bit 25	Bit 24
n + 1	Bit 23	Bit 22	Bit 21	Bit 20	Bit 19	Bit 18	Bit 17	Bit 16
n + 2	Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8
n + 3	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0 (LSB)
•••	Other field(s), if any							

EXAMPLE 1 - If the field in table 3 and table 4 contains a value of 00010203h, then:

a) byte n contains 00h;
b) byte n+1 contains 01h;
c) byte n+2 contains 02h; and
d) byte n+3 contains 03h.

Table 5 shows how this standard depicts a 32-bit little-endian field.

Table 5 — Example of a 32-bit little-endian field

Bit / Byte	7	6	5	4	3	2	1	0
•••	Other field(s), if any							
n								(LSB)
•••	Field name							
n + 3	(MSB)							
•••	Other field(s), if any							

Table 6 shows the bit numbers for the field shown in table 5.

Table 6 — Bit numbers for a 32-bit little-endian field

Bit / Byte	7	6	5	4	3	2	1	0
•••	Other field(s), if any							
n	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	(LSB) Bit 0
n + 1	Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8
n + 2	Bit 23	Bit 22	Bit 21	Bit 20	Bit 19	Bit 18	Bit 17	Bit 16
n + 3	Bit 31 (MSB)	Bit 30	Bit 29	Bit 28	Bit 27	Bit 26	Bit 25	Bit 24
•••	Other field(s), if any							

EXAMPLE 2 - If the field in table 5 and table 6 contains a value of 00010203h, then:

a) byte n contains 03h;
b) byte n+1 contains 02h;
c) byte n+2 contains 01h; and
d) byte n+3 contains 00h.

3.7 Data field requirements

3.7.1 ASCII data field requirements

ASCII data fields shall contain only ASCII printable characters (i.e., code values 20h to 7Eh) and may be terminated with one or more ASCII null (00h) characters.

ASCII data fields described as being left-aligned shall have any unused bytes at the end of the field (i.e., highest offset) and the unused bytes shall be filled with ASCII space characters (20h).

ASCII data fields described as being right-aligned shall have any unused bytes at the start of the field (i.e., lowest offset) and the unused bytes shall be filled with ASCII space characters (20h).

4 SCSI enclosure services model

4.1 Access to the enclosure services process

4.1.1 Access to the enclosure services process overview

Enclosures may provide power, cooling, and protection for devices. In addition, enclosures may provide external indicators about the state of the enclosure and devices. The indicators may identify the enclosure, identify proper operation of the devices and enclosure elements, provide indications of the state of RAID devices in the enclosure, and provide failure and maintenance information. Some of the individual elements of an enclosure may be removable and replaceable while the enclosure continues to operate. An enclosure services process typically manages all these enclosure elements and communicates with the SCSI application client. All those elements managed by the enclosure services process are in the enclosure domain of that process. The enclosure domain may extend outside the actual box containing the enclosure services process. As an example, an Uninterruptible Power Supply element may be located remotely and attached to the enclosure services process by a serial link.

The application client has two mechanisms for accessing the enclosure services process, both using the RECEIVE DIAGNOSTIC RESULTS command (see SPC-5) and SEND DIAGNOSTIC command (see SPC-5):

a) directly to a standalone enclosure services process (see 4.1.2); or
b) indirectly through a logical unit of another peripheral device type (e.g., a block device) to an attached enclosure services process (see 4.1.3).

4.1.2 Standalone enclosure services process

An application client may address the enclosure services process as a logical unit having the peripheral device type of enclosure services (i.e., 0Dh) (see the INQUIRY command in SPC-5). The commands for this peripheral device type are described in clause 5.

Standalone enclosure services processes shall set the ENCSERV bit to one in the Standard INQUIRY data (see SPC-5).

The application client uses the SEND DIAGNOSTIC command and the SES control-type diagnostic pages (see 6.1) to set various indicators and states within the enclosure domain, allowing the enclosure to provide the most appropriate environment for the other SCSI devices contained within it. Similarly, the application client requests information from the enclosure services process using the RECEIVE DIAGNOSTIC RESULTS command and the SES status-type diagnostic pages (see 6.1) to examine various status and warning information available from the enclosure. The diagnostic pages and page formats are defined in 6.1.

The Enclosure Services Management mode page (see 6.3.2) may be implemented by a standalone enclosure services process.

Figure 2 shows an example of an enclosure with a standalone enclosure services process.

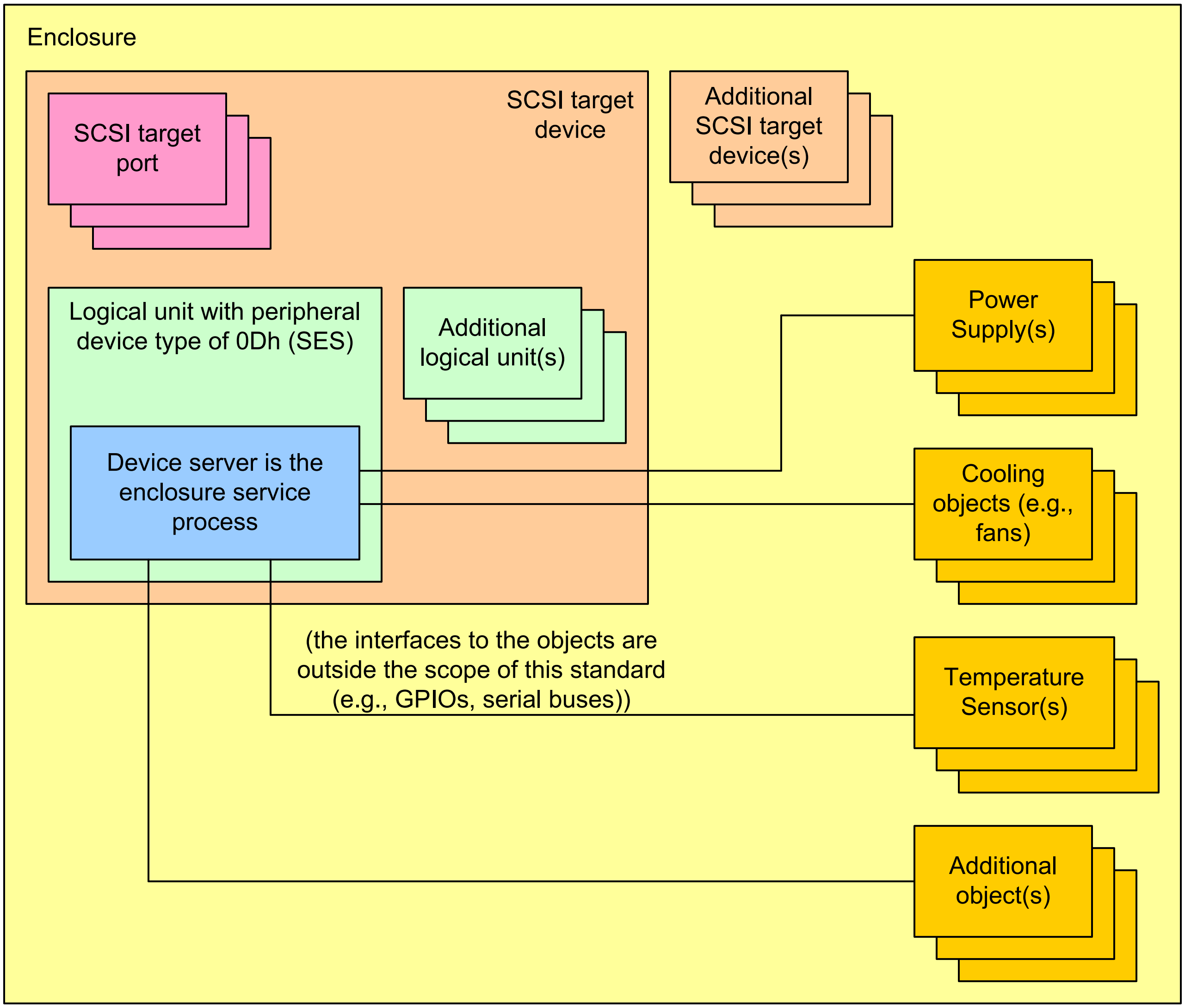

Figure 2 — Standalone enclosure services process

4.1.3 Attached enclosure services process

An application client may also be able to address the enclosure services process using a logical unit with some other peripheral device type (e.g., a block device) as a transport for enclosure services information. Such peripheral devices have a communications connection to the attached enclosure services process defined outside this standard (e.g., the Enclosure Services Interface (ESI) in SFF-8067). The attached enclosure services process is not accessible as its own logical unit; instead, it transports the standard enclosure services information through the addressed logical unit.

A device server with an attached enclosure services process shall set the ENCSERV bit to one in the Standard INQUIRY data (see SPC-5). The attached enclosure services process may or may not be currently attached.

Such device servers shall use the same SEND DIAGNOSTIC command and RECEIVE DIAGNOSTIC RESULTS command and page formats used by a standalone enclosure services process (see 4.1.2), but otherwise support the peripheral device model specified by their peripheral device type value.

An application client determines whether an enclosure services process is attached to the device server by using the RECEIVE DIAGNOSTIC RESULTS command to request a Configuration diagnostic page (see 6.1.2). If the device server is not able to communicate with an enclosure services process, the device server shall terminate the command as described in 4.8.

The Enclosure Services Management mode page (see 6.3.2) may be implemented by a logical unit that allows access to an attached enclosure services process.

NOTE 5 - One example using an attached enclosure services process is an enclosure of Fibre Channel disk drives with SCA-2 connectors defined in SFF-8067. The SCA-2 connector include pins for an Enclosure Services Interface (ESI). The backplane connects selected disk drives' ESI interfaces to an enclosure management processor serving as the attached enclosure services process.

Figure 3 shows an example of an enclosure with an attached enclosure services process.

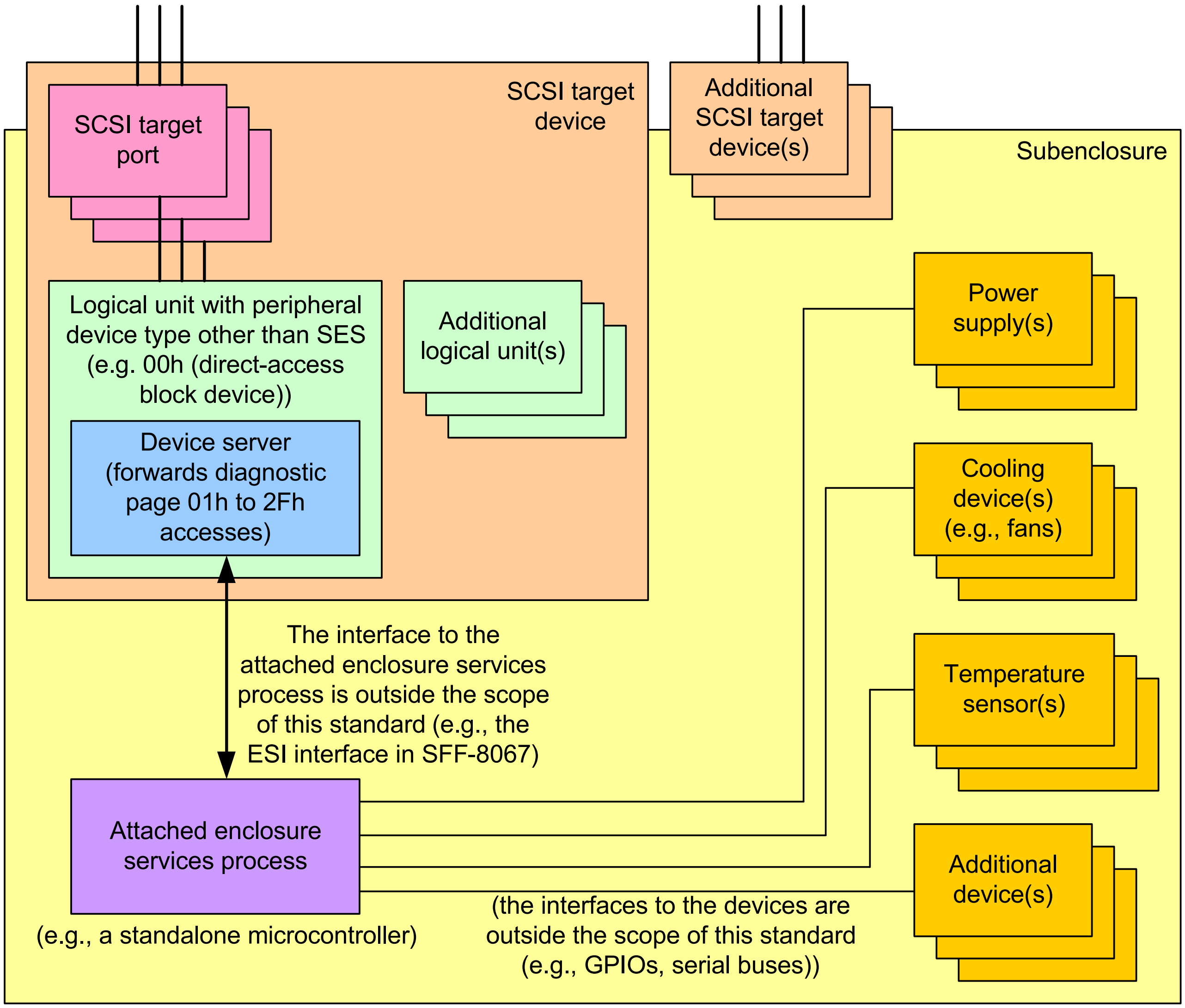

Figure 3 — Attached enclosure services process

The only SCSI device condition (see SAM-4) supported by an attached enclosure services process is power on (see 3.1.27). The logical unit does not communicate hard reset (see 3.1.19), logical unit reset (see 3.1.24), or I_T nexus loss (see 3.1.20) to the attached enclosure services process.

4.2 Management of indicators and controls

An application client uses the SEND DIAGNOSTIC command to transmit control information to the enclosure services process. The control information may include internal and external state indicators as well as instructions to the enclosure to perform certain operations or to modify its operating mode.

The internal and external state indicators may be set to one or zero by any application client. The instructions of the application client may be ignored or overridden by the enclosure services process to assure that the proper state information is available to any application client that wants to sense an indicator (e.g., an application client may set the CRIT bit to zero in the Enclosure Control diagnostic page (see 6.1.3) to specify that it believes that a critical condition does not exist in the enclosure. The enclosure may choose to ignore the instruction if a critical condition still exists.).

The instructions to the enclosure may be ignored by the enclosure services process if the instructions request an operation not implemented by the enclosure. Enclosure services processes may modify the values requested by an application client to the most appropriate value implemented in the enclosure. Instructions may also be ignored if the enclosure services process detects that the instructions would generate undesirable conditions within the enclosure. As an example, an application client may choose to save energy by selecting low fan speeds, but the enclosure services process may ignore the request because high ambient temperatures are present, requiring high fan speeds.

An application client uses the RECEIVE DIAGNOSTIC RESULTS command with the PCV bit set to one to obtain many kinds of enclosure status information. The information shall indicate the actual state of the enclosure. The actual state is a vendor specific combination of the indications set by the instructions from application clients and the indications established by the enclosure services process.

4.3 Subenclosures

4.3.1 Subenclosures overview

An enclosure consists of one subenclosure or multiple subenclosures.

If a single subenclosure is present, it is considered the primary subenclosure. There are no secondary subenclosures.

If multiple subenclosures are present:

a) the primary subenclosure is the subenclosure whose enclosure services process provides access to enclosure services information of all the subenclosures; and
b) all other subenclosures are considered secondary subenclosures.

Figure 4 shows an example of subenclosures.

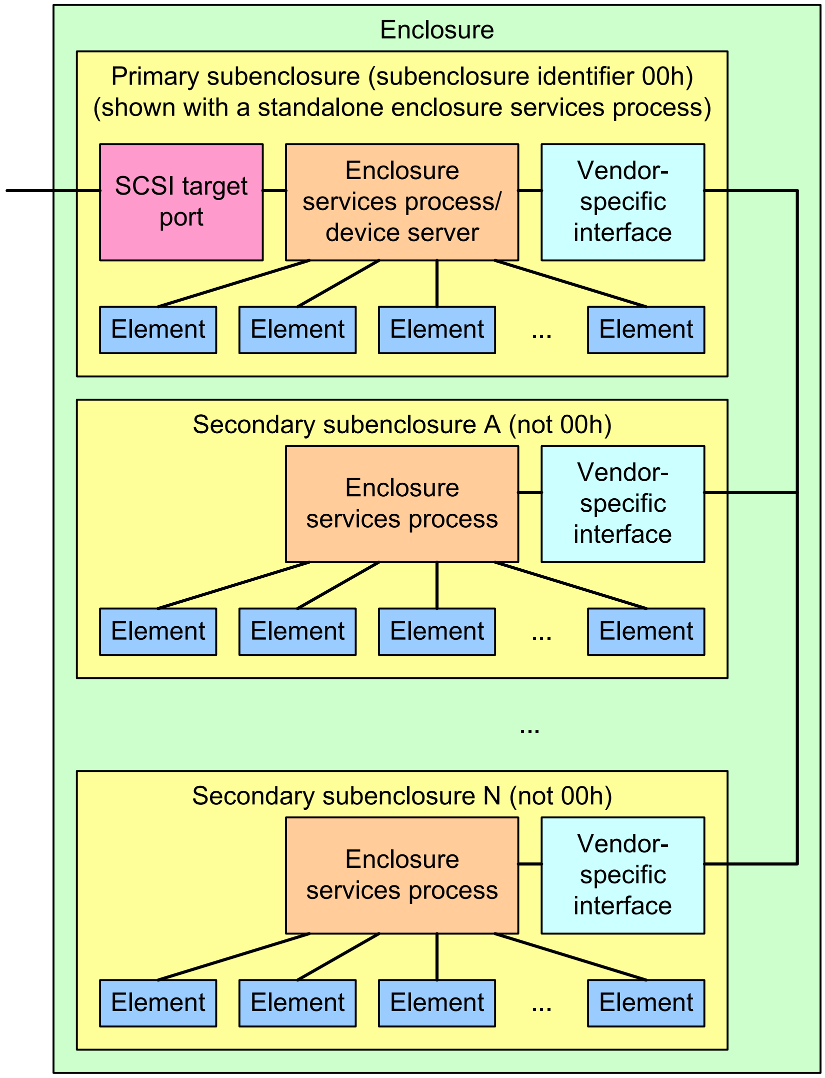

Figure 4 — Subenclosures

Each subenclosure is identified by a one-byte subenclosure identifier. The primary subenclosure shall have a subenclosure identifier of 00h. The primary subenclosure shall assign a non-zero subenclosure identifier for each secondary subenclosure. The relationship between the subenclosure identifier and the subenclosure's location is vendor specific.

The enclosure services information from multiple subenclosures is combined together into a single set of SES diagnostic pages by the primary subenclosure. The information from each subenclosure is distinguished in the Configuration diagnostic page (see 6.1.2) by its subenclosure identifier.

The primary subenclosure may access enclosure service information in a subenclosure using the SEND DIAGNOSTIC command and RECEIVE DIAGNOSTIC RESULTS command over a SCSI transport protocol, or may use a vendor specific interface.

4.3.2 Generation code

The primary subenclosure's enclosure services process shall maintain a four-byte wrapping counter (see 3.1.49) called the generation code. The generation code shall be incremented by one every time that the Configuration diagnostic page changes (e.g., there is a change in the number or configuration of subenclosures). The counter shall not be changed because of status element changes. Enclosures that do not change in configuration should set the generation code to 00000000h. If the generation code is at its maximum value (i.e., FFFFFFFFh), it shall wrap to 00000000h. The generation code should be set to 00000000h on power on.

The relationship between the subenclosure identifier and the subenclosure is fixed for a particular configuration and generation code. As subenclosures are added or removed, the configuration and generation code shall change. The addition or removal of a subenclosure may result in a change in the relationship between a physical subenclosure and the corresponding subenclosure identifier.

The generation code is reported in most SES status-type diagnostic pages (see 6.1). The expected generation code is used in most SES control-type diagnostic pages (see 6.1).

Standalone enclosure services processes (see 4.1.2) shall establish a unit attention condition (see SAM-5 and SPC-5) for all I_T nexuses if there is a change in the generation code. The additional sense code for the unit attention condition shall be TARGET OPERATING CONDITIONS HAVE CHANGED. The unit attention condition shall be cleared for all I_T nexuses without being reported if a RECEIVE DIAGNOSTIC RESULTS command is processed that requests the Configuration diagnostic page (i.e., the PCV bit is set to one and the PAGE CODE field is set to 01h).

Application clients accessing an attached enclosure services process (see 4.1.3) should verify that the generation code has not unexpectedly changed, since no unit attention condition is established by the device server.

4.3.3 Simple subenclosures

A simple subenclosure is a subenclosure that does not support any SES diagnostic page (see 6.1.1) except the Short Enclosure Status diagnostic page (see 6.1.11). If a simple subenclosure is a primary subenclosure, no secondary subenclosures exist.

The enclosure services process in a simple subenclosure shall always return the Short Enclosure Status diagnostic page, regardless of which SES diagnostic page is requested by a RECEIVE DIAGNOSTIC RESULTS command. If a simple subenclosure is used as a secondary subenclosure, it shall be represented by a Simple Subenclosure element (see 7.3.24).

The enclosure services process in a simple subenclosure shall terminate any SEND DIAGNOSTIC command using an SES diagnostic page code with CHECK CONDITION status with a sense key set to ILLEGAL REQUEST and an additional sense code set to UNSUPPORTED ENCLOSURE FUNCTION.

4.3.4 Multiple enclosure services processes in a subenclosure

A subenclosure may be managed by more than one enclosure services process, as shown in figure 5.

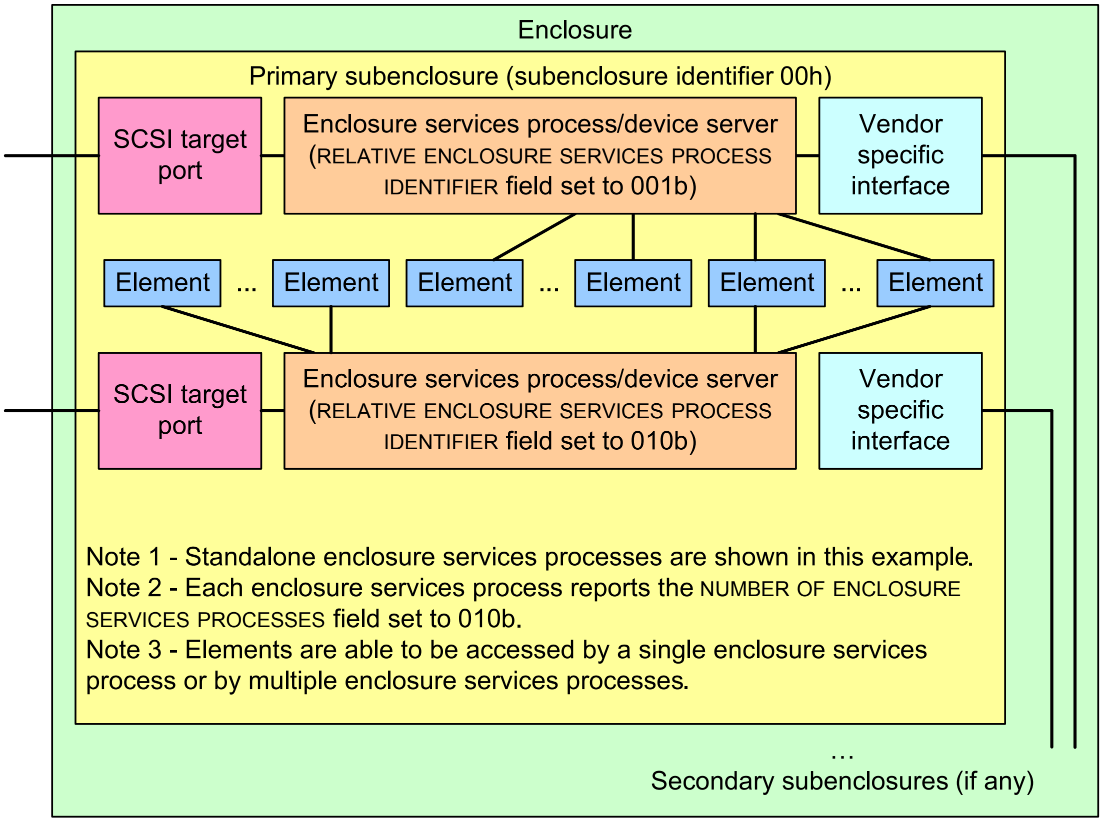

Figure 5 — Multiple enclosure service processes in a subenclosure

Elements may be accessible by one or more of the enclosure services processes. Coordination of access between multiple enclosure services processes is vendor specific.

4.4 Use of the Enclosure Busy diagnostic page

An enclosure services process may return the Enclosure Busy diagnostic page (see 6.1.12) with the BUSY bit set to one rather than the requested diagnostic page if the enclosure services process is temporarily unable to provide the requested diagnostic page.

4.5 Invalid field errors

A standalone enclosure services process (see 4.1.2) shall report errors detected while processing the SEND DIAGNOSTIC command and the RECEIVE DIAGNOSTIC RESULTS command as defined in SPC-5 (e.g., if the PAGE CODE field in the parameter list for the SEND DIAGNOSTIC command is set to an unsupported value, terminate the command with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST).

For an attached enclosure services process (see 4.1.3):

a) for the SEND DIAGNOSTIC command with the PF bit set to one and the PAGE CODE field in the parameter list set to a value in the SES diagnostic page code range (see 6.1.1), the device server is not capable of completely checking the fields in the CDB and parameter list. Instead, the device server shall pass the page code and parameter list to the attached enclosure services process and complete the command with GOOD status;
b) for the SEND DIAGNOSTIC command with PF bit set to zero or with the PF bit set to one and the PAGE CODE field in the parameter list set to a value outside the SES diagnostic page code range (see 6.1.1), the device server shall report errors detected while processing other fields in the CDB and while

processing parameter lists containing page codes outside the SES diagnostic page code range as defined in SPC-5;

c) for the RECEIVE DIAGNOSTIC RESULTS command with the PCV bit set to one and the PAGE CODE field set to a value in the SES diagnostic page code range (see 6.1.1), the device server is not capable of completely checking the fields in the CDB. Instead, the device server shall pass the page code to the attached enclosure services process, retrieve the diagnostic page, if any, from the attached enclosure services process and return it to the application client as parameter data, and complete the command with GOOD status; and
d) for the RECEIVE DIAGNOSTIC RESULTS command with the PCV bit set to zero or with the PCV bit set to one and the PAGE CODE field set to a value outside the SES diagnostic page code range (see 6.1.1), the device server shall report errors detected while processing other fields in the CDB and while processing page codes outside the SES diagnostic page code range as defined in SPC-5.

The attached enclosure services process uses the INVOP bit in the Enclosure Status diagnostic page (see 6.1.4) and the Threshold In diagnostic page (see 6.1.9) to report errors.

To report errors detected in the SEND DIAGNOSTIC command CDB fields or parameter list, the attached enclosure services process shall:

a) if the PAGE CODE field is set to an unsupported value, set the INVOP bit to one in the next Enclosure Status diagnostic page returned to any application client;
b) if the PAGE CODE field is set to 05h (i.e., Threshold Out diagnostic page) and that is a supported value, set the INVOP bit to one in the next Threshold In diagnostic page (see 6.1.9) returned to any application client; and
c) if the PAGE CODE field is set to a supported value other than 05h, set the INVOP bit to one in the next Enclosure Status diagnostic page (see 6.1.4) returned to any application client.

To report errors detected in the RECEIVE DIAGNOSTIC RESULTS command CDB fields, the attached enclosure services process shall:

a) if the PAGE CODE field is set to an unsupported value, return no data; and
b) if the PAGE CODE field is set to a supported value, set the INVOP (invalid operation requested) bit to one in the next Enclosure Status diagnostic page (see 6.1.4) returned to any application client. If this command is returning the Enclosure Status diagnostic page, report the error in this command.

The attached enclosure services process may include an Invalid Operation Reason element (see 7.3.12) in the element list to indicate the reason for the error.

4.6 Thresholds

For elements that have limited sensing capability (e.g., temperature sensors, uninterruptible power supplies, voltage sensors, and current sensors), an enclosure services process may support reporting if the element crosses certain threshold values:

a) a high critical threshold;
b) a high warning threshold;
c) a low warning threshold; and
d) a low critical threshold.

Thresholds are supported using the Threshold Out diagnostic page (see 6.1.8), the Threshold In diagnostic page (see 6.1.9), the threshold control element (see 7.2.4), and the threshold status element (see 7.2.4).

If the value of a sensed parameter increases above the high critical threshold value or falls below the low critical threshold value, the enclosure services process shall report a critical condition to the application client by one of the mechanisms defined in 4.7. For those device servers that use CHECK CONDITION status to indicate enclosure failures (see 4.7.4), the command shall be terminated and the sense key shall be set to HARDWARE ERROR and the additional sense code shall be set to ENCLOSURE FAILURE.

If the value of a sensed parameter increases above the high warning threshold value or falls below the low warning threshold value, the enclosure services process shall report a noncritical condition to the application client by one of the mechanisms defined in 4.7. For those device servers that use CHECK CONDITION status to indicate enclosure failures (see 4.7.4), the command shall be terminated with the sense key set to

RECOVERED ERROR and the additional sense code set to WARNING – ENCLOSURE DEGRADED.

4.7 Reporting methods

4.7.1 Reporting methods overview

Many enclosure functions are managed simply by setting controls and testing the status of the elements within an enclosure. However, the enclosure services process also monitors a variety of warning and error conditions. These conditions may be communicated to an application client using any of the following methods:

a) polling (see 4.7.2);
b) polling based on the timed completion function (see 4.7.3);
c) CHECK CONDITION status (see 4.7.4); and
d) asynchronous event notification (see 4.7.5).

4.7.2 Polling

The application client may periodically poll the enclosure by sending a RECEIVE DIAGNOSTIC RESULTS command requesting an Enclosure Status diagnostic page (see 6.1.4) with an allocation length greater than one. The information returned in byte 1 of the Enclosure Status diagnostic page includes bits that summarize the status of the enclosure and its elements as described in 6.1.4. If one of these bits is set to one, detailed information may then be obtained by the application client by sending a RECEIVE DIAGNOSTIC RESULTS command requesting a complete Enclosure Status diagnostic page, Help Text diagnostic page (see 6.1.5), or Subenclosure Help Text diagnostic page (see 6.1.14).

4.7.3 Timed completion function

The application client may enable the optional timed completion function using the Enclosure Services Management mode page (see 6.3.2). The application client may then periodically poll the enclosure by sending a RECEIVE DIAGNOSTIC RESULTS command requesting an Enclosure Status diagnostic page (see 6.1.4) with an allocation length greater than one. The return of the diagnostic page may be delayed until one or more of the bits in byte 1 of the diagnostic page are set to one. The command shall be completed by the device server before the time specified in the MAXIMUM TASK COMPLETION TIME field is exceeded whether or not one of these bits is set to one. This polling option allows the application client to access warning and error information at a time closer to the detection of the information by the enclosure services process.

4.7.4 CHECK CONDITION status

A standalone device server should not terminate a RECEIVE DIAGNOSTIC RESULTS command with CHECK CONDITION status to report warning conditions and failure conditions relating to enclosure services.

The device server may use informational exception conditions (see SPC-5) to indicate conditions that do not require any recovery action.

For attached enclosure services processes (see 4.1.3), the device server shall not terminate commands with CHECK CONDITION status to indicate the presence of information from the enclosure services process. Application clients shall use polling (see 4.7.2) to access the enclosure information through such device servers.

4.7.5 Asynchronous event notification

For standalone enclosure services processes with a SCSI target port using a SCSI transport protocol that supports notification of SES asynchronous events (e.g., Broadcast (SES) in SPL-4), the enclosure services process:

a) shall report an asynchronous event if the generation code changes (see 4.3.2);
b) shall report an asynchronous event if an element change results in a change to the PRDFAIL bit or the ELEMENT STATUS CODE field in a status element (see 7.2.3)(e.g., an element exceeds a threshold);
c) may report an asynchronous event if an element change does not result in a change to the PRDFAIL bit or the ELEMENT STATUS CODE field in a status element (see 7.2.3);

d) should report an asynchronous event if the Element Descriptor diagnostic page (see 6.1.10) changes;
e) should report an asynchronous event if the Short Enclosure Status diagnostic page (see 6.1.11) changes;
f) should report an asynchronous event if the Additional Element Status diagnostic page (see 6.1.13) changes;
g) should report an asynchronous event if the Download Microcode Status diagnostic page (see 6.1.19) changes to a code implementing completion; and
h) should report an asynchronous event if the Subenclosure Nickname Status diagnostic page (see 6.1.21) changes.

4.8 Additional sense codes

The additional sense code values defined for this standard are described in table 7. The values are assigned in SPC-5.

Table 7 — Sense keys and additional sense codes

Sense key	Additional sense code	Reason
HARDWARE ERROR	ENCLOSURE SERVICES FAILURE [a]	The enclosure services process has failed in an unknown manner.
	ENCLOSURE SERVICES TRANSFER FAILURE [a]	The device server communication with the enclosure services process has failed.
	ENCLOSURE FAILURE [b]	An unrecoverable enclosure failure (e.g., from a threshold exceeding a critical limit (see 4.6)) has been detected by the enclosure services process. Further information may be available using the RECEIVE DIAGNOSTIC RESULTS command and requesting the Enclosure Status diagnostic page (see 6.1.4).
HARDWARE ERROR or ILLEGAL REQUEST	ENCLOSURE SERVICES TRANSFER REFUSED [a]	The device server or the enclosure services process indicated either an error or an invalid format in their communication.
ILLEGAL REQUEST	UNSUPPORTED ENCLOSURE FUNCTION [a]	A SEND DIAGNOSTIC command has been attempted to a simple subenclosure (see 4.3.3).
NOT READY	ENCLOSURE SERVICES UNAVAILABLE [a]	The device server communication with the enclosure service process has encountered an error, but may become available again.
RECOVERED ERROR	WARNING – ENCLOSURE DEGRADED [b]	A noncritical failure (e.g., from a threshold exceeding a warning limit (see 4.6)) has been detected by the enclosure services process. This may be managed by the Informational Exceptions Control mode page (see SBC-4). Further information may be available using the RECEIVE DIAGNOSTIC RESULTS command and requesting the Enclosure Status diagnostic page (see 6.1.4).

[a] May be returned by any logical unit that provides access to enclosure services, either standalone (see 4.1.2) or attached (see 4.1.3).
[b] Should only be returned by a standalone enclosure services process in the sense data for a CHECK CONDITION status returned for a command other than RECEIVE DIAGNOSTIC RESULTS.

5 Commands for enclosure services peripheral devices

The commands for standalone enclosure services processes (i.e., logical units with the peripheral device type of enclosure services (i.e., 0Dh)) (see 4.1.2) are shown in table 8.

Table 8 — Commands for standalone enclosure services processes (part 1 of 2)

Command name	Operation code [a]	Type	Reference
CHANGE ALIASES	A4h/0Bh	O	SPC-5
INQUIRY [e]	12h	M	SPC-5
LOG SELECT	4Ch	O	SPC-5
LOG SENSE	4Dh	O	SPC-5
MAINTENANCE IN	A3h/00h to 04h A3h/06h to 09h	X [d]	SCC-2
MAINTENANCE OUT	A4h/00h to 05h A4h/07h to 09h	X [d]	SCC-2
MODE SELECT (10)	55h	O	SPC-5
MODE SELECT (6)	15h	O	SPC-5
MODE SENSE (10)	5Ah	O	SPC-5
MODE SENSE (6)	1Ah	O	SPC-5
PERSISTENT RESERVE IN	5Eh	O	SPC-5
PERSISTENT RESERVE OUT	5Fh	O	SPC-5
READ BUFFER	3Ch	O	SPC-5
RECEIVE DIAGNOSTIC RESULTS [b]	1Ch	M	SPC-5
REDUNDANCY GROUP IN	BAh	X [d]	SCC-2
REDUNDANCY GROUP OUT	BBh	X [d]	SCC-2
REPORT ALIASES	A3h/0Bh	O	SPC-5
REPORT IDENTIFYING INFORMATION	A3h/05h	O	SPC-5
REPORT LUNS	A0h	M	SPC-5
REPORT PRIORITY	A3h/0Eh	O	SPC-5
REPORT SUPPORTED OPERATION CODES	A3h/0Ch	O	SPC-5
REPORT SUPPORTED TASK MANAGEMENT FUNCTIONS	A3h/0Dh	O	SPC-5
REPORT TARGET PORT GROUPS	A3h/0Ah	O	SPC-5
REPORT TIMESTAMP	A3h/0Fh	O	SPC-5
REQUEST SENSE	03h	M	SPC-5
SEND DIAGNOSTIC [c]	1Dh	M	SPC-5
SET IDENTIFYING INFORMATION	A4h/06h	O	SPC-5
SET PRIORITY	A4h/0Eh	O	SPC-5

Table 8 — Commands for standalone enclosure services processes (part 2 of 2)

Command name	Operation code [a]	Type	Reference
SET TARGET PORT GROUPS	A4h/0Ah	O	SPC-5
SET TIMESTAMP	A4h/0Fh	O	SPC-5
SPARE IN	BCh	X [d]	SCC-2
SPARE OUT	BDh	X [d]	SCC-2
TEST UNIT READY	00h	M	SPC-5
VOLUME SET IN	BEh	X [d]	SCC-2
VOLUME SET OUT	BFh	X [d]	SCC-2
WRITE BUFFER	3Bh	O	SPC-5
Obsolete [f]			
Reserved	All others		

Key:
M = command implementation is mandatory.
O = command implementation is optional.
X = Command implementation requirements are detailed in the reference

[a] Some commands are defined by a combination of operation code and service action. The operation code value is shown preceding the slash and the service action value is shown after the slash.
[b] SES status-type diagnostic pages (see 6.1) are transferred by the RECEIVE DIAGNOSTIC RESULTS command with the PCV bit set to one.
[c] SES control-type diagnostic pages (see 6.1) are transferred by the SEND DIAGNOSTIC command with the PF bit set to one. Device servers are only required to accept a single diagnostic page in each command.
[d] If the SCCS bit is set to one in the standard INQUIRY data (see SPC-5), these commands shall be supported as required by SCC-2. If the SCCS bit is set to zero, these commands shall not be supported.
[e] In the standard INQUIRY data (see SPC-5), the MCHNGR bit shall be set to zero.
[f] The following operation codes are obsolete: 16h, 17h, 56h, and 57h.

All the commands are described in the referenced standards. The diagnostic pages accessed by the SEND DIAGNOSTIC command and the RECEIVE DIAGNOSTIC RESULTS command are defined in 6.1. The elements accessed by some of the diagnostic pages are defined in clause 7. The format for the mode parameters and mode page accessed by the MODE SELECT commands and the MODE SENSE commands are defined in 6.3.

6 Parameters for enclosure services devices

6.1 Diagnostic parameters

6.1.1 Diagnostic parameters overview

This clause defines the diagnostic page structure and the diagnostic pages that are applicable to enclosure services devices and other device types that provide communications access to an enclosure services process. Control pages are accessed with the SEND DIAGNOSTIC command. Status pages are accessed with the RECEIVE DIAGNOSTIC RESULTS command.

The diagnostic page format is specified in SPC-5. All diagnostic pages have the diagnostic page header defined in SPC-5, including the PAGE CODE and PAGE LENGTH fields.

The PAGE CODE field identifies the diagnostic page being sent or requested. The page codes are defined in table 9.

Table 9 — Diagnostic page codes for enclosure service devices (part 1 of 2)

Page code	Description [a]	Control or status	Type	Reference
00h	Supported Diagnostic Pages diagnostic page	Status	M	SPC-5
SES diagnostic pages				
01h	Configuration diagnostic page	Status	A	6.1.2
02h	Enclosure Control diagnostic page	Control	A	6.1.3
	Enclosure Status diagnostic page	Status	A	6.1.4
03h	Help Text diagnostic page	Status	B	6.1.5
04h	String Out diagnostic page	Control	B	6.1.6
	String In diagnostic page	Status	B	6.1.7
05h	Threshold Out diagnostic page	Control	B	6.1.8
	Threshold In diagnostic page	Status	B	6.1.9
06h	Obsolete			
07h	Element Descriptor diagnostic page	Status	B	6.1.10
08h	Short Enclosure Status diagnostic page	Status	O	6.1.11
09h	Enclosure Busy diagnostic page	Status	B	6.1.12
0Ah	Additional Element Status diagnostic page	Status	B	6.1.13
0Bh	Subenclosure Help Text diagnostic page	Status	B	6.1.14

Key:

M = Mandatory
O = Optional
A = mandatory if the Short Enclosure Status diagnostic page (see 6.1.11) is not supported, prohibited if the Short Enclosure Status diagnostic page is supported (i.e., in a simple subenclosure)
B = optional if the Short Enclosure Status diagnostic page is not supported, prohibited if the Short Enclosure Status diagnostic page is supported (i.e., in a simple subenclosure)

[a] A simple subenclosure responds with a Short Enclosure Status diagnostic page if any SES diagnostic page is requested by a RECEIVE DIAGNOSTIC RESULTS command. See 4.3.3.

Table 9 — Diagnostic page codes for enclosure service devices (part 2 of 2)

Page code	Description [a]	Control or status	Type	Reference
0Ch	Subenclosure String Out diagnostic page	Control	B	6.1.15
	Subenclosure String In diagnostic page	Status	B	6.1.16
0Dh	Supported SES Diagnostic Pages diagnostic page	Status	B	6.1.17
0Eh	Download Microcode Control diagnostic page	Control	B	6.1.18
	Download Microcode Status diagnostic page	Status	B	6.1.19
0Fh	Subenclosure Nickname Control diagnostic page	Control	B	6.1.20
	Subenclosure Nickname Status diagnostic page	Status	B	6.1.21
10h to 1Fh	vendor specific SES diagnostic pages			
20h to 2Fh	Reserved for this standard			
Additional non-SES diagnostic pages				
30h to 3Eh	Reserved for all peripheral device types			SPC-5
3Fh	See specific SCSI transport protocol for definition			SCSI transport protocol
40h to 7Fh	See specific peripheral device type for definition. Reserved for the SES peripheral device type			SPC-5
80h to FFh	vendor specific diagnostic pages			SPC-5

Key:

M = Mandatory
O = Optional
A = mandatory if the Short Enclosure Status diagnostic page (see 6.1.11) is not supported, prohibited if the Short Enclosure Status diagnostic page is supported (i.e., in a simple subenclosure)
B = optional if the Short Enclosure Status diagnostic page is not supported, prohibited if the Short Enclosure Status diagnostic page is supported (i.e., in a simple subenclosure)

[a] A simple subenclosure responds with a Short Enclosure Status diagnostic page if any SES diagnostic page is requested by a RECEIVE DIAGNOSTIC RESULTS command. See 4.3.3.

The Supported Diagnostic Pages diagnostic page defined in SPC-5 contains a list of all diagnostic page codes implemented by the device server in ascending order beginning with diagnostic page code 00h. If the device server is capable of accessing a diagnostic page that may temporarily or permanently be unavailable, then its diagnostic page code shall be included in the list. The unavailability of the resources necessary to transfer a diagnostic page shall not result in an error until a command attempts to access that diagnostic page.

Device servers supporting access to an attached enclosure services process (see 4.1.3) shall direct diagnostic pages 01h through 2Fh to the attached enclosure services process and shall report all diagnostic page codes 00h through 2Fh in the Supported Diagnostic Pages diagnostic page.

6.1.2 Configuration diagnostic page

6.1.2.1 Configuration diagnostic page overview

The Configuration diagnostic page returns information about the enclosure, including the list of elements in the enclosure. The element list shall include all elements with defined element status or controls and may list any other elements in the enclosure. The Configuration diagnostic page provides enclosure descriptor information and parameters. The Configuration diagnostic page may provide descriptive text identifying element types in more detail.

The Configuration diagnostic page is read by the RECEIVE DIAGNOSTIC RESULTS command with a PCV bit set to one and a PAGE CODE field set to 01h. A PAGE CODE field set to 01h in the parameter list for a SEND DIAGNOSTIC command is an invalid field error (see 4.5).

Table 10 defines the Configuration diagnostic page.

Table 10 — Configuration diagnostic page

Byte\Bit	7	6	5	4	3	2	1	0
0	PAGE CODE (01h)							
1	NUMBER OF SECONDARY SUBENCLOSURES							
2	(MSB)	PAGE LENGTH (n - 3)						
3								(LSB)
4	(MSB)	GENERATION CODE						
•••								
7								(LSB)
Enclosure descriptor list								
8	Enclosure descriptor(s) (one per subenclosure)(see table 11 in 6.1.2.2)							
Type descriptor header list (see 6.1.2.3)								
	Type descriptor header(s)(see table 12 in 6.1.2.3)							
Type descriptor text list (see 6.1.2.4)								
	Type descriptor text(s) (one per type descriptor header)(see 6.1.2.4)							
n								

The PAGE CODE field is set to 01h.

The NUMBER OF SECONDARY SUBENCLOSURES field indicates the number of secondary subenclosures included in the enclosure descriptor list. The primary subenclosure shall be described by the first enclosure descriptor. Secondary subenclosures shall be described in subsequent enclosure descriptors, and may be included in any order.

The PAGE LENGTH field indicates the number of bytes that follow in the diagnostic page.

The GENERATION CODE field indicates the value of the generation code (see 4.3.2).

The enclosure descriptor list contains an enclosure descriptor (see 6.1.2.2) for the primary subenclosure and each secondary subenclosure, if any. The first enclosure descriptor shall describe the primary subenclosure. Subsequent enclosure descriptors shall describe the secondary subenclosures, and may be in any order.

The type descriptor header list is defined in 6.1.2.3.

The type descriptor text list is defined in 6.1.2.4.

NOTE 6 - The type descriptor text list follows the complete type descriptor header list (i.e., after all type descriptor headers).

6.1.2.2 Enclosure descriptor

Table 11 defines the enclosure descriptor.

Table 11 — Enclosure descriptor

Byte\Bit	7	6	5	4	3	2	1	0
0	Reserved	RELATIVE ENCLOSURE SERVICES PROCESS IDENTIFIER			Reserved	NUMBER OF ENCLOSURE SERVICES PROCESSES		
1	SUBENCLOSURE IDENTIFIER							
2	NUMBER OF TYPE DESCRIPTOR HEADERS							
3	ENCLOSURE DESCRIPTOR LENGTH (m - 3)							
4 ••• 11	ENCLOSURE LOGICAL IDENTIFIER							
12 ••• 19	ENCLOSURE VENDOR IDENTIFICATION							
20 ••• 35	PRODUCT IDENTIFICATION							
36 ••• 39	PRODUCT REVISION LEVEL							
40 ••• m	VENDOR SPECIFIC ENCLOSURE INFORMATION							

The RELATIVE ENCLOSURE SERVICES PROCESS IDENTIFIER field identifies the enclosure services process relative to other enclosure services processes in the subenclosure. A value of 0h is reserved.

The NUMBER OF ENCLOSURE SERVICES PROCESSES field indicates the number of enclosure services processes in the subenclosure. A value of 0h indicates the number is not known.

The SUBENCLOSURE IDENTIFIER field indicates the subenclosure (see 4.3) described by this enclosure descriptor.

The NUMBER OF TYPE DESCRIPTOR HEADERS field indicates the number of type descriptor headers (see 6.1.2.3) in the Configuration diagnostic page with this subenclosure identifier. The total number of type descriptor headers is equal to the sum of the contents of the NUMBER OF TYPE DESCRIPTOR HEADERS fields for the primary subenclosure and all of the secondary subenclosures.

The ENCLOSURE DESCRIPTOR LENGTH field indicates the number of bytes that follow in the enclosure descriptor. The value shall be a multiple of four, having allowed values between 36 and 252. The ENCLOSURE DESCRIPTOR LENGTH includes the length of the ENCLOSURE LOGICAL IDENTIFIER field, the ENCLOSURE VENDOR IDENTIFICATION field, the PRODUCT IDENTIFICATION field, the PRODUCT REVISION LEVEL field, and any vendor specific enclosure information.

The ENCLOSURE LOGICAL IDENTIFIER field contains a unique logical identifier for the subenclosure. It shall use an 8-byte NAA identifier, the format of which is defined in SPC-5 vital product data (see SPC-5). The

ENCLOSURE LOGICAL IDENTIFIER field shall be unique to the subenclosure and may be different than the world wide name of the logical unit providing the enclosure services.

The ENCLOSURE VENDOR IDENTIFICATION field contains the identification string for the vendor of the subenclosure in the same format as specified for the VENDOR IDENTIFICATION field of the standard INQUIRY data (see SPC-5). The ENCLOSURE VENDOR IDENTIFICATION field may contain a different value than the vendor identification of the logical unit providing the enclosure services.

The PRODUCT IDENTIFICATION field contains the product identification string for the subenclosure in the same format as specified for the PRODUCT IDENTIFICATION field of the standard INQUIRY data (see SPC-5). The PRODUCT IDENTIFICATION field may contain a different value than the product identification of the logical unit providing the enclosure services.

The PRODUCT REVISION LEVEL field contains the product revision level string for the subenclosure in the same format as specified for the PRODUCT REVISION LEVEL field of the standard INQUIRY data (see SPC-5). The PRODUCT REVISION LEVEL field may contain a different value than the product revision level of the logical unit providing the enclosure services.

The VENDOR SPECIFIC ENCLOSURE INFORMATION field contains vendor specific information.

6.1.2.3 Type descriptor header list

The type descriptor header list shall contain type descriptor headers in the following order, regardless of their subenclosure identifiers:

1) type descriptor headers for Device Slot elements and Array Device Slot elements; and
2) type descriptor headers for elements with other element types.

The elements of an enclosure shall be listed in the same order in:

a) the type descriptor header list;
b) the type descriptor text list (see 6.1.2.4);
c) the Enclosure Control diagnostic page (see 6.1.3);
d) the Enclosure Status diagnostic page (see 6.1.4);
e) the Threshold Out diagnostic page (see 6.1.8); and
f) the Threshold In diagnostic page (see 6.1.9).

The type descriptor header is defined in table 12.

Table 12 — Type descriptor header format

Byte\Bit	7	6	5	4	3	2	1	0
0	ELEMENT TYPE							
1	NUMBER OF POSSIBLE ELEMENTS							
2	SUBENCLOSURE IDENTIFIER							
3	TYPE DESCRIPTOR TEXT LENGTH							

The ELEMENT TYPE field in the type descriptor header indicates the element type being described in the type descriptor. The list of element types is shown in table 69 (see 7.1). More than one type descriptor header may contain the same ELEMENT TYPE field value (e.g., there may be two power supplies that provide +12 V, and five power supplies that provide +5 V. In this case, a separate TYPE DESCRIPTOR HEADER may be used for the +12 V power supplies and for the +5 V power supplies).

The NUMBER OF POSSIBLE ELEMENTS field in the type descriptor header indicates the number of elements of the indicated type that it is possible to install in the subenclosure. The actual number of elements installed may be smaller than the number that the configuration is capable of accepting. If the NUMBER OF POSSIBLE ELEMENTS field is set to zero, then the type descriptor corresponds to one overall element and no individual elements. The maximum number of elements represented by a single type descriptor shall be 255.

The SUBENCLOSURE IDENTIFIER field in the type descriptor header indicates the subenclosure (see 4.3) in which the elements described by this type descriptor reside.

The TYPE DESCRIPTOR TEXT LENGTH field in the type descriptor header indicates the number of bytes in the type descriptor text (see 6.1.2.4), if any. If the ELEMENT TYPE field is set to a vendor specific value, then the TYPE DESCRIPTOR TEXT LENGTH field shall be set to a nonzero value and shall have type descriptor text adequate to identify the element to an application client. Other element types may have a TYPE DESCRIPTOR TEXT LENGTH field set to 00h.

6.1.2.4 Type descriptor text list

The type descriptor text list shall contain type descriptor texts in the same order as the type descriptor headers. If the TYPE DESCRIPTOR TEXT LENGTH field is set to zero in the type descriptor header, then there is no type descriptor text.

The type descriptor text is a text string from zero to 255 bytes for each type descriptor header (see 6.1.2.3). The text string, if it has a length greater than zero, may contain any descriptive information about the element type that may be useful to an application client that is displaying the configuration of the enclosure (e.g., the manufacturer's part number for a replacement element, a brief description of the element and its properties, or instructions about configuration limitations and redundancy requirements of the elements of that type).

The type descriptor text uses the character encoding and language indicated by the Language element (see 7.3.18).

6.1.3 Enclosure Control diagnostic page

The Enclosure Control diagnostic page provides access to the control elements identified by the Configuration diagnostic page (see 6.1.2).

The Enclosure Control diagnostic page is written by the SEND DIAGNOSTIC command. A RECEIVE DIAGNOSTIC RESULTS command with a PCV bit set to one and a PAGE CODE field set to 02h is defined as the request to read the Enclosure Status diagnostic page (see 6.1.4).

Table 13 defines the Enclosure Control diagnostic page.

Table 13 — Enclosure Control diagnostic page

Byte\Bit	7	6	5	4	3	2	1	0
0	PAGE CODE (02h)							
1	Reserved				INFO	NON-CRIT	CRIT	UNRECOV
2	(MSB)	PAGE LENGTH (n - 3)						
3								(LSB)
4	(MSB)	EXPECTED GENERATION CODE						
•••								
7								(LSB)
Control descriptor list								
8	Control descriptor (first)(see table 14)							
	⋮							
	Control descriptor (last)(see table 14)							
n								

The PAGE CODE field is set to 02h.

The INFO bit, the NON-CRIT bit, the CRIT bit, and the UNRECOV bit are each mandatory and may be set to one in the enclosure by the application client if the application client has detected that one or more of the elements in the enclosure are not operating normally.

An INFO (informational condition) bit set to one specifies that the application client is detecting an informational condition (see 3.1.21). An INFO bit set to zero has no effect.

A NON-CRIT (noncritical condition) bit set to one specifies that the application client is detecting a noncritical condition (see 3.1.25). A NON-CRIT bit set to zero specifies that the application client is not detecting a noncritical condition. If the enclosure services process has independently determined that a noncritical condition is present, then a request from the application client to set the NON-CRIT bit to zero shall be ignored by the enclosure services process.

A CRIT (critical condition) bit set to one specifies that the application client is detecting a critical condition (see 3.1.9). A CRIT bit set to zero specifies that the application client is not detecting a critical condition. If the enclosure services process has independently determined that a critical condition is present, then a request from the application client to set the CRIT bit to zero shall be ignored by the enclosure services process.

An UNRECOV (unrecoverable condition) bit set to one specifies that the application client is detecting an unrecoverable condition (see 3.1.48). An UNRECOV bit set to zero specifies that the application client is not detecting an unrecoverable condition. If the enclosure services process has independently determined that an unrecoverable condition is present, then a request from the application client to set the UNRECOV bit to zero shall be ignored by the enclosure services process.

The PAGE LENGTH field specifies the number of bytes that follow in the diagnostic page.

The EXPECTED GENERATION CODE field specifies the expected value of the generation code (see 4.3.2). If the EXPECTED GENERATION CODE field contains the current generation code (i.e., the value of the generation code field that would be returned by a Configuration diagnostic page at this time), then the enclosure services process shall process the diagnostic page. If the EXPECTED GENERATION CODE field does not contain the current generation code, then the application client shall be notified of an invalid field error (see 4.5) and the enclosure services process shall ignore the remainder of the Enclosure Control diagnostic page.

The control descriptor list contains a control descriptor for each type descriptor header in the Configuration diagnostic page (see 6.1.2).

Table 14 defines the control descriptor.

Table 14 — Control descriptor

Byte\Bit	7	6	5	4	3	2	1	0
0	Overall control element (see table 70 in 7.2.2)							
•••								
3								
Individual control element list								
4	Individual control element (first)(see table 70 in 7.2.2)							
•••								
7								
	⋮							
m - 3	Individual control element (last)(see table 70 in 7.2.2)							
•••								
m								

The overall control element provides control for all the elements corresponding to the type descriptor header. The general format for the overall control element is defined by table 70 in 7.2.2.

The individual control element list contains an individual control element for each of the possible elements identified by the NUMBER OF POSSIBLE ELEMENTS field in the corresponding type descriptor header.

Each control element contains control information for the element. The general format for the individual control element is defined by table 70 in 7.2.2.

The individual control elements override the overall control element as defined in table 15.

Table 15 — Control element processing

Individual control element SELECT bit	Overall control element SELECT bit	Description
0	0	The enclosure services process shall not change the element
	1	The enclosure services process should change the element based on the overall control element
1	0 or 1	The enclosure services process should change the element based on the individual control element

6.1.4 Enclosure Status diagnostic page

The Enclosure Status diagnostic page provides access to the status elements identified by the Configuration diagnostic page (see 6.1.2).

The Enclosure Status diagnostic page is read by the RECEIVE DIAGNOSTIC RESULTS command with a PCV bit set to one and a PAGE CODE field set to 02h. The transmission of a page using the SEND DIAGNOSTIC command with a PAGE CODE field set to 02h is defined as the transmission of an Enclosure Control diagnostic page (see 6.1.3).

Table 16 defines the Enclosure Status diagnostic page.

Table 16 — Enclosure Status diagnostic page

Byte\Bit	7	6	5	4	3	2	1	0
0	PAGE CODE (02h)							
1	Reserved			INVOP	INFO	NON-CRIT	CRIT	UNRECOV
2	(MSB)	PAGE LENGTH (n - 3)						
3								(LSB)
4	(MSB)	GENERATION CODE						
•••								
7								(LSB)
Status descriptor list								
8	Status descriptor (first)(see table 17)							
	⋮							
	Status descriptor (last)(see table 17)							
n								

The PAGE CODE field is set to 02h.

The INVOP bit, the INFO bit, the NON-CRIT bit, the CRIT bit, and the UNRECOV bit are each mandatory. The bits may be read with an allocation length greater than one and may be examined by an enclosure polling procedure to determine if events have occurred that require reading the complete page. The bits are set independently and may be set in any combination. The bits may be set by either the enclosure services process or with the Enclosure Control diagnostic page.

The INVOP (invalid operation requested) bit shall be set to one if an invalid field error has occurred (e.g., an Enclosure Control diagnostic page with an invalid format has previously been transmitted to the enclosure services process and an application client has not already been informed of the invalid field error) and the SEND DIAGNOSTIC command was not terminated with CHECK CONDITION status to notify the application client of the invalid field error.

Each time the INVOP bit is set to one:

a) standalone enclosure services processes (see 4.1.2) shall set the INVOP bit to one the first time they return the Enclosure Status diagnostic page to the same I_T nexus that transmitted the invalid control-type diagnostic page and shall set the INVOP bit to zero for subsequent requests; and
b) attached enclosure services processes (see 4.1.3) shall set the INVOP bit to one the first time they return the Enclosure Status diagnostic page to any application client and shall set the INVOP bit to zero for subsequent requests.

An Invalid Operation Reason status element may be included in the element list as reported by the Configuration diagnostic page (see 6.1.2). If the INVOP bit is set to zero and an Invalid Operation Reason status element (see 7.3.12) is included, then the Invalid Operation Reason status element shall be ignored.

An INFO (information) bit set to one indicates that one or more information conditions (see 3.1.21) have been detected by the enclosure services process or specified by an application client with the Enclosure Control diagnostic page. Each time the INFO bit is set to one by any mechanism:

a) standalone enclosure services processes (see 4.1.2) shall set the INFO bit set to one the first time they return the Enclosure Status diagnostic page to each I_T nexus and shall set the INFO bit to zero for subsequent requests; and
b) attached enclosure services processes (see 4.1.3) shall set the INFO bit set to one the first time they return the Enclosure Status diagnostic page to any application client and may set the INFO bit to zero for subsequent requests.

An INFO bit shall be set to one once as an indication to the application client that an information condition is available and not set to one again until a new information condition occurs.

A NON-CRIT (noncritical condition) bit set to one indicates that one or more noncritical conditions (see 3.1.25) have been detected by the enclosure services process or specified by an application client with the Enclosure Control diagnostic page. A NON-CRIT bit set to zero indicates that both the following conditions are met:

a) all noncritical conditions have been corrected in the enclosure; and
b) an application client has set the NON-CRIT bit to zero in the Enclosure Control diagnostic page.

A CRIT (critical condition) bit set to one indicates that one or more critical conditions (see 3.1.9) have been detected by the enclosure services process or specified by an application client with the Enclosure Control diagnostic page. A CRIT bit set to zero indicates that both the following conditions are met:

a) all critical conditions have been corrected in the enclosure; and
b) an application client has set the CRIT bit to zero in the Enclosure Control diagnostic page.

An UNRECOV (unrecoverable condition) bit set to one indicates that one or more unrecoverable conditions (see 3.1.48) have been detected by the enclosure services process or specified by an application client with the Enclosure Control diagnostic page. An UNRECOV bit set to zero indicates that both the following conditions are met:

a) all unrecoverable conditions have been corrected in the enclosure; and
b) an application client has set the UNRECOV bit to zero in the Enclosure Control diagnostic page.

The PAGE LENGTH field indicates the number of bytes that follow in the diagnostic page.

The GENERATION CODE field indicates the value of the generation code (see 4.3.2).

The status descriptor list contains a status descriptor for each type descriptor header in the Configuration diagnostic page (see 6.1.2).

Table 17 defines the status descriptor.

Table 17 — Status descriptor

Byte\Bit	7	6	5	4	3	2	1	0
0 ••• 3	Overall status element (see table 71 in 7.2.3)							
Individual status element list								
4 ••• 7	Individual status element (first)(see table 71 in 7.2.3)							
	⋮							
m - 3 ••• m	Individual status element (last)(see table 71 in 7.2.3)							

The overall status element provides summary status for all the elements described by the type descriptor header and may provide status for elements whose individual status is not available. The general format for the overall status element is defined by table 71 in 7.2.3.

The individual status element list contains an individual status element for each of the possible elements identified by the NUMBER OF POSSIBLE ELEMENTS field in the corresponding type descriptor header.

Each individual status element contains status information for the element. The general format for the individual status element is defined by table 71 in 7.2.3.

Individual status elements override the overall status element (e.g., an enclosure with three temperature sensors may report the average of the three sensors in the overall status element and/or may report the individual sensor values in the individual status elements). Both the overall status element and the element status element may contain information (e.g., the overall status element contains the average and the individual status elements contain the specific individual values).

6.1.5 Help Text diagnostic page

The Help Text diagnostic page contains a text string (see 3.1.42) from the primary subenclosure that describes the present state of the primary subenclosure and indicates what corrective actions, if any, should be performed. The Help Text diagnostic page allows enclosure-independent application clients to return enclosure-specific text describing the state of the enclosure and explaining enclosure-dependent corrective actions that may be required. This page does not support secondary subenclosures. For secondary subenclosures, see the Subenclosure Help Text diagnostic page (see 6.1.14).

The Help Text diagnostic page is read by the RECEIVE DIAGNOSTIC RESULTS command with a PCV bit set to one and a PAGE CODE field set to 03h. A PAGE CODE field set to 03h in the parameter list for a SEND DIAGNOSTIC command is an invalid field error (see 4.5).

Table 18 defines the Help Text diagnostic page.

Table 18 — Help Text diagnostic page

Byte\Bit	7	6	5	4	3	2	1	0
0	PAGE CODE (03h)							
1	Obsolete							
2	(MSB)	PAGE LENGTH (n - 3)						
3								(LSB)
4	PRIMARY SUBENCLOSURE HELP TEXT							
•••								
n								

The PAGE CODE field is set to 03h.

The PAGE LENGTH field indicates the number of bytes that follow in the diagnostic page.

The PRIMARY SUBENCLOSURE HELP TEXT field contains a text string (see 3.1.42) describing what corrective actions should be performed on the primary subenclosure. The text string shall use the language and character set indicated by the Language element (see 7.3.18).

6.1.6 String Out diagnostic page

The String Out diagnostic page transmits an enclosure dependent binary string from the application client to the enclosure services process of the primary subenclosure. The binary string may contain bits describing indicator states, text or graphic display information, or control information outside the context of the elements defined in the Configuration diagnostic page (see 6.1.2).

This page does not support secondary subenclosures. For secondary subenclosures, see the Subenclosure String Out diagnostic page (see 6.1.15).

The format of the binary string is vendor specific. For standalone enclosure services processes (see 4.1.2), an application client may select the format of the binary string using the vendor identification and product identification from the standard INQUIRY data (see SPC-5) or using the enclosure descriptor in the Configuration diagnostic page (see 6.1.2). For attached enclosure services processes (see 4.1.3), an application client should select the format of the binary string using the enclosure descriptor in the Configuration diagnostic page.

The String Out diagnostic page is written by the SEND DIAGNOSTIC command. A RECEIVE DIAGNOSTIC RESULTS command with a PCV bit set to one and a PAGE CODE field set to 04h is defined as the request to read the String In diagnostic page (see 6.1.7).

Table 19 defines the String Out diagnostic page.

Table 19 — String Out diagnostic page

Byte\Bit	7	6	5	4	3	2	1	0
0	PAGE CODE (04h)							
1	Obsolete							
2	(MSB)	PAGE LENGTH (n - 3)						
3								(LSB)
4	PRIMARY SUBENCLOSURE STRING OUT DATA							
•••								
n								

The PAGE CODE field is set to 04h.

The PAGE LENGTH field specifies the number of bytes that follow in the diagnostic page.

The PRIMARY SUBENCLOSURE STRING OUT DATA field shall contain the vendor specific information to be transferred from the application client to the enclosure services process of the primary subenclosure.

6.1.7 String In diagnostic page

The String In diagnostic page transmits a subenclosure dependent binary string from the enclosure services process of the primary subenclosure to the application client. The binary string may contain bits describing keyboard states, switch states, or the content of other information provided by the primary subenclosure to the application client.

This page does not support secondary subenclosures. For secondary subenclosures, see the Subenclosure String In diagnostic page (see 6.1.16).

The format of the binary string is vendor specific. For standalone enclosure services processes (see 4.1.2), an application client may determine the format of the binary string using the vendor identification and product identification from the standard INQUIRY data (see SPC-5) or using the enclosure descriptor in the Configuration diagnostic page (see 6.1.2). For attached enclosure services processes (see 4.1.3), an application client should select the format of the binary string using the enclosure descriptor in the Configuration diagnostic page.

The String In diagnostic page is read by the RECEIVE DIAGNOSTIC RESULTS command with a PCV bit set to one and a PAGE CODE field set to 04h. The transmission of a page using the SEND DIAGNOSTIC command with a PAGE CODE field set to 04h is defined as the transmission of a String Out diagnostic page (see 6.1.6).

Table 20 defines the String In diagnostic page.

Table 20 — String In diagnostic page

Byte\Bit	7	6	5	4	3	2	1	0
0	PAGE CODE (04h)							
1	Obsolete							
2	(MSB)	PAGE LENGTH (n - 3)						
3								(LSB)
4	PRIMARY SUBENCLOSURE STRING IN DATA							
•••								
n								

The PAGE CODE field is set to 04h.

The PAGE LENGTH field indicates the number of bytes that follow in the diagnostic page.

The PRIMARY SUBENCLOSURE STRING IN DATA field shall contain the vendor specific information to be transferred from the enclosure services process of the primary subenclosure to the application client.

6.1.8 Threshold Out diagnostic page

The Threshold Out diagnostic page is transmitted to the enclosure services process to establish threshold values for those elements that have limited sensing capability (e.g., temperature sensors, uninterruptible power supplies, voltage sensors, and current sensors).

The Threshold Out diagnostic page is written by the SEND DIAGNOSTIC command. A RECEIVE DIAGNOSTIC RESULTS command with a PCV bit set to one and a PAGE CODE field set to 05h is defined as the request to read the Threshold In diagnostic page (see 6.1.9).

Table 21 defines the Threshold Out diagnostic page.

Table 21 — Threshold Out diagnostic page

Byte\Bit	7	6	5	4	3	2	1	0
0	PAGE CODE (05h)							
1	Reserved							
2	(MSB)	PAGE LENGTH (n - 3)						
3								(LSB)
4	(MSB)	EXPECTED GENERATION CODE						
•••								
7								(LSB)
Threshold control descriptor list								
8	Threshold control descriptor (first)(see table 22)							
	⋮							
	Threshold control descriptor (last)(see table 22)							
n								

The PAGE CODE field is set to 05h.

The PAGE LENGTH field specifies the number of bytes that follow in the diagnostic page.

The EXPECTED GENERATION CODE field is defined in the Enclosure Control diagnostic page (see 6.1.3).

The threshold control descriptor list contains a threshold control descriptor for each type descriptor header in the Configuration diagnostic page (see 6.1.2).

Table 22 defines the threshold control descriptor.

Table 22 — Threshold control descriptor

Byte\Bit	7	6	5	4	3	2	1	0
0	Overall threshold control element (see table 74 in 7.2.4)							
•••								
3								
Individual threshold control element list								
4	Individual threshold control element (first)(see table 74 in 7.2.4)							
•••								
7								
	⋮							
m - 3	Individual threshold control element (last)(see table 74 in 7.2.4)							
•••								
m								

The overall threshold control element provides shared threshold control for all the elements described by the type descriptor header. The general format for the overall threshold control element is defined by table 74 (see 7.2.4).

The individual threshold control element list contains an individual threshold control element for each of the possible elements identified by the NUMBER OF POSSIBLE ELEMENTS field in the corresponding type descriptor header.

Each individual threshold control element contains threshold control information for the element. The general format for the individual threshold control element is defined by table 74 (see 7.2.4).

6.1.9 Threshold In diagnostic page

The Threshold In diagnostic page is transmitted from the enclosure services process to the application client to report the actual threshold values for those elements that have limited sensing capability (e.g., temperature sensors, uninterruptible power supplies, voltage sensors, and current sensors).

The Threshold In diagnostic page is read by the RECEIVE DIAGNOSTIC RESULTS command with a PCV bit set to one and a PAGE CODE field set to 05h. The transmission of a page using the SEND DIAGNOSTIC command with a PAGE CODE field set to 05h is defined as the transmission of a Threshold Out diagnostic page (see 6.1.8).

Table 23 defines the Threshold In diagnostic page.

Table 23 — Threshold In diagnostic page

Byte\Bit	7	6	5	4	3	2	1	0
0	PAGE CODE (05h)							
1	Reserved			INVOP	Reserved			
2	(MSB)	PAGE LENGTH (n - 3)						
3								(LSB)
4	(MSB)	GENERATION CODE						
•••								
7								(LSB)
Threshold status descriptor list								
8	Threshold status descriptor (first)(see table 24)							
	⋮							
	Threshold status descriptor (last)(see table 24)							
n								

The PAGE CODE field is set to 05h.

The INVOP (Invalid operation requested) bit shall be set to one if a Threshold Out diagnostic page with an invalid format has previously been transmitted to the enclosure services process and an application client has not already been informed of the error (i.e., if the SEND DIAGNOSTIC command sending the invalid Threshold Out diagnostic page was not terminated with CHECK CONDITION status to notify the application client of the error).

Each time the INVOP bit is set to one:

a) standalone enclosure services processes (see 4.1.2) shall set the INVOP bit to one the first time they return the Threshold In diagnostic page to the same I_T nexus that transmitted the invalid control page and shall set the INVOP bit to zero for subsequent requests; and
b) attached enclosure services processes (see 4.1.3) shall set the INVOP bit to one the first time they return the Threshold In diagnostic page to any application client and shall set the INVOP bit to zero for subsequent requests.

An Invalid Operation Reason threshold status element may be included in the element list. If the INVOP bit is set to zero and an Invalid Operation Reason threshold status element (see 7.3.12) is included, then the Invalid Operation Reason threshold status element shall be ignored.

The PAGE LENGTH field indicates the number of bytes that follow in the diagnostic page.

The GENERATION CODE field indicates the value of the generation code (see 4.3.2).

The threshold status descriptor list contains a threshold status descriptor for each type descriptor header in the Configuration diagnostic page (see 6.1.2).

Table 24 defines the threshold status descriptor.

Table 24 — Threshold status descriptor

Byte\Bit	7	6	5	4	3	2	1	0
0 ••• 3	Overall threshold status element (see table 75 in 7.2.5)							
Individual threshold status element list								
4 ••• 7	Individual threshold status element (first)(see table 75 in 7.2.5)							
	⋮							
m - 3 ••• m	Individual threshold status element (last)(see table 75 in 7.2.5)							

The overall threshold status element provides shared threshold status for all the elements described by the type descriptor header. The general format for the overall threshold status element is defined by table 75 (see 7.2.5).

The individual threshold status element list contains an individual threshold status element for each of the possible elements identified by the NUMBER OF POSSIBLE ELEMENTS field in the corresponding type descriptor header.

Each individual threshold status element contains threshold status information for the element. The general format for the individual threshold status element is defined by table 75 (see 7.2.5).

6.1.10 Element Descriptor diagnostic page

The Element Descriptor diagnostic page returns a list of vendor specific, variable-length ASCII strings, one for each element in the Enclosure Status diagnostic page (see 6.1.4).

The Element Descriptor diagnostic page is read by the RECEIVE DIAGNOSTIC RESULTS command with a PCV bit set to one and a PAGE CODE field set to 07h. A PAGE CODE field set to 07h in the parameter list for a SEND DIAGNOSTIC command is an invalid field error (see 4.5).

Table 25 defines the Element Descriptor diagnostic page.

Table 25 — Element Descriptor diagnostic page

Byte\Bit	7	6	5	4	3	2	1	0
0	PAGE CODE (07h)							
1	Reserved							
2	(MSB)	PAGE LENGTH (n - 3)						
3								(LSB)
4	(MSB)	GENERATION CODE						
•••								
7								(LSB)
Element descriptor by type list								
8	Element descriptor by type descriptor (first element type)(see table 26)							
	⋮							
n	Element descriptor by type descriptor (last element type)(see table 26)							

The PAGE CODE field is set to 07h.

The PAGE LENGTH field indicates the number of bytes that follow in the diagnostic page.

The GENERATION CODE field indicates the value of the generation code (see 4.3.2).

The element descriptor by type list contains an element descriptor by type descriptor for each element type.

Table 26 defines the element descriptor by type descriptor.

Table 26 — Element descriptor by type descriptor

Byte\Bit	7	6	5	4	3	2	1	0
0	Overall descriptor (see table 27)							
variable	Element descriptor (first element)(see table 27)							
	⋮							
x	Element descriptor (last element)(see table 27)							

The overall descriptor contains any descriptor information applying to all elements of the type or describing elements that have no individual descriptor information. The format of the overall descriptor is defined in table 27.

Following the overall descriptor, there shall be one element descriptor for each of the possible elements identified by the NUMBER OF POSSIBLE ELEMENTS field in the corresponding type descriptor header in the Configuration diagnostic page (see 6.1.2). Each element descriptor contains the descriptive information for the element. The format of the element descriptor is defined in table 27.

Table 27 defines the overall descriptor and the element descriptor.

Table 27 — Overall descriptor format and element descriptor format

Byte\Bit	7	6	5	4	3	2	1	0
0	Reserved							
1								
2	(MSB)	DESCRIPTOR LENGTH (m - 3)						
3								(LSB)
4	DESCRIPTOR							
•••								
m								

The DESCRIPTOR LENGTH field indicates the length in bytes of the DESCRIPTOR field. A DESCRIPTOR LENGTH of zero indicates that no DESCRIPTOR field is contained in the overall descriptor or element descriptor.

The DESCRIPTOR field indicates an ASCII string (see 3.7.1) reporting vendor specific information about the element. The DESCRIPTOR field shall not be modified by the Language element (see 7.3.18).

6.1.11 Short Enclosure Status diagnostic page

The Short Enclosure Status diagnostic page indicates the status of a simple subenclosure (see 4.3.3).

Table 28 defines the Short Enclosure Status diagnostic page.

Table 28 — Short Enclosure Status diagnostic page

Byte\Bit	7	6	5	4	3	2	1	0
0	PAGE CODE (08h)							
1	SHORT ENCLOSURE STATUS							
2	(MSB)	PAGE LENGTH (0000h)						
3								(LSB)

The PAGE CODE field is set to 08h.

The SHORT ENCLOSURE STATUS field indicates vendor specific status about the simple subenclosure.

The PAGE LENGTH field indicates the number of bytes that follow in the diagnostic page and is set to 0000h.

6.1.12 Enclosure Busy diagnostic page

The Enclosure Busy diagnostic page indicates that the enclosure services process is busy and is unable to return the requested diagnostic page. See 4.4.

Table 29 defines the Enclosure Busy diagnostic page.

Table 29 — Enclosure Busy diagnostic page

Byte\Bit	7	6	5	4	3	2	1	0
0	PAGE CODE (09h)							
1	Vendor specific							BUSY
2	(MSB)	PAGE LENGTH (0000h)						
3								(LSB)

The PAGE CODE field is set to 09h.

A BUSY bit set to one indicates that the enclosure services process is busy and the application client should retry the RECEIVE DIAGNOSTIC RESULTS command. A BUSY bit set to zero indicates that the enclosure services process is not busy and is capable of responding to a RECEIVE DIAGNOSTIC RESULTS command requesting an SES diagnostic page. The BUSY bit shall be set to one if this diagnostic page is returned in place of another diagnostic page (i.e., in place of the requested diagnostic page).

The PAGE LENGTH field indicates the number of bytes that follow in the diagnostic page and is set to 0000h.

6.1.13 Additional Element Status diagnostic page

6.1.13.1 Additional Element Status diagnostic page overview

The Additional Element Status diagnostic page provides additional information about:

a) Device Slot elements (see 7.3.2);
b) Array Device Slot elements (see 7.3.3);
c) SAS Expander elements (see 7.3.25);
d) SCSI Initiator Port elements (see 7.3.23) containing SAS phys;
e) SCSI Target Port elements (see 7.3.22) containing SAS phys; and
f) Enclosure Services Controller Electronics elements (see 7.3.9).

The Additional Element Status diagnostic page returns an Additional Element Status descriptor for each of the following elements that have been allowed for by the NUMBER OF POSSIBLE ELEMENTS field in the corresponding type descriptor header in the Configuration diagnostic page (see 6.1.2):

a) Device Slot elements;
b) Array Device Slot elements; and
c) SAS Expander elements.

It may include Additional Element Status descriptors for:

a) SCSI Initiator Port elements;
b) SCSI Target Port elements; and
c) Enclosure Services Controller Electronics elements.

The Additional Element Status descriptors shall be in the same order as the status elements in the Enclosure Status diagnostic page (see 6.1.4).

The Additional Element Status diagnostic page is read by the RECEIVE DIAGNOSTIC RESULTS command with a PCV bit set to one and a PAGE CODE field set to 0Ah. A PAGE CODE field set to 0Ah in the parameter list for a SEND DIAGNOSTIC command is an invalid field error (see 4.5).

Table 30 defines the Additional Element Status diagnostic page.

Table 30 — Additional Element Status diagnostic page

Byte\Bit	7	6	5	4	3	2	1	0
0	PAGE CODE (0Ah)							
1	Reserved							
2	(MSB)	PAGE LENGTH (n - 3)						
3								(LSB)
4	(MSB)	GENERATION CODE						
•••								
7								(LSB)
Additional element status descriptor list								
8	Additional element status descriptor (first)(see table 31 and table 32)							
	⋮							
	Additional element status descriptor (last)(see table 31 and table 32)							
n								

The PAGE CODE field is set to 0Ah.

The PAGE LENGTH field indicates the number of bytes that follow in the diagnostic page.

The GENERATION CODE field indicates the value of the generation code (see 4.3.2).

The additional element status descriptor list contains an additional element status descriptor for each element for which the enclosure services process provides additional information.

Table 31 defines the format of the Additional Element Status descriptor with the EIP bit set to one.

Table 31 — Additional Element Status descriptor with the EIP bit set to one

Byte\Bit	7	6	5	4	3	2	1	0
0	INVALID	Reserved		EIP (1b)	PROTOCOL IDENTIFIER			
1	ADDITIONAL ELEMENT STATUS DESCRIPTOR LENGTH (x - 1)							
2	Reserved						EIIOE	
3	ELEMENT INDEX							
4	Protocol-specific information							
•••								
x								

Table 32 defines the format of the Additional Element Status descriptor with the EIP bit set to zero.

Table 32 — Additional Element Status descriptor with the EIP bit set to zero

Byte\Bit	7	6	5	4	3	2	1	0
0	INVALID	Reserved		EIP (0b)	PROTOCOL IDENTIFIER			
1	ADDITIONAL ELEMENT STATUS DESCRIPTOR LENGTH (x - 1)							
2	Protocol-specific information							
•••								
x								

An INVALID bit set to one indicates that the contents of the protocol-specific information are invalid. An INVALID bit set to zero indicates that the contents of the protocol-specific information are valid. The enclosure services process may set the INVALID bit to one if the ELEMENT STATUS CODE field in the element status for the associated element (see table 72 in 7.2.3) is set to 5h (i.e., not installed), 6h (i.e., unknown), 7h (i.e., not available), or 8h (i.e., No Access Allowed).

An EIP (element index present) bit set to one indicates that the Additional Element Status descriptor has the format defined in table 31. An EIP bit set to zero indicates that the Additional Element Status descriptor has the format defined in table 32 (i.e., does not include the two extra bytes including the ELEMENT INDEX field that are defined in table 31). The EIP bit shall be set to one in an Additional Element Status descriptor that contains an Additional Element Status descriptor protocol-specific information for PCIe (see 6.1.13.4) and should be set to one in all other Additional Element Status descriptors.

The PROTOCOL IDENTIFIER field is defined in SPC-5 and identifies the protocol of the device being described by the Additional Element Status descriptor.

The ADDITIONAL ELEMENT STATUS DESCRIPTOR LENGTH field indicates the number of bytes that follow in the Additional Element Status descriptor.

The value in the ELEMENT INDEX field (see table 31), the CONNECTOR ELEMENT INDEX field (see table 44 and table 46), and the OTHER ELEMENT INDEX field (see table 44 and table 46) is based on the position in the status descriptor list in the Enclosure Status diagnostic page (see 6.1.4). The EIIOE field indicates if the position includes overall status elements as defined in table 33. The device server should set the EIIOE field to 01b.

Table 33 — EIIOE field

Code	Description
00b	The ELEMENT INDEX field, the CONNECTOR ELEMENT INDEX field, and the OTHER ELEMENT INDEX field are as defined in SES-2.
01b	The ELEMENT INDEX field, the CONNECTOR ELEMENT INDEX field, and the OTHER ELEMENT INDEX field are based on the position in the status descriptor list (see table 16) in the Enclosure Status diagnostic page (see 6.1.4) including overall status elements (see table 17).
10b	The ELEMENT INDEX field, the CONNECTOR ELEMENT INDEX field, and the OTHER ELEMENT INDEX field are based on the position in the status descriptor list (see table 16) in the Enclosure Status diagnostic page (see 6.1.4) not including overall status elements (see table 17).
11b	The ELEMENT INDEX field is based on the position in the status descriptor list (see table 16) in the Enclosure Status diagnostics page (see 6.1.4) not including overall status elements (see table 17) and the CONNECTOR ELEMENT INDEX field, and the OTHER ELEMENT INDEX field are based on the position in the status descriptor list in the Enclosure Status diagnostic page including overall status elements.

The ELEMENT INDEX field indicates the index of the status element that this descriptor is describing. The index is based on the EIIOE field (see table 33).

EXAMPLE - If the element list contains an overall Device Slot element, four individual Device Slot elements, an overall SAS Expander element, and an individual SAS Expander element, then to point to the individual SAS Expander element, the ELEMENT INDEX field contains 06h if the EIIOE field is set to 01b and 04h for all other values of the EIIOE field.

The contents of the protocol-specific information bytes depend on the contents of the PROTOCOL IDENTIFIER field. If the PROTOCOL IDENTIFIER field is set to 0h (i.e., Fibre Channel), then the protocol-specific information is defined in table 34 and table 30 (see 6.1.13.2). If the PROTOCOL IDENTIFIER field is set to 6h (i.e., SAS), then the protocol-specific information is defined in table 38 (see 6.1.13.3). If the PROTOCOL IDENTIFIER field is set to Bh (i.e., PCIe), then the protocol-specific information is defined in table 47 (see 6.1.13.4).

6.1.13.2 Additional Element Status descriptor protocol-specific information for Fibre Channel

The Additional Element Status descriptor is used to describe a Device Slot element or an Array Device Slot element that may contain:

a) a Fibre Channel device; or
b) a SCSI Initiator Port, SCSI Target Port, or Enclosure Services Controller Electronics element that is a Fibre Channel device.

Table 34 defines the Additional Element Status descriptor protocol-specific information for Fibre Channel devices (see FCP-4) with the EIP bit set to one.

Table 34 — Additional Element Status descriptor protocol-specific information for Fibre Channel with the EIP bit set to one

Byte\Bit	7	6	5	4	3	2	1	0
0	NUMBER OF PORTS							
1	Reserved							
2								
3	DEVICE SLOT NUMBER							
4	(MSB)	NODE NAME						
•••								
11								(LSB)
Port descriptor list								
12	Port descriptor (first)(see table 36)							
•••								
27								
	⋮							
y - 15	Port descriptor (last)(see table 36)							
•••								
y								

Table 35 defines the Additional Element Status descriptor protocol-specific information for Fibre Channel devices (see FCP-4) with the EIP bit set to zero. This format does not include the two extra bytes that are in table 34.

Table 35 — Additional Element Status descriptor protocol-specific information for Fibre Channel with the EIP bit set to zero

Byte\Bit	7	6	5	4	3	2	1	0
0	NUMBER OF PORTS							
1	Reserved							
2	(MSB)							
•••	NODE NAME							
9								(LSB)
Port descriptor list								
10								
•••	Port descriptor (first)(see table 36)							
25								
	⋮							
y - 15								
•••	Port descriptor (last)(see table 36)							
y								

The NUMBER OF PORTS field indicates how many Fibre Channel ports are in the port descriptor list. There is one port descriptor for each port.

The DEVICE SLOT NUMBER field indicates the number of the device slot represented by the element.

The NODE NAME field contains the Node_Name (see FCP-4) of the corresponding Fibre Channel node.

The port descriptor list contains a port descriptor for each port counted in the NUMBER OF PORTS field.

Table 36 defines the port descriptor.

Table 36 — Port descriptor

Byte\Bit	7	6	5	4	3	2	1	0
0	PORT LOOP POSITION							
1	BYPASS REASON							
2	Reserved							
3								
4	PORT REQUESTED HARD ADDRESS							
5	(MSB)							
•••	N_PORT IDENTIFIER							
7								(LSB)
8	(MSB)							
•••	N_PORT NAME							
15								(LSB)

The PORT LOOP POSITION field indicates the relative position of the corresponding Fibre Channel port on a Fibre Channel Arbitrated Loop (see FC-AL-2).

The BYPASS REASON field indicates the reason the corresponding Fibre Channel port is being bypassed, if it is being bypassed, and is defined in table 37.

Table 37 — BYPASS REASON field

Code	Description
00h	Either: a) the port is not being bypassed; or b) the port is being bypassed and no reason is available (e.g., it is being bypassed by request of an application client or the device).
01h to 0Fh	Reserved
10h	Link failure rate is too high
11h	Loss-of-synchronization rate is too high
12h	Loss-of-signal rate is too high
13h	Primitive sequence protocol error rate is too high
14h	Invalid transmission word rate is too high
15h	CRC error rate is too high
16h to 1Fh	Reserved for error rate reasons
20h	Link failure count is too high
21h	Loss-of-synchronization count is too high
22h	Loss-of-signal count is too high
23h	Primitive sequence protocol error count is too high
24h	Invalid transmission word count is too high
25h	CRC error count is too high
26h to 2Fh	Reserved for count reasons
30h to BFh	Reserved
C0h to FFh	Vendor specific

The PORT REQUESTED HARD ADDRESS field contains the Preferred Hard Address of the corresponding Fibre Channel port on a Fibre Channel Arbitrated Loop (see FC-AL-2).

The N_PORT IDENTIFIER field contains the Port Identifier (see FCP-4) of the corresponding Fibre Channel port. Applications may compare the lower 8 bits of this field with the PORT REQUESTED HARD ADDRESS field to determine whether the port was assigned its requested address.

The N_PORT NAME field contains the Port_Name (see FCP-4) of the corresponding Fibre Channel port.

6.1.13.3 Additional Element Status descriptor protocol-specific information for SAS

6.1.13.3.1 Additional Element Status descriptor protocol-specific information for SAS overview

Table 38 defines the Additional Element Status descriptor for SAS devices and expander devices (see SPL-4). This is used to describe:

a) a Device Slot element or an Array Device Slot element that may contain a SAS device or a SATA device;
b) a SAS Expander element;
c) a SCSI Initiator Port element containing SAS phys;
d) a SCSI Target Port element containing SAS phys; or

e) an Enclosure Services Controller Electronics element containing SAS phys.

Table 38 — Additional Element Status descriptor protocol-specific information for SAS

Byte\Bit	7	6	5	4	3	2	1	0
0	Descriptor-type specific							
1	DESCRIPTOR TYPE		Descriptor-type specific					
2 ••• y	Descriptor-type specific							

The DESCRIPTOR TYPE field is defined in table 39.

Table 39 — DESCRIPTOR TYPE field

Code	Description
00b	Used for Device Slot elements and Array Device Slot elements (see 6.1.13.3.2)
01b	Used for: a) SAS Expander elements (see 6.1.13.3.3); b) SCSI Initiator Port element (see 6.1.13.3.4); c) SCSI Target Port element (see 6.1.13.3.4); and d) Enclosure Services Controller Electronics elements (see 6.1.13.3.4).
All others	Reserved

6.1.13.3.2 Additional Element Status descriptor protocol-specific information for Device Slot elements and Array Device Slot elements for SAS

Table 40 defines the Additional Element Status descriptor protocol-specific information for Device Slot elements and Array Device Slot elements with the EIP bit (see 6.1.13.1) set to one.

Table 40 — Additional Element Status descriptor protocol-specific information for Device Slot elements and Array Device Slot elements for SAS with the EIP bit set to one

Byte\Bit	7	6	5	4	3	2	1	0
0	NUMBER OF PHY DESCRIPTORS							
1	DESCRIPTOR TYPE (00b)		Reserved					NOT ALL PHYS
2	Reserved							
3	DEVICE SLOT NUMBER							
Phy descriptor list								
4 ••• 31	Phy descriptor (first)(see table 42)							
	⋮							
z - 27 ••• z	Phy descriptor (last)(see table 42)							

Table 41 defines the Additional Element Status descriptor protocol-specific information for Device Slot elements and Array Device Slot elements with the EIP bit (see 6.1.13.1) set to zero. This format does not include the two extra bytes including the DEVICE SLOT NUMBER field that are in table 40.

Table 41 — Additional Element Status descriptor protocol-specific information for Device Slot elements and Array Device Slot elements for SAS with the EIP bit set to zero

Byte\Bit	7	6	5	4	3	2	1	0
0	NUMBER OF PHY DESCRIPTORS							
1	DESCRIPTOR TYPE (00b)		Reserved					NOT ALL PHYS
Phy descriptor list								
2	Phy descriptor (first)(see table 42)							
•••								
29								
	⋮							
z - 27	Phy descriptor (last)(see table 42)							
•••								
z								

The DESCRIPTOR TYPE field is set to 00b.

The NUMBER OF PHY DESCRIPTORS field indicates how many phy descriptors are in the phy descriptor list.

A NOT ALL PHYS bit set to one indicates that all phys in the SAS device or SATA device may or may not be described. A NOT ALL PHYS bit set to zero indicates that all phys in the SAS device or SATA device are described.

NOTE 7 - The NOT ALL PHYS bit may be set to one for SAS devices with multiple ports, where the enclosure services process only has access to information about the phys in one of the ports (e.g., in the same SAS domain as the enclosure services process).

The DEVICE SLOT NUMBER field, if any, indicates the number of the device slot.

The phy descriptor list contains a phy descriptor for each phy counted in the NUMBER OF PHY DESCRIPTORS field.

Table 42 defines the phy descriptor.

Table 42 — Phy descriptor

Byte\Bit	7	6	5	4	3	2	1	0
0	Reserved	DEVICE TYPE			Reserved			
1	Reserved							
2	Reserved				SSP INITIATOR PORT	STP INITIATOR PORT	SMP INITIATOR PORT	Reserved
3	SATA PORT SELECTOR	Reserved			SSP TARGET PORT	STP TARGET PORT	SMP TARGET PORT	SATA DEVICE
4 ••• 11	ATTACHED SAS ADDRESS							
12 ••• 19	SAS ADDRESS							
20	PHY IDENTIFIER							
21 ••• 27	Reserved							

If the device in the device slot is a SAS device, then:

a) the DEVICE TYPE field, SSP INITIATOR PORT bit, STP INITIATOR PORT bit, SMP INITIATOR PORT bit, SSP TARGET PORT bit, STP TARGET PORT bit, SMP TARGET PORT bit, SAS ADDRESS field, and PHY IDENTIFIER field contain the values of the fields in the IDENTIFY address frame transmitted by the phy;
b) the SATA PORT SELECTOR bit shall be set to zero; and
c) the SATA DEVICE bit shall be set to zero.

NOTE 8 - The phy transmits these fields in the IDENTIFY address frame to the attached phy (e.g., an expander phy in an expander device). The enclosure services process may retrieve the values from the attached phy (e.g., an enclosure process built into an expander device has direct access to the values received by the expander phy).

If the device in the device slot is a SATA device, then:

a) the DEVICE TYPE field shall be set to 000b;
b) the SSP INITIATOR PORT bit shall be set to zero;
c) the STP INITIATOR PORT bit shall be set to zero;
d) the SMP INITIATOR PORT bit shall be set to zero;
e) the SSP TARGET PORT bit shall be set to zero;
f) the STP TARGET PORT bit shall be set to zero;
g) the SMP TARGET PORT bit shall be set to zero;
h) if the SATA device is attached to a SATA port selector, the SATA PORT SELECTOR bit shall be set to one;
i) if the SATA device is not attached to a SATA port selector, the SATA PORT SELECTOR bit shall be set to zero;
j) the SATA DEVICE bit shall be set to one;
k) the SAS ADDRESS field shall be set to the SAS address of the STP target port of the STP/SATA bridge; and
l) the PHY IDENTIFIER field shall be set to 00h.

The ATTACHED SAS ADDRESS field contains the SAS address of the attached phy (e.g., the SAS address of the expander phy to which the SAS device or SATA device is attached).

NOTE 9 - All the fields are from the perspective of the SAS device or SATA device associated with the element (e.g., the disk drive), not the device (e.g., the expander device) which receives the IDENTIFY address frame. The ATTACHED SAS ADDRESS fields for multiple phys in the same SAS device or SATA device differ if it is attached to more than one SAS domain.

NOTE 10 - A SATA device may be attached to more than one SAS domain using a SATA port selector.

6.1.13.3.3 Additional Element Status descriptor protocol-specific information for SAS Expander elements

Table 43 defines the Additional Element Status descriptor protocol-specific information for SAS Expander elements.

Table 43 — Additional Element Status descriptor protocol-specific information for SAS Expander elements

Byte\Bit	7	6	5	4	3	2	1	0
0	NUMBER OF EXPANDER PHY DESCRIPTORS							
1	DESCRIPTOR TYPE (01b)		Reserved					
2	Reserved							
3								
4	SAS ADDRESS							
•••								
11								
Expander phy descriptor list								
12	Expander phy descriptor (first)(see table 44)							
13								
	⋮							
y - 1	Expander phy descriptor (last)(see table 44)							
y								

The NUMBER OF EXPANDER PHY DESCRIPTORS field indicates how many expander phy descriptors are in the expander phy descriptor list.

The DESCRIPTOR TYPE field is set to 01b.

The SAS ADDRESS field indicates the SAS address of the expander device.

The expander phy descriptor list contains an expander phy descriptor for each expander phy counted in the NUMBER OF EXPANDER PHY DESCRIPTORS field.

Table 44 defines the expander phy descriptor.

Table 44 — Expander phy descriptor

Byte\Bit	7	6	5	4	3	2	1	0
0	CONNECTOR ELEMENT INDEX							
1	OTHER ELEMENT INDEX							

The CONNECTOR ELEMENT INDEX field indicates the index of a SAS Connector element (see 7.3.26) to which the expander phy is attached. The index is based on the position of the status element in the Enclosure Status diagnostic page (see 6.1.4) and based on the EIIOE field (see table 33). If the expander phy is not attached to a connector represented by a SAS Connector element, then the CONNECTOR ELEMENT INDEX field shall be set to FFh.

The OTHER ELEMENT INDEX field indicates the index of a Device Slot element (see 7.3.2), Array Device Slot element (see 7.3.3), SAS Expander element (see 7.3.25), SCSI Initiator Port element (see 7.3.23), SCSI Target Port element (see 7.3.22), or Enclosure Services Controller Electronics element (see 7.3.9) to which the expander phy is attached. The index is based on the position of the status element in the Enclosure Status diagnostic page (see 6.1.4) and based on the EIIOE field (see table 33). If the expander phy is not attached to one of those elements, then the OTHER ELEMENT INDEX field shall be set to FFh.

6.1.13.3.4 Additional Element Status descriptor protocol-specific information for SCSI Initiator Port, SCSI Target Port, and Enclosure Services Controller Electronics elements for SAS

Table 45 defines the Additional Element Status descriptor protocol-specific information for SCSI Initiator Port and SCSI Target Port elements representing SCSI initiator ports and SCSI target ports with SAS phys.

Table 45 — Additional Element Status descriptor protocol-specific information for SCSI Initiator Port, SCSI Target Port, and Enclosure Services Controller Electronics elements for SAS

Byte\Bit	7	6	5	4	3	2	1	0
0	NUMBER OF PHY DESCRIPTORS							
1	DESCRIPTOR TYPE (01b)		Reserved					
2	Reserved							
3								
Phy descriptor list								
4	Phy descriptor (first)(see table 46)							
•••								
15								
	⋮							
y - 11	Phy descriptor (last)(see table 46)							
•••								
y								

The DESCRIPTOR TYPE field is set to 01b.

The NUMBER OF PHY DESCRIPTORS field indicates how many phy descriptors are in the phy descriptor list.

The phy descriptor list contains a phy descriptor for each phy counted in the NUMBER OF PHY DESCRIPTORS field.

Table 46 defines the phy descriptor.

Table 46 — Phy descriptor

Byte\Bit	7	6	5	4	3	2	1	0
0	PHY IDENTIFIER							
1	Reserved							
2	CONNECTOR ELEMENT INDEX							
3	OTHER ELEMENT INDEX							
4	SAS ADDRESS							
•••								
11								

The PHY IDENTIFIER field indicates the phy identifier (see SPL-4) of the phy.

The CONNECTOR ELEMENT INDEX field indicates the index of a SAS Connector element (see 7.3.26) to which the phy is attached. The index is based on the position of the status element in the Enclosure Status diagnostic page (see 6.1.4) and based on the EIIOE field (see table 33). If the phy is not attached to a connector represented by a SAS Connector element, then this field shall be set to FFh.

The OTHER ELEMENT INDEX field indicates the index of a Device Slot element (see 7.3.2), Array Device Slot element (see 7.3.3), SAS Expander element (see 7.3.25), SCSI Initiator Port element (see 7.3.23), SCSI Target Port element (see 7.3.22), or Enclosure Services Controller Electronics element (see 7.3.9) to which the phy is attached. The index is based on the position of the status element in the Enclosure Status diagnostic page (see 6.1.4) and based on the EIIOE field (see table 33). If the phy is not attached to one of those elements, then this field shall be set to FFh.

The SAS ADDRESS field indicates the SAS address of the phy. If the enclosure services process does not know the SAS address (e.g., the enclosure services process is in an expander on the back-side of an SCC controller, and this is a phy in a SCSI target port on the front-side of the SCC controller), this field shall be set to zero.

6.1.13.4 Additional Element Status descriptor protocol-specific information for PCIe

6.1.13.4.1 Additional Element Status descriptor protocol-specific information for PCIe overview

Table 47 defines the Additional Element Status descriptor protocol-specific information for PCIe devices (see PCIe). The EIP bit is set to one in an Additional Element Status descriptor (see 6.1.13.1) that contains an Additional Element Status descriptor protocol-specific information for PCIe.

Table 47 — Additional Element Status descriptor protocol-specific information for PCIe

Byte\Bit	7	6	5	4	3	2	1	0
0	PCIe Protocol-type specific							
1	PCIE PROTOCOL TYPE			PCIe Protocol-type specific				
2	PCIe Protocol-type specific							
•••								
y								

The PCIE PROTOCOL TYPE field indicates the protocol supported by the PCIe device (see table 48).

Table 48 — PCIE PROTOCOL TYPE field

Code	Description
001b	NVMe
All others	Reserved

6.1.13.4.2 Additional Element Status descriptor protocol-specific information for NVMe

The Additional Element Status descriptor is used to describe a Device Slot element or an Array Device Slot element that contains an NVMe device (see NVMe).

Table 49 defines the Additional Element Status descriptor protocol-specific information for NVMe devices.

Table 49 — Additional Element Status descriptor protocol-specific information for NVMe

Byte\Bit	7	6	5	4	3	2	1	0
0	NUMBER OF PORTS							
1	PCIE PROTOCOL TYPE (001b)			Reserved				NOT ALL PORTS
2	Reserved							
3	DEVICE SLOT NUMBER							
4	Reserved							
5								
6	PCIE VENDOR ID							(LSB)
7	(MSB)							
8	(MSB)	SERIAL NUMBER						
•••								
27								(LSB)
28	(MSB)	MODEL NUMBER						
•••								
67								(LSB)
Physical port descriptor list								
68	Port descriptor (first)(see table 50)							
•••								
75								
	⋮							
y - 8	Port descriptor (last)(see table 50)							
•••								
y								

The NUMBER OF PORTS field indicates how many physical PCIe ports are in the physical port descriptor list. There is one port descriptor for each physical port.

The PCIE PROTOCOL TYPE field indicates the PCIe protocol type and shall be set as shown in table 49.

A NOT ALL PORTS bit set to one indicates that the device may contain more physical ports than are described in the NUMBER OF PORTS field (i.e., the NVMe device may contain other physical ports that are reported in a different domain (see PCIe)). A NOT ALL PORTS bit set to zero indicates that all physical ports contained in the NVMe device are described in the physical port descriptor list.

The DEVICE SLOT NUMBER field indicates the number of the device slot represented by the element.

The PCIE VENDOR ID field indicates the Vendor ID (see PCIe) for the device. This is the same value that is reported in the Identify Controller Data Structure (see NVMe). A PCIE VENDOR ID field set to FFFFh indicates that the vendor ID for the device is not reported.

The SERIAL NUMBER field contains the 20 bytes of left-aligned ASCII data identifying the serial number for the NVMe subsystem, that is reported in the Identify Controller Data Structure (see NVMe). A SERIAL NUMBER field set to all ASCII spaces indicates that the serial number for the device is not reported.

The MODEL NUMBER field contains the 40 bytes of left-aligned ASCII data identifying the model number for the NVMe subsystem, that is reported in the Identify Controller Data Structure (see NVMe). A MODEL NUMBER field set to all ASCII spaces indicates that the model number for the device is not reported.

Table 50 defines the NVMe port descriptor.

Table 50 — NVMe port descriptor

Byte\Bit	7	6	5	4	3	2	1	0
0	Reserved					PSN VALID	BDF VALID	CID VALID
1	CONTROLLER ID							(LSB)
2	(MSB)							
3	Reserved							
4	BUS NUMBER							
5	DEVICE NUMBER					FUNCTION NUMBER		
6	PHYSICAL SLOT NUMBER							(LSB)
7	Reserved			(MSB)				

A PSN VALID bit set to one indicates the PHYSICAL SLOT NUMBER field contains valid data. A PSN VALID bit set to zero indicates that the PHYSICAL SLOT NUMBER field is invalid.

A BDF VALID bit set to one indicates that all of the following fields are valid:

a) BUS NUMBER field;
b) DEVICE NUMBER field; and
c) FUNCTION NUMBER field.

A BDF VALID bit set to zero indicates that all of the following fields are invalid:

a) BUS NUMBER field;
b) DEVICE NUMBER field; and
c) FUNCTION NUMBER field.

A CID VALID bit set to one indicates that the CONTROLLER ID field contains valid data. A CID VALID bit set to zero indicates that the CONTROLLER ID field is invalid.

The CONTROLLER ID field indicates the NVMe subsystem unique controller identifier associated with the controller reported in the NVMe Identify Controller response that is received through the port (see NVMe).

The BUS NUMBER field, DEVICE NUMBER field and FUNCTION NUMBER field contain the Bus Number, Device Number and Function Number for the physical NVMe device enumerated through the port (see PCIe).

The PHYSICAL SLOT NUMBER field contains the 13-bit Physical slot number indicated in the Slot Capabilities Register associated with the port (see PCIe). The Physical slot number indicates the chassis unique identifier for the physical slot attached to the port.

6.1.14 Subenclosure Help Text diagnostic page

The Subenclosure Help Text diagnostic page contains a text string (see 3.1.42) from an enclosure that describes the present state of the enclosure and provides text indicating what corrective actions, if any, should be performed. The Subenclosure Help Text diagnostic page allows enclosure-independent application clients to return enclosure-specific text describing the state of the enclosure and explain enclosure-dependent corrective actions that may be required.

The Subenclosure Help Text diagnostic page is read by the RECEIVE DIAGNOSTIC RESULTS command with a PCV bit set to one and a PAGE CODE field set to 0Bh. A PAGE CODE field set to 0Bh in the parameter list for a SEND DIAGNOSTIC command is an invalid field error (see 4.5).

Table 51 defines the Subenclosure Help Text diagnostic page.

Table 51 — Subenclosure Help Text diagnostic page

Byte\Bit	7	6	5	4	3	2	1	0
0	PAGE CODE (0Bh)							
1	NUMBER OF SECONDARY SUBENCLOSURES							
2	(MSB)	PAGE LENGTH (n - 3)						
3								(LSB)
4	(MSB)	GENERATION CODE						
•••								
7								(LSB)
Subenclosure help text list								
8	Subenclosure help text (primary subenclosure)(see table 52)							
	⋮							
	Subenclosure help text (last subenclosure)(see table 52)							
n								

The PAGE CODE field is set to 0Bh.

The NUMBER OF SECONDARY SUBENCLOSURES field specifies the number of secondary subenclosure help texts that are included in the subenclosure help text list, not including the primary subenclosure help text. The NUMBER OF SECONDARY SUBENCLOSURES field shall be set to the same value as the NUMBER OF SECONDARY SUBENCLOSURES field in the Configuration diagnostic page (see 6.1.2).

The PAGE LENGTH field indicates the number of bytes that follow in the diagnostic page.

The GENERATION CODE field indicates the value of the generation code (see 4.3.2).

Table 52 defines the format of each subenclosure help text. The first subenclosure help text shall be for the primary subenclosure. Subenclosure help text for the secondary subenclosures may follow in any order.

Table 52 — Subenclosure help text format

Byte\Bit	7	6	5	4	3	2	1	0
0	Reserved							
1	SUBENCLOSURE IDENTIFIER							
2	(MSB)	SUBENCLOSURE HELP TEXT LENGTH (m - 3)						
3								(LSB)
4	SUBENCLOSURE HELP TEXT							
•••								
m								

The SUBENCLOSURE IDENTIFIER field indicates the subenclosure (see 4.3) to which the subenclosure help text applies.

The SUBENCLOSURE HELP TEXT LENGTH field indicates the number of bytes in the SUBENCLOSURE HELP TEXT field. If a subenclosure has no help text, then the SUBENCLOSURE HELP TEXT LENGTH field shall be set to 0000h.

The SUBENCLOSURE HELP TEXT field contains a text string (see 3.1.42) describing what corrective actions should be performed on the subenclosure. The text string shall use the language and character set indicated by the Language element (see 7.3.18).

6.1.15 Subenclosure String Out diagnostic page

The Subenclosure String Out diagnostic page transmits an enclosure dependent binary string from the application client to the enclosure services process of the specified subenclosure. The binary string may contain bits describing indicator states, text or graphic display information, or control information outside the context of the elements defined in the Configuration diagnostic page (see 6.1.2).

The format of the binary string is vendor specific. For standalone enclosure services processes (see 4.1.2), an application client may select the format of the binary string using the manufacturer name and model from the standard INQUIRY data (see SPC-5) or using the enclosure header information in the Configuration diagnostic page. For attached enclosure services processes (see 4.1.3), an application client should select the format of the binary string using the enclosure header information in the Configuration diagnostic page.

The Subenclosure String Out diagnostic page is written by the SEND DIAGNOSTIC command. A RECEIVE DIAGNOSTIC RESULTS command with a PCV bit set to one and a PAGE CODE field set to 0Ch is defined as the request to read the Subenclosure String In diagnostic page (see 6.1.16).

Table 53 defines the Subenclosure String Out diagnostic page.

Table 53 — Subenclosure String Out diagnostic page

Byte\Bit	7	6	5	4	3	2	1	0
0	PAGE CODE (0Ch)							
1	SUBENCLOSURE IDENTIFIER							
2	(MSB)	PAGE LENGTH (n - 3)						
3								(LSB)
4	(MSB)	EXPECTED GENERATION CODE						
•••								
7								(LSB)
8	SUBENCLOSURE STRING OUT DATA							
•••								
n								

The PAGE CODE field is set to 0Ch.

The SUBENCLOSURE IDENTIFIER field specifies the subenclosure (see 4.3) to which the application client is sending the subenclosure string out data. If the SUBENCLOSURE IDENTIFIER field does not match a SUBENCLOSURE IDENTIFIER field value indicated in the Configuration diagnostic page, then the enclosure services process shall report an invalid field error (see 4.5).

The PAGE LENGTH field specifies the number of bytes that follow in the diagnostic page.

The EXPECTED GENERATION CODE field is defined in the Enclosure Control diagnostic page (see 6.1.3).

The SUBENCLOSURE STRING OUT DATA field shall contain the vendor specific information to be transferred from the application client to the enclosure services process of the specified subenclosure.

6.1.16 Subenclosure String In diagnostic page

The Subenclosure String In diagnostic page transmits enclosure dependent binary string(s) from the enclosure services process of the subenclosures to the application client. The binary strings may contain bits describing keyboard states, switch states, or the content of other information provided by the primary subenclosure to the application client.

The format of each binary string is vendor specific. For standalone enclosure services processes (see 4.1.2), an application client may determine the format of the binary string using the manufacturer name and mode from the standard INQUIRY data (see SPC-5) or using the enclosure header information in the Configuration diagnostic page (see 6.1.2). For attached enclosure services processes (see 4.1.3), an application client should select the format of the binary string using the enclosure header information in the Configuration diagnostic page.

The transmission of a page using the SEND DIAGNOSTIC command with a PAGE CODE field set to 0Ch is defined as the transmission of a Subenclosure String Out diagnostic page (see 6.1.15).

Table 54 defines the Subenclosure String In diagnostic page.

Table 54 — Subenclosure String In diagnostic page

Byte\Bit	7	6	5	4	3	2	1	0
0	PAGE CODE (0Ch)							
1	NUMBER OF SECONDARY SUBENCLOSURES							
2	(MSB)	PAGE LENGTH (n - 3)						
3								(LSB)
4	(MSB)	GENERATION CODE						
•••								
7								(LSB)
Subenclosure string in data list								
8	Subenclosure string in data (primary subenclosure)(see table 55)							
	⋮							
	Subenclosure string in data (last subenclosure)(see table 55)							
n								

The PAGE CODE field is set to 0Ch.

The NUMBER OF SECONDARY SUBENCLOSURES field indicates the number of secondary subenclosure string in data values that are included in the subenclosure string in data list, not including the primary subenclosure string in data. The NUMBER OF SECONDARY SUBENCLOSURES field shall be set to the same value as the NUMBER OF SECONDARY SUBENCLOSURES field in the Configuration diagnostic page (see 6.1.2).

The PAGE LENGTH field indicates the number of bytes that follow in the diagnostic page.

The GENERATION CODE field indicates the value of the generation code (see 4.3.2).

Table 55 defines the format of each subenclosure string in data. The first subenclosure string in data shall be for the primary subenclosure; subenclosure string in data for the secondary subenclosures may follow in any order.

Table 55 — Subenclosure string in data format

Byte\Bit	7	6	5	4	3	2	1	0
0	Reserved							
1	SUBENCLOSURE IDENTIFIER							
2	(MSB)	SUBENCLOSURE STRING IN DATA LENGTH (m - 3)						
3								(LSB)
4	SUBENCLOSURE STRING IN DATA							
•••								
m								

The SUBENCLOSURE IDENTIFIER field indicates the subenclosure (see 4.3) to which the subenclosure string in data applies.

The SUBENCLOSURE STRING IN DATA LENGTH field indicates the number of bytes in the SUBENCLOSURE STRING IN DATA field. If a subenclosure has no subenclosure string in data, then the SUBENCLOSURE STRING IN DATA LENGTH field shall be set to 0000h.

The SUBENCLOSURE STRING IN DATA field shall contain the vendor specific information to be transferred from the enclosure services process to the application client.

6.1.17 Supported SES Diagnostic Pages diagnostic page

The Supported SES Diagnostic Pages diagnostic subpage returns the list of diagnostic pages in the range of 01h to 2Fh implemented by the enclosure services process.

The Supported SES Diagnostic Pages diagnostic page is read by the RECEIVE DIAGNOSTIC RESULTS command with a PCV bit set to one and a PAGE CODE field set to 0Dh. A PAGE CODE field set to 0Dh in the parameter list for a SEND DIAGNOSTIC command is an invalid field error (see 4.5).

Table 56 defines the Supported SES Diagnostic Pages diagnostic page.

Table 56 — Supported SES Diagnostic Pages diagnostic page

Byte\Bit	7	6	5	4	3	2	1	0
0	PAGE CODE (0Dh)							
1	Reserved							
2	(MSB)	PAGE LENGTH (n - 3)						
3								(LSB)
4	SUPPORTED SES PAGE LIST							
	PAD (if needed)							
n								

The PAGE CODE field is set to 0Dh.

The PAGE LENGTH field indicates the number of bytes that follow in the diagnostic page.

The SUPPORTED SES PAGE LIST field contains a list of all diagnostic page codes, one per byte, in the range of 01h to 2Fh that are implemented by the enclosure services process. It shall be sorted in ascending order beginning with page code 01h. The Supported SES Diagnostic Pages page code (i.e., 0Dh) shall be included in the list.

The PAD field contains zero, one, two, or three bytes set to 00h such that the total length of the diagnostic page is a multiple of four.

6.1.18 Download Microcode Control diagnostic page

The Download Microcode Control diagnostic page transmits a vendor specific microcode (i.e., firmware) image to the control memory space of the enclosure services process. The image may be saved to non-volatile storage (e.g., a flash ROM).

The Download Microcode Control diagnostic page is written by the SEND DIAGNOSTIC command. A RECEIVE DIAGNOSTIC RESULTS command with a PCV bit set to one and a PAGE CODE field set to 0Eh is defined as the request to read the Download Microcode Status diagnostic page (see 6.1.19).

The microcode image may be sent using one or more SEND DIAGNOSTIC commands. If the complete set of SEND DIAGNOSTIC commands required to deliver the microcode image are not received before:

a) for standalone enclosure services processes (see 4.1.2), a logical unit reset, hard reset, power on, or I_T nexus loss; or
b) for attached enclosure services processes (see 4.1.3), power on,

then the incomplete microcode image shall not be used.

If an error is detected, then the enclosure services process shall abort the download microcode operation and set the SUBENCLOSURE DOWNLOAD MICROCODE STATUS field to the appropriate value in the Download Microcode Status diagnostic page.

Table 57 defines the Download Microcode Control diagnostic page.

Table 57 — Download Microcode Control diagnostic page

Byte\Bit	7	6	5	4	3	2	1	0
0	PAGE CODE (0Eh)							
1	SUBENCLOSURE IDENTIFIER							
2	(MSB)	PAGE LENGTH (n - 3)						
3								(LSB)
4	(MSB)	EXPECTED GENERATION CODE						
•••								
7								(LSB)
8	DOWNLOAD MICROCODE MODE							
9	Reserved							
10								
11	BUFFER ID							
12	(MSB)	BUFFER OFFSET						
•••								
15								(LSB)
16	(MSB)	MICROCODE IMAGE LENGTH						
•••								
19								(LSB)
20	(MSB)	MICROCODE DATA LENGTH (m - 23)						
•••								
23								(LSB)
24	MICROCODE DATA							
•••								
m								
m + 1	PAD (if needed)							
n								

The PAGE CODE field is set to 0Eh.

The SUBENCLOSURE IDENTIFIER field specifies the subenclosure (see 4.3) to which the application client is sending the microcode image. If the SUBENCLOSURE IDENTIFIER field does not match a SUBENCLOSURE IDENTIFIER field value found in the Configuration diagnostic page (see 6.1.2), then the enclosure services process shall abort the download microcode operation and set the SUBENCLOSURE DOWNLOAD MICROCODE STATUS field to 80h in the Download Microcode Status diagnostic page.

The PAGE LENGTH field specifies the number of bytes that follow in the diagnostic page. If the PAGE LENGTH field value does not match the number of bytes that follow in the diagnostic page, then the enclosure services process shall abort the download microcode operation and set the SUBENCLOSURE DOWNLOAD MICROCODE STATUS field to 80h in the Download Microcode Status diagnostic page.

The EXPECTED GENERATION CODE field is defined in the Enclosure Control diagnostic page (see 6.1.3). If the EXPECTED GENERATION CODE field is not set to the current generation code, then the enclosure services process shall abort the download microcode operation and set the SUBENCLOSURE DOWNLOAD MICROCODE STATUS field to 80h in the Download Microcode Status diagnostic page.

The DOWNLOAD MICROCODE MODE field is defined in table 58.

Table 58 — DOWNLOAD MICROCODE MODE field (part 1 of 2)

Code	Name	Description
06h	Download microcode with offsets and activate	After the last SEND DIAGNOSTIC command delivering a Download Microcode Control diagnostic page to the subenclosure completes, the enclosure services process shall: 1) verify the complete microcode image (e.g., perform a vendor specific checksum); 2) provided there are no errors in the microcode image, set the SUBENCLOSURE DOWNLOAD MICROCODE STATUS field to 10h in the Download Microcode Status diagnostic page; 3) wait for a RECEIVE DIAGNOSTIC RESULTS command requesting the Download Microcode Status diagnostic page; and 4) activate the new microcode image (i.e., reboot). The downloaded microcode shall be used until: a) it is supplanted by another download microcode operation; b) for standalone enclosure services processes, hard reset or power on; or c) for attached enclosure services processes, power on.
07h	Download microcode with offsets, save, and activate	After the last SEND DIAGNOSTIC command delivering a Download Microcode Control diagnostic page to the subenclosure completes, the enclosure services process shall verify the complete microcode image (e.g., perform a vendor specific checksum) and save the new microcode image into non-volatile storage (e.g., flash ROM). If there are no errors in the microcode image or in the save operation, then the enclosure services process shall return the SUBENCLOSURE DOWNLOAD MICROCODE STATUS field set to one of the following values in the Download Microcode Status diagnostic page, if requested, and activate the new microcode when specified: a) 10h: activate the new microcode image after: A) returning the Download Microcode Status diagnostic page; B) power on; or C) for standalone enclosure services processes, hard reset, b) 11h: for standalone enclosure services processes only. Activate the new microcode image after: A) power on; or B) hard reset, or c) 12h: activate the new microcode image after power on. The application client may determine the microcode revision level currently in use by retrieving the PRODUCT REVISION LEVEL field in the Enclosure descriptor in the Configuration diagnostic page.

Table 58 — DOWNLOAD MICROCODE MODE field (part 2 of 2)

Code	Name	Description
0Eh	Download microcode with offsets, save, and defer activate	After the last SEND DIAGNOSTIC command delivering a Download Microcode Control diagnostic page to the subenclosure completes, the enclosure services process shall verify the complete microcode image (e.g., perform a vendor specific checksum), save the new microcode image into non-volatile storage (e.g., flash ROM), and defer activation of the new microcode. If there are no errors in the microcode image or in the save operation, then the enclosure services process shall return the SUBENCLOSURE DOWNLOAD MICROCODE STATUS field set to 13h in the Download Microcode Status diagnostic page, if requested, and activate the new microcode after: a) processing a Download Microcode Control diagnostic page with the DOWNLOAD MICROCODE MODE field set to 0Fh (i.e., Activate deferred microcode); b) power on; or c) hard reset.
0Fh	Activate deferred microcode	After the SEND DIAGNOSTIC command specifying this mode completes, the enclosure services process shall activate the new microcode image. The application client may determine the microcode revision level currently in use by retrieving the PRODUCT REVISION LEVEL field in the Enclosure descriptor in the Configuration diagnostic page.
All others	Reserved	Reserved. The enclosure services process shall abort the download microcode operation and set the SUBENCLOSURE DOWNLOAD MICROCODE STATUS field to 80h in the Download Microcode Status diagnostic page.

Once a download microcode operation has begun, if the DOWNLOAD MICROCODE MODE field value changes while specifying the same buffer ID, then the enclosure services process shall abort the download microcode operation and set the SUBENCLOSURE DOWNLOAD MICROCODE STATUS field to 80h in the Download Microcode Status diagnostic page.

The BUFFER ID field specifies a specific buffer within the enclosure services process to receive the microcode image. The enclosure services process assigns vendor specific buffer ID codes to buffers (e.g., the main firmware image may be stored in buffer 00h and a backup firmware image may be stored in buffer 01h). The enclosure services process shall support a buffer ID value of 00h. If more than one buffer is supported, then it shall assign additional buffer ID codes contiguously, beginning with 01h. If it receives an unsupported buffer ID code, then the enclosure services process shall abort the download microcode operation and set the SUBENCLOSURE DOWNLOAD MICROCODE STATUS field to 80h in the Download Microcode Status diagnostic page.

The enclosure services process may require that only one subenclosure download microcode operation be processed at a time, and/or may require that only one buffer ID be used at a time. If the enclosure services process does not accept the specified combination of subenclosure identifier and buffer ID, then it shall abort the download microcode operation and set the SUBENCLOSURE DOWNLOAD MICROCODE STATUS field to 80h in the Download Microcode Status diagnostic page.

The BUFFER OFFSET field specifies the offset in bytes within the buffer to which the microcode data is written. The BUFFER OFFSET field shall be set to a multiple of four. The enclosure services process may require that the BUFFER OFFSET field be contiguously increasing in consecutive SEND DIAGNOSTIC commands. If the enclosure services process does not accept the specified buffer offset, then it shall abort the download microcode operation and set the SUBENCLOSURE DOWNLOAD MICROCODE STATUS field to 80h in the Download Microcode Status diagnostic page.

The MICROCODE IMAGE LENGTH field specifies the total number of bytes in the microcode image the application intends to send to the specified buffer ID. The microcode image may be sent using one or more SEND DIAGNOSTIC commands.

The MICROCODE DATA LENGTH field specifies the number of bytes in the MICROCODE DATA field.

The MICROCODE DATA field contains part of the vendor specific microcode image.

The PAD field contains zero, one, two, or three bytes set to 00h such that the total length of the diagnostic page is a multiple of four.

6.1.19 Download Microcode Status diagnostic page

The Download Microcode Status diagnostic page transmits information about the status of one or more download microcode operations to the application client.

The transmission of a page using the SEND DIAGNOSTIC command with a PAGE CODE field set to 0Eh is defined as the transmission of a Download Microcode Control diagnostic page (see 6.1.18).

Table 59 defines the Download Microcode Status diagnostic page.

Table 59 — Download Microcode Status diagnostic page

Byte\Bit	7	6	5	4	3	2	1	0
0	PAGE CODE (0Eh)							
1	NUMBER OF SECONDARY SUBENCLOSURES							
2	(MSB)	PAGE LENGTH (n - 3)						
3								(LSB)
4	(MSB)	GENERATION CODE						
•••								
7								(LSB)
Download microcode status descriptor list								
8	Download microcode status descriptor (primary subenclosure)(see table 60)							
•••								
23								
	⋮							
n - 15	Download microcode status descriptor (last subenclosure)(see table 60)							
•••								
n								

The PAGE CODE field is set to 0Eh.

The NUMBER OF SECONDARY SUBENCLOSURES field indicates the number of separate subenclosure download microcode status descriptors that are included in the download microcode status descriptor list, not including the primary subenclosure download microcode status descriptor. The NUMBER OF SECONDARY SUBENCLOSURES field shall be set to the same value as the NUMBER OF SECONDARY SUBENCLOSURES field in the Configuration diagnostic page (see 6.1.2).

The PAGE LENGTH field indicates the number of bytes that follow in the diagnostic page.

The GENERATION CODE field indicates the value of the generation code (see 4.3.2).

The download microcode status descriptor list contains a download microcode status descriptor for each download microcode operation for which status is being reported.

Table 60 defines the format of each subenclosure's download microcode status descriptor. The first download microcode status descriptor shall be for the primary subenclosure. Download microcode status descriptors for the secondary subenclosures may follow in any order.

Table 60 — Download microcode status descriptor format

Byte\Bit	7	6	5	4	3	2	1	0
0	Reserved							
1	SUBENCLOSURE IDENTIFIER							
2	SUBENCLOSURE DOWNLOAD MICROCODE STATUS							
3	SUBENCLOSURE DOWNLOAD MICROCODE ADDITIONAL STATUS							
4	(MSB)	SUBENCLOSURE DOWNLOAD MICROCODE MAXIMUM SIZE						
•••								
7								(LSB)
8	Reserved							
•••								
10								
11	SUBENCLOSURE DOWNLOAD MICROCODE EXPECTED BUFFER ID							
12	(MSB)	SUBENCLOSURE DOWNLOAD MICROCODE EXPECTED BUFFER OFFSET						
•••								
15								(LSB)

The SUBENCLOSURE IDENTIFIER field indicates the subenclosure (see 4.3) to which the download microcode status descriptor applies.

The SUBENCLOSURE DOWNLOAD MICROCODE STATUS field indicates the status of download microcode operations for the subenclosure and is defined in table 61. After reporting a code indicating completion, the enclosure services process shall set the SUBENCLOSURE DOWNLOAD MICROCODE STATUS field to 00h and shall set the SUBENCLOSURE DOWNLOAD MICROCODE ADDITIONAL STATUS field to 00h.

Table 61 — SUBENCLOSURE DOWNLOAD MICROCODE STATUS field (part 1 of 2)

Code	Description
Codes indicating interim status	
00h	No download microcode operation is in progress.
01h	Download microcode operation is in progress. The enclosure services process has received one or more Download Microcode Control diagnostic pages and is awaiting additional microcode data.
02h	Download microcode operation data transfer is complete, currently updating non-volatile storage.
03h	The enclosure services process is currently updating non-volatile storage with deferred microcode.
04h to 0Fh	Reserved for codes indicating interim status
Codes indicating completion with no errors	
10h	Download microcode operation complete with no error. The enclosure services process begins using the new microcode after returning this status.

Table 61 — SUBENCLOSURE DOWNLOAD MICROCODE STATUS field (part 2 of 2)

Code	Description
11h	Download microcode operation complete with no error. The enclosure services process (e.g., a standalone enclosure services process) begins using the new microcode after the next hard reset or power on.
12h	Download microcode operation complete with no error. The enclosure services process (e.g., an attached enclosure services process) begins using the new microcode after the next power on.
13h	Download microcode operation complete with no error. The enclosure services process (e.g., an attached enclosure services process) begins using the new microcode after: a) processing a Download Microcode Control diagnostic page specifying the activate deferred microcode mode; b) hard reset; or c) power on.
14h to 6Fh	Reserved for codes indicating no error
Other	
70h to 7Fh	Vendor specific
Codes indicating completion with errors	
80h	Error in one or more of the Download Microcode Control diagnostic page fields, new microcode discarded. The SUBENCLOSURE DOWNLOAD MICROCODE ADDITIONAL STATUS field shall be set to the offset of the lowest byte of the field in the Download Microcode Control diagnostic page that is in error.
81h	Microcode image error (e.g., a problem detected from a vendor specific check of the microcode image such as a checksum), new microcode discarded
82h	Download microcode timeout, new microcode discarded. The enclosure services process may discard microcode data after a vendor specific amount of time if it does not receive the entire microcode image.
83h	Internal error in the download microcode operation. New microcode image is needed before a hard reset or power on (e.g., a flash ROM write failed and no backup ROM image is available).
84h	Internal error in the download microcode operation. Hard reset and power on safe (e.g., the enclosure services process uses a backup ROM image on hard reset or power on).
85h	Processed a Download Microcode Control diagnostic page with the DOWNLOAD MICROCODE MODE field set to 0Fh (i.e., activate deferred microcode) if there is no deferred microcode.
86h to EFh	Reserved for codes indicating errors
Other	
F0h to FFh	Vendor specific error in the download microcode operation. Microcode image status is vendor specific.

The SUBENCLOSURE DOWNLOAD MICROCODE ADDITIONAL STATUS field provides additional status for certain values of the SUBENCLOSURE DOWNLOAD MICROCODE STATUS field as described in table 61.

The SUBENCLOSURE DOWNLOAD MICROCODE MAXIMUM SIZE field indicates the maximum size in bytes of the microcode image that the enclosure services process accepts. The image may be delivered using one or more Download Microcode Control diagnostic pages.

The SUBENCLOSURE DOWNLOAD MICROCODE EXPECTED BUFFER ID field indicates the next value that the enclosure services process expects in the BUFFER ID field in the Download Microcode Control diagnostic page.

If the enclosure services process accepts multiple BUFFER ID field values concurrently, then it shall set the SUBENCLOSURE DOWNLOAD MICROCODE EXPECTED BUFFER ID field to FFh.

The SUBENCLOSURE DOWNLOAD MICROCODE EXPECTED BUFFER OFFSET field indicates the next value that the enclosure services process expects in the BUFFER OFFSET field in the Download Microcode Control diagnostic page. If the enclosure services process accepts arbitrary BUFFER OFFSET field values, then it shall set the SUBENCLOSURE DOWNLOAD MICROCODE EXPECTED BUFFER OFFSET field to FFFFFFFFh.

6.1.20 Subenclosure Nickname Control diagnostic page

The Subenclosure Nickname Control diagnostic page transmits a text string (see 3.1.42) to the enclosure services process to serve as the nickname for the specified subenclosure. The nickname is saved to non-volatile storage (e.g., a flash ROM) so it may be retrieved after future hard resets.

The Subenclosure Nickname Control diagnostic page is written by the SEND DIAGNOSTIC command. A RECEIVE DIAGNOSTIC RESULTS command with a PCV bit set to one and a PAGE CODE field set to 0Fh is defined as the request to read the Subenclosure Nickname Status diagnostic page (see 6.1.21).

Table 62 defines the Subenclosure Nickname Control diagnostic page.

Table 62 — Subenclosure Nickname Control diagnostic page

Byte\Bit	7	6	5	4	3	2	1	0
0	PAGE CODE (0Fh)							
1	SUBENCLOSURE IDENTIFIER							
2	(MSB)	PAGE LENGTH (0024h)						
3								(LSB)
4	(MSB)	EXPECTED GENERATION CODE						
•••								
7								(LSB)
8	SUBENCLOSURE NICKNAME							
•••								
39								

The PAGE CODE field is set to 0Fh.

The SUBENCLOSURE IDENTIFIER field specifies the subenclosure (see 4.3) to which the application client is sending the subenclosure nickname. If the SUBENCLOSURE IDENTIFIER value does not match a SUBENCLOSURE IDENTIFIER value found in the Configuration diagnostic page (see 6.1.2), then the enclosure services process shall set the SUBENCLOSURE NICKNAME STATUS field to 80h in the Subenclosure Nickname Status diagnostic page.

The PAGE LENGTH field specifies the number of bytes that follow in the diagnostic page. If the PAGE LENGTH field value does not match the length of the page, then the enclosure services process shall not change the subenclosure nickname and shall set the SUBENCLOSURE NICKNAME MICROCODE STATUS field to 80h in the Subenclosure Nickname Status diagnostic page.

The EXPECTED GENERATION CODE field is defined in the Enclosure Control diagnostic page (see 6.1.3). If the EXPECTED GENERATION CODE field is not set to the current generation code, the enclosure services process shall not change the subenclosure nickname and shall set the SUBENCLOSURE NICKNAME MICROCODE STATUS field to 80h in the Subenclosure Nickname Status diagnostic page.

The SUBENCLOSURE NICKNAME field specifies the subenclosure nickname. If a Language element (see 7.3.18) is present, then the SUBENCLOSURE NICKNAME field shall contain a text string (see 3.1.42) with characters using the language and character set indicated by the Language element and the enclosure services process shall store the language code value indicated by the Language element along with the subenclosure nickname. If a Language element is not available, then the SUBENCLOSURE NICKNAME field shall contain an ASCII string (see

3.7.1) and the enclosure services process shall store the language code value of 0000h along with the subenclosure nickname.

6.1.21 Subenclosure Nickname Status diagnostic page

The Subenclosure Nickname Status diagnostic page transmits the nickname of each subenclosure to the application client.

The transmission of a page using the SEND DIAGNOSTIC command with a PAGE CODE field set to 0Fh is defined as the transmission of a Subenclosure Nickname Control diagnostic page (see 6.1.20).

Table 63 defines the Subenclosure Nickname Status diagnostic page.

Table 63 — Subenclosure Nickname Status diagnostic page

Byte\Bit	7	6	5	4	3	2	1	0
0	PAGE CODE (0Fh)							
1	NUMBER OF SECONDARY SUBENCLOSURES							
2	(MSB)	PAGE LENGTH (n - 3)						
3								(LSB)
4	(MSB)	GENERATION CODE						
•••								
7								(LSB)
Subenclosure nickname status descriptor list								
8	Subenclosure nickname status descriptor (primary subenclosure)(see table 64)							
•••								
47								
	⋮							
n - 39	Subenclosure nickname status descriptor (last subenclosure)(see table 64)							
•••								
n								

The PAGE CODE field is set to 0Fh.

The NUMBER OF SECONDARY SUBENCLOSURES field indicates the number of secondary subenclosure nickname status descriptor values that are included, not including the primary subenclosure. The NUMBER OF SECONDARY SUBENCLOSURES field shall be set to the same value as the NUMBER OF SECONDARY SUBENCLOSURES field in the Configuration diagnostic page (see 6.1.2).

The PAGE LENGTH field indicates the number of bytes that follow in the diagnostic page.

The GENERATION CODE field indicates the value of the generation code (see 4.3.2).

The subenclosure nickname status descriptor list contains a subenclosure nickname status descriptor for each subenclosure nickname reported.

Table 64 defines the format of each subenclosure's enclosure nickname status descriptor. The first subenclosure nickname status descriptor shall be for the primary subenclosure. Subenclosure nickname status descriptors for secondary subenclosures may follow in any order.

Table 64 — Subenclosure nickname status descriptor format

Byte\Bit	7	6	5	4	3	2	1	0
0	Reserved							
1	SUBENCLOSURE IDENTIFIER							
2	SUBENCLOSURE ENCLOSURE NICKNAME STATUS							
3	SUBENCLOSURE ENCLOSURE NICKNAME ADDITIONAL STATUS							
4	Reserved							
5								
6	(MSB)	SUBENCLOSURE NICKNAME LANGUAGE CODE						
7								(LSB)
8	SUBENCLOSURE NICKNAME							
•••								
39								

The SUBENCLOSURE IDENTIFIER field indicates the subenclosure (see 4.3) to which the subenclosure nickname status descriptor applies.

The SUBENCLOSURE NICKNAME STATUS field indicates the status of nickname operations for the subenclosure and is defined in table 65. After reporting a non-zero value, the enclosure services process shall set the SUBENCLOSURE NICKNAME STATUS field to 00h and shall set the SUBENCLOSURE NICKNAME ADDITIONAL STATUS field to 00h.

Table 65 — SUBENCLOSURE NICKNAME STATUS field

Code	Description
00h	No errors
80h	Error in one or more of the Subenclosure Nickname Control diagnostic page fields. The SUBENCLOSURE NICKNAME ADDITIONAL STATUS field shall be set to the offset of the lowest byte of the field in the Subenclosure Nickname Control diagnostic page that has an error.
81h	Internal error. The nickname is lost.
82h	Internal error. The previous nickname preserved.
All others	Reserved

The SUBENCLOSURE NICKNAME ADDITIONAL STATUS field provides additional status for certain values of the SUBENCLOSURE NICKNAME STATUS field as described in table 65.

The SUBENCLOSURE NICKNAME LANGUAGE CODE field indicates the language and character set of the subenclosure nickname, as defined by the LANGUAGE CODE field in the Language element (see 7.3.18).

The SUBENCLOSURE NICKNAME field indicates the subenclosure nickname.

6.2 Log parameters for enclosure services devices

This subclause describes descriptors and pages for log parameters used with enclosure services devices.

Table 66 defines the log page codes for enclosure services devices.

Table 66 — Log page codes for enclosure services devices

Page code	Subpage code	Description	Reference
00h	00h	Supported Log Pages log page	SPC-5
	FFh	Supported Log Pages and Subpages log pages	SPC-5
06h	00h	Non-Medium Error log page	SPC-5
07h	00h	Last n Error Events log page	SPC-5
0Bh	00h	Last n Deferred Error or Asynchronous Events log page	SPC-5
0Dh	00h	Temperature log page	SPC-5
0Eh	00h	Start-Stop Cycle Counter log page	SPC-5
0Fh	00h	Application Client log page	SPC-5
10h	00h	Self-Test Results log page	SPC-5
18h	00h to FEh	Protocol Specific Port log pages	SPC-5
2Fh	00h	Informational Exceptions log page	SPC-5
01h to 3Fh	FFh	Supported Subpages log page	SPC-5
30h to 3Eh	00h to FEh	Vendor specific	
All others		Reserved	

6.3 Mode parameters for enclosure services devices

6.3.1 Mode parameters overview

This subclause describes descriptors and pages for mode parameters used with enclosure services devices.

The mode parameter list, including the mode parameter header and mode block descriptor are described in SPC-5.

The MEDIUM TYPE field is contained in the mode parameter header (see SPC-5). For enclosure services devices, the MEDIUM TYPE field is reserved.

The DEVICE SPECIFIC PARAMETER field is contained in the mode parameter header (see SPC-5). For enclosure services devices, the DEVICE SPECIFIC PARAMETER field is reserved.

The BLOCK DESCRIPTOR LENGTH field is contained in the mode parameter header (see SPC-5). Enclosure services devices have no BLOCK DESCRIPTOR field. For enclosure services devices, the BLOCK DESCRIPTOR LENGTH field shall be set to zero.

Table 67 defines the mode page codes for enclosure services devices.

Table 67 — Mode page codes for enclosure services devices

Page code	Subpage code	Description	Reference
00h	N/A	Vendor specific	
01h	00h to FEh	Reserved for this standard	
02h	00h	Disconnect-Reconnect mode page	SPC-5
03h to 08h	00h to FEh	Reserved for this standard	
09h	00h	Obsolete	
0Ah	00h	Control mode page	SPC-5
	01h	Control Extension mode page	SPC-5
	F0h to FEh	Reserved for this standard	
0Bh to 13h	00h to FEh	Reserved for this standard	
14h	00h	Enclosure Services Management mode page	6.3.2
14h	01h to FEh	Reserved for this standard	
18h	00h	Protocol Specific Logical Unit mode page	SPC-5
	01h to FEh	See SCSI transport protocol standard	SPC-5
19h	00h	Protocol Specific Port mode page	SPC-5
	01h to FEh	See SCSI transport protocol standard	SPC-5
1Bh	00h to FEh	Reserved for this standard	
1Ch	00h	Informational Exceptions Control mode page	SBC-4
1Dh to 1Fh	00h to FEh	Reserved for this standard	
20h to 3Eh	N/A	Vendor specific	
3Fh [a]	00h [a]	Return all pages	SPC-5
3Fh [a]	FFh [a]	Return all pages and subpages	SPC-5
00h to 3Fh [a]	FFh [a]	Return all subpages	SPC-5
All others		Reserved for SPC-5	

[a] Valid only for the MODE SENSE command (see SPC-5)

6.3.2 Enclosure Services Management mode page

The Enclosure Services Management mode page provides controls over those features involving communication with an enclosure services process. If the Enclosure Services Management mode page is not implemented, then the device server shall not implement the timed completion function (see 4.7.3).

If a RECEIVE DIAGNOSTIC RESULTS command is received by a device server that supports enclosure services and the ENBLTC bit has been set to one, the device server may wait up to the time contained in the MAXIMUM TASK COMPLETION TIME field before returning the requested diagnostic page. The device server shall only perform this delay operation for Enclosure Status diagnostic pages (see 6.1.4). If a noncritical, critical, or unrecoverable condition exists or occurs during the waiting period, then the device server shall stop waiting and return the requested diagnostic page.

Table 68 defines the Enclosure Services Management mode page.

Table 68 — Enclosure Services Management mode page

Byte\Bit	7	6	5	4	3	2	1	0
0	PS	SPF (0b)	PAGE CODE (14h)					
1	PAGE LENGTH (06h)							
2	Reserved							
•••								
4								
5	Reserved							ENBLTC
6	(MSB)	MAXIMUM TASK COMPLETION TIME						
7								(LSB)

The PS (parameters savable) bit is defined in SPC-5. For enclosure services devices, the PS bit is not restricted.

The SPF bit is defined in SPC-5 and is set to zero for this mode page.

The PAGE CODE field is defined in SPC-5 and is set to 14h for this mode page.

The PAGE LENGTH field is defined in SPC-5 and is set to 06h for this mode page.

An ENBLTC (enable timed completion) bit set to one specifies that the device server shall enable the timed completion function (see 4.7.3). An ENBLTC bit set to zero specifies that the device server shall disable the timed completion function.

The MAXIMUM TASK COMPLETION TIME field specifies the maximum time that the device server may choose to wait before returning a diagnostic page. The timing of the wait period shall begin when the transmission of RECEIVE DIAGNOSTIC RESULTS command to the device server is complete and end with the transfer of the Enclosure Status diagnostic page and the transfer of completion status. In establishing the value for the MAXIMUM TASK COMPLETION TIME field, the application client should consider any time periods that are not controlled by the device server (e.g., reconnection overheads, congestion latency, and protocol timeouts). The value is specified in 100 millisecond units. A value of 0000h specifies a vendor specific maximum time (e.g., infinite).

7 Element definitions

7.1 Element definitions overview

This clause contains the format definitions for:

a) control elements in the Enclosure Control diagnostic page (see 6.1.3);
b) status elements in the Enclosure Status diagnostic page (see 6.1.4);
c) threshold control elements in the Threshold Out diagnostic page (see 6.1.8); and
d) threshold status elements in the Threshold In diagnostic page (see 6.1.9).

Field format definitions common to all element types are described in 7.2. Field format definitions that differ for different element types are described in 7.3.

Table 69 defines the elements and their element type codes.

Table 69 — Element type codes

Element type code	Name	DISABLE bit support [a]	Threshold [b]	Reference
00h	Unspecified	no	none	7.3.1
01h	Device Slot	no	none	7.3.2
02h	Power Supply	no	none	7.3.4
03h	Cooling	no	none	7.3.5
04h	Temperature Sensor	yes	temperature	7.3.6
05h	Door	no	none	7.3.7
06h	Audible Alarm	yes	none	7.3.8
07h	Enclosure Services Controller Electronics	no	none	7.3.9
08h	SCC Controller Electronics	no	none	7.3.10
09h	Nonvolatile Cache	no	none	7.3.11
0Ah	Invalid Operation Reason [c]	no	none	7.3.12
0Bh	Uninterruptible Power Supply	no	battery status	7.3.13
0Ch	Display	no	none	7.3.14
0Dh	Key Pad Entry	no	none	7.3.15
0Eh	Enclosure	no	none	7.3.16
0Fh	SCSI Port/Transceiver	no	none	7.3.17
10h	Language	no	none	7.3.18
11h	Communication Port	no	none	7.3.19
12h	Voltage Sensor	yes	% voltage	7.3.20
13h	Current Sensor	yes	% current	7.3.21
14h	SCSI Target Port	no	none	7.3.22
15h	SCSI Initiator Port	no	none	7.3.23
16h	Simple Subenclosure	no	none	7.3.24
17h	Array Device Slot	no	none	7.3.3
18h	SAS Expander	no	none	7.3.25
19h	SAS Connector	no	none	7.3.26
1Ah to 7Fh	Reserved			
80h to FFh	Vendor specific			

[a] A "DISABLE bit support" value of yes means the DISABLE bit is supported in the COMMON CONTROL field of the control element (see 7.2.2).
[b] The "threshold" value indicates the value, if any, that is subject to comparison with the threshold specified by the threshold control element (see 7.2.4) and indicated by the threshold status element (see 7.2.5).
[c] A special threshold status element format defined if the INVOP bit is set to one. See 7.3.12.

7.2 Element formats

7.2.1 Element formats overview

Unless otherwise specified, all status and control bits are optional. All control bits are advisory and may be ignored or overridden to maintain a proper operating environment in the enclosure.

7.2.2 Control element format

Table 70 defines the format of the control element.

Table 70 — Control element format

Byte\Bit	7	6	5	4	3	2	1	0
0	COMMON CONTROL							
	SELECT	PRDFAIL	DISABLE	RST SWAP	Reserved			
1	Element type specific control information							
•••								
3								

The COMMON CONTROL field contains those bits that may be used by any control element.

A SELECT bit set to one specifies that the enclosure services process should perform the control functions defined by the other bits in the control element. A SELECT bit set to zero specifies that the enclosure services process shall ignore all other bits in the control element. The SELECT bit allows individual control elements to be selected for control operations.

A PRDFAIL (predicted failure) bit set to one specifies that the enclosure services process shall turn on the “predicted failure state” indicator, if any, for the element. A PRDFAIL bit set to zero specifies that the enclosure services process turn off the “predicted failure state” indicator, if any, for the element. The element is not required to implement the PRDFAIL bit or the “predicted failure state” indicator.

A DISABLE bit set to one specifies that the enclosure services process shall disable the element. A DISABLE bit set to zero specifies that the enclosure services shall allow normal operation of the element to resume. The interpretation of the disabled state is specific to the element. The DISABLE bit is defined for each element listed with disable support in table 69 (see 7.1).

A RST SWAP (reset swap) bit set to one specifies that the enclosure services process shall set the SWAP bit to zero in the status element for the I_T nexus accessing the control element. A RST SWAP bit set to zero specifies that the enclosure services process shall not change the SWAP bit in the status element for the I_T nexus accessing the control element.

NOTE 11 - The DISABLE bit and the RST SWAP bit are not intended to be accessed as part of a read-modify-write procedure with the corresponding bits in the status element (see 7.2.3).

The element type specific control information is defined separately for each element type in 7.3. Control information containing conflicting bits may cause unpredictable behavior or may cause the enclosure services process to report an invalid field error (see 4.5).

7.2.3 Status element format

Table 71 defines the format of the status element.

Table 71 — Status element format

Byte\Bit	7	6	5	4	3	2	1	0
0	COMMON STATUS							
	Reserved	PRDFAIL	DISABLED	SWAP	ELEMENT STATUS CODE			
1	Element type specific status information							
•••								
3								

The COMMON STATUS field contains those bits that may be returned by any status element.

A PRDFAIL (predicted failure) bit set to one indicates that the element has the capability of predicting failure and that a failure has been predicted. The “predicted failure state” indicator may additionally be set by the PRDFAIL bit in the corresponding control element. A PRDFAIL bit set to zero indicates that the “predicted failure state” indicator is turned off or is not implemented.

A DISABLED bit set to one indicates that the element has been disabled (see the DISABLE bit in the control element (see 7.2.2)). A DISABLED bit set to zero indicates that the element has not been disabled or that the disable function is not implemented. The DISABLED bit is defined for each element listed with disable support in table 69 (see 7.1).

A SWAP bit set to one indicates that an element has been swapped (i.e., removed and inserted) (e.g., for a Device Slot element, the device has been removed and the same or another device has been inserted in the same device slot) since the last time the RST SWAP bit was set to one in the control element (see 7.2.2) for the I_T nexus being used to access the status element. A SWAP bit set to zero indicates that the element has not been swapped. The SWAP bit is set to zero if the RST SWAP bit is set to one in the control element and remains set to zero until another swap occurs. The SWAP bit provides an indication that an element's properties may have been changed without any change of configuration. A standalone enclosure services process shall maintain one SWAP bit for each I_T nexus. An attached enclosure services process shall maintain one SWAP bit shared by all I_T nexuses.

The ELEMENT STATUS CODE field is defined in table 72.

Table 72 — ELEMENT STATUS CODE field

Code	Name	Condition
0h	Unsupported	Status detection is not implemented for this element.
1h	OK	Element is installed and no error conditions are known.
2h	Critical	Critical condition is detected.
3h	Noncritical	Noncritical condition is detected.
4h	Unrecoverable	Unrecoverable condition is detected.
5h	Not Installed	Element is not installed in enclosure.
6h	Unknown	Sensor has failed or element status is not available.
7h	Not Available	Element installed, no known errors, but the element has not been turned on or set into operation.
8h	No Access Allowed	The initiator port from which the RECEIVE DIAGNOSTIC RESULT command was received does not have access to this element.
9h to Fh	Reserved	

In an overall status element, the enclosure services process shall set the ELEMENT STATUS CODE field as defined in table 73.

Table 73 — ELEMENT STATUS CODE field usage in an overall status element

<table>
<tr><th colspan="2">Condition</th><th>Valid values</th></tr>
<tr><td colspan="2">The enclosure services process does not implement overall status detection</td><td>0h</td></tr>
<tr><td rowspan="3">The enclosure services process implements overall status detection</td><td>There are no individual status elements</td><td>Any value representing the overall status</td></tr>
<tr><td>There are one or more individual status elements and, in each of them, the ELEMENT STATUS CODE field is set to 0h (i.e., Unsupported)</td><td>Any value representing the overall status</td></tr>
<tr><td>There are one or more individual status elements and, in each of them, the ELEMENT STATUS CODE field is not set to 0h (i.e., Unsupported)</td><td>0h (i.e., Unsupported) or any value representing the overall status</td></tr>
</table>

The element type specific status information is defined separately for each element type in 7.3.

7.2.4 Threshold control element format

Table 74 defines the format of the threshold control element.

Table 74 — Threshold control element format

Byte\Bit	7	6	5	4	3	2	1	0
0	REQUESTED HIGH CRITICAL THRESHOLD							
1	REQUESTED HIGH WARNING THRESHOLD							
2	REQUESTED LOW WARNING THRESHOLD							
3	REQUESTED LOW CRITICAL THRESHOLD							

The REQUESTED HIGH CRITICAL THRESHOLD field recommends a value for the high critical threshold.

The REQUESTED HIGH WARNING THRESHOLD field recommends a value for the high warning threshold.

The REQUESTED LOW WARNING THRESHOLD field recommends a value for the low warning threshold.

The REQUESTED LOW CRITICAL THRESHOLD field recommends a value for the low critical threshold.

All fields in the threshold control element are advisory. The enclosure services process shall ignore the contents of the threshold control element for those elements that have no value to be compared with a threshold and for those elements that do not implement the threshold function. For those elements that have a sensor value to compare with a threshold, the enclosure services process may:

a) accept the fields transmitted in the overall threshold control element or the individual threshold control element;
b) set the thresholds to more appropriate values than those requested; or
c) ignore the contents of any or all of the requested threshold fields.

Table 69 (see 7.1) lists those elements that use threshold control elements. The definition of each threshold field for an element type is defined in the subclause describing that element type.

See 4.6 for how the enclosure services process uses thresholds.

7.2.5 Threshold status element format

Table 75 defines the format of the threshold status element.

Table 75 — Threshold status element format

Byte\Bit	7	6	5	4	3	2	1	0
0	HIGH CRITICAL THRESHOLD							
1	HIGH WARNING THRESHOLD							
2	LOW WARNING THRESHOLD							
3	LOW CRITICAL THRESHOLD							

The HIGH CRITICAL THRESHOLD field indicates the high critical threshold. The enclosure indicates a critical condition if the sensor detects a value higher than the high critical threshold. A HIGH CRITICAL THRESHOLD field set to 00h indicates that the sensor does not test a high critical threshold.

The HIGH WARNING THRESHOLD field indicates the high warning threshold. The enclosure indicates a noncritical condition if the sensor detects a value higher than the high warning threshold. A HIGH WARNING THRESHOLD field set to 00h indicates that the sensor does not test a high warning threshold.

The LOW WARNING THRESHOLD field indicates the low warning threshold. The enclosure indicates a noncritical condition if the sensor detects a value lower than the low warning threshold. A LOW WARNING THRESHOLD field set to 00h indicates that the sensor does not test a low warning threshold.

The LOW CRITICAL THRESHOLD field indicates the low critical threshold. The enclosure indicates a critical condition if the sensor detects a value lower than the low critical threshold. A LOW CRITICAL THRESHOLD field set to 00h indicates that the sensor does not test a low critical threshold.

The threshold fields indicate the thresholds that the enclosure is using at the time the Threshold In diagnostic page is returned.

Table 69 (see 7.1) lists those elements that use threshold status elements. The definition of each threshold field for an element type is defined in the subclause describing that element type.

See 4.6 for how the enclosure services process uses thresholds.

7.3 Field definitions for all element types

7.3.1 Unspecified element

The Unspecified element manages an unspecified part of the enclosure.

Table 76 defines the Unspecified control element.

Table 76 — Unspecified control element

Byte\Bit	7	6	5	4	3	2	1	0
0	COMMON CONTROL							
1 ••• 3	Reserved							

The COMMON CONTROL field is defined in 7.2.2.

Table 77 defines the Unspecified status element.

Table 77 — Unspecified status element

Byte\Bit	7	6	5	4	3	2	1	0
0	COMMON STATUS							
1 ••• 3	Reserved							

The COMMON STATUS field is defined in 7.2.3.

7.3.2 Device Slot element

The Device Slot element manages a device slot (e.g., containing a SCSI device such as a disk drive) in the enclosure.

Additional information about a Device Slot element may be reported in the Additional Element Status diagnostic page (see 6.1.13).

Table 78 defines the Device Slot control element.

Table 78 — Device Slot control element

Byte\Bit	7	6	5	4	3	2	1	0
0	COMMON CONTROL							
1	Reserved							
2	RQST ACTIVE	DO NOT REMOVE	Reserved	RQST MISSING	RQST INSERT	RQST REMOVE	RQST IDENT	Reserved
3	Reserved		RQST FAULT	DEVICE OFF	ENABLE BYP A	ENABLE BYP B	Reserved	

The COMMON CONTROL field is defined in 7.2.2.

The RQST ACTIVE (request device activity indication) bit has no effect if the enclosure provides no visual activity indication. The RQST ACTIVE bit may be set to one by the application client to cause a visual indication that the device is active. The enclosure services process shall sustain the active condition of the visual indicator for at least 0.5 s.

NOTE 12 - To maintain the active indication asserted (if present), the application client sets the bit to one at least once every 0.5 s.

A DO NOT REMOVE bit set to one specifies that the device not be removed. A DO NOT REMOVE bit set to zero specifies that the device may be removed. The DO NOT REMOVE bit may control mechanical interlocks or visual indications that the device should not be removed.

A RQST MISSING (request device missing indication) bit set to one specifies that the device slot be identified by a visual indication that a previously present device is missing (e.g., has been removed). A RQST MISSING bit set to zero specifies that the device missing indication shall be cleared.

A RQST INSERT (request insert) bit set to one specifies that the device slot be prepared for the insertion of a device. A RQST INSERT bit set to zero specifies that the device slot take no action to prepare for the insertion of a device. The bit may control mechanical interlocks or visual indications that a device may be inserted in the device slot.

A RQST REMOVE (request removal) bit set to one specifies that the device slot be prepared for the removal of a device. A RQST REMOVE bit set to zero specifies that the device slot take no action to prepare for the removal of a device. The bit may control mechanical interlocks or visual indications that a device may be removed from the device slot.

A RQST IDENT (request identify) bit set to one specifies that the enclosure services process identify the element (i.e., the device slot) by a visual indication. A RQST IDENT bit set to zero specifies that the enclosure services process not identify the element by a visual indication.

A RQST FAULT (request fault indication) bit set to one specifies that the device slot be identified by a visual indication that a fault is present in the device. A RQST FAULT bit set to zero specifies that the fault indication shall be cleared if the indication is not also being set by the device or the enclosure services process.

A DEVICE OFF bit set to one specifies that the device be turned off. A DEVICE OFF bit set to zero specifies that the device may be turned on if all other prerequisites are met.

An ENABLE BYP A (enable bypass Port A) bit set to one specifies that port A for the device be bypassed. An ENABLE BYP A bit set to zero specifies that, if there is no other cause for the port to be bypassed, the port bypass shall be disabled and the device shall be included on the device interface.

An ENABLE BYP B (enable bypass Port B) bit set to one specifies that port B for the device be bypassed. An ENABLE BYP B bit set to zero specifies that, if there is no other cause for the port to be bypassed, the port bypass shall be disabled and the device shall be included on the device interface.

Table 79 defines the Device Slot status element.

Table 79 — Device Slot status element

Byte\Bit	7	6	5	4	3	2	1	0
0	COMMON STATUS							
1	SLOT ADDRESS							
2	APP CLIENT BYPASSED A	DO NOT REMOVE	ENCLOSURE BYPASSED A	ENCLOSURE BYPASSED B	READY TO INSERT	RMV	IDENT	REPORT
3	APP CLIENT BYPASSED B	FAULT SENSED	FAULT REQSTD	DEVICE OFF	BYPASSED A	BYPASSED B	DEVICE BYPASSED A	DEVICE BYPASSED B

The COMMON STATUS field is defined in 7.2.3.

Table 80 defines the SLOT ADDRESS field.

Table 80 — SLOT ADDRESS field

Kind of status element	Condition	Description
Overall	Any	Vendor specific
Individual	Device Slot is for a parallel SCSI device	SCSI address of the primary parallel SCSI target port of the SCSI target device
	Device Slot is not for a parallel SCSI device	Vendor specific

A DO NOT REMOVE bit set to one indicates that:

a) the corresponding bit has been set to one in the Device Slot control element; and
b) mechanical interlocks or visual signals are present and activated to indicate that the device should not be removed.

A DO NOT REMOVE bit set to zero indicates that:

a) the corresponding bit has been set to zero in the Device Slot control element or has not been implemented; and
b) mechanical interlocks or visual signals are not present and activated to indicate that the device may be removed.

A READY TO INSERT bit set to one indicates that the device slot has been prepared for the insertion of a device. A READY TO INSERT bit set to zero indicates that the device slot is unable to accept the insertion of a device or that the RQST INSERT bit in the Device Slot control element is not implemented.

A RMV (remove) bit set to one indicates that the device slot has been prepared for the removal of the device. A RMV bit set to zero indicates that the device should not be removed from the device slot or that the RQST REMOVE bit in the Device Slot control element is not implemented.

An IDENT (identify) bit set to one indicates that the enclosure services process is identifying the element by a visual indication because the RQST IDENT bit was set to one in the Device Slot control element. An IDENT bit set to zero indicates that the enclosure services process is not identifying the element by a visual indication because of the RQST IDENT bit in the Device Slot control element, or a visual indication is not implemented.

A REPORT bit set to one indicates that the enclosure services process is using this device to report the Enclosure Status diagnostic page. A REPORT bit set to zero indicates that it is not using this device to report the Enclosure Status diagnostic page. In the overall status element, the device server shall set the REPORT bit to zero and the application client should ignore the REPORT bit.

A FAULT SENSED bit set to one indicates that the enclosure or device has detected a fault condition and may be displaying a visual indication of the fault condition. A FAULT SENSED bit set to zero indicates that there is no fault condition detected by the device or enclosure.

A FAULT REQSTD (fault requested) bit set to one indicates that the RQST FAULT bit has been set to one in the Device Slot control element, specifying that the device slot be identified by a visual fault indication. A FAULT REQSTD bit set to zero indicates that the RQST FAULT bit has been set to zero in the Device Slot control element or that the RQST FAULT bit in the Device Slot control element is not implemented.

A DEVICE OFF bit set to one indicates that the device is turned off. A DEVICE OFF bit set to zero indicates that the device is turned on.

A BYPASSED A bit set to one indicates that Port A has been bypassed by request of the application client, the device, or the enclosure. A BYPASSED A bit set to zero indicates that the port bypass is disabled and the device is included on the device interface.

A BYPASSED B bit set to one indicates that Port B has been bypassed by request of the application client, the device, or the enclosure. A BYPASSED B bit set to zero indicates that the port bypass is disabled and the device is included on the device interface.

An ENCLOSURE BYPASSED A bit set to one indicates that Port A has been bypassed by request of the enclosure services process. An ENCLOSURE BYPASSED A bit set to zero indicates that Port A is not being bypassed under control of the enclosure services process. The device may still be bypassed under control of the application client or the device.

An ENCLOSURE BYPASSED B bit set to one indicates that Port B has been bypassed by request of the enclosure services process. An ENCLOSURE BYPASSED B bit set to zero indicates that Port B is not being bypassed under control of the enclosure services process. The device may still be bypassed under control of the application client or the device.

An APP CLIENT BYPASSED A (application client bypassed Port A) bit set to one indicates that Port A has been bypassed by request of an application client. An APP CLIENT BYPASSED A bit set to zero indicates that Port A is not being bypassed under control of an application client. The device may still be bypassed under control of the enclosure services process or the device.

An APP CLIENT BYPASSED B (application client bypassed Port B) bit set to one indicates that Port B has been bypassed by request of an application client. An APP CLIENT BYPASSED B bit set to zero indicates that Port B is not being bypassed under control of an application client. The device may still be bypassed under control of the enclosure services process or the device.

A DEVICE BYPASSED A bit set to one indicates that Port A has been bypassed by request of the device. A DEVICE BYPASSED A bit set to zero indicates that Port A is not being bypassed by request of the device. If set to one, the device may be removed, turned off, not operational, or controlling the bypass signals under control of the device. If set to zero, the device may still be bypassed under control of the enclosure services process or the application client.

A DEVICE BYPASSED B bit set to one indicates that Port B has been bypassed by request of the device. A DEVICE BYPASSED B bit set to zero indicates Port B is not being bypassed by request of the device. If set to one, the device may be removed, turned off, not operational, or controlling the bypass signals under control of the device. If set to zero, the device may still be bypassed under control of the enclosure services process or the application client.

7.3.3 Array Device Slot element

The Array Device Slot element manages a device slot (e.g., a slot containing a SCSI disk drive) in an enclosure that is being used in a storage array (e.g., by a RAID controller). The mapping between the visual indicators associated with the Array Device Slot element and the requests to set those indicators is vendor specific.

Additional information about an Array Device Slot element may be reported in the Additional Element Status diagnostic page (see 6.1.13).

Table 81 defines the Array Device Slot control element.

Table 81 — Array Device Slot control element

Byte\Bit	7	6	5	4	3	2	1	0
0	COMMON CONTROL							
1	RQST OK	RQST RSVD DEVICE	RQST HOT SPARE	RQST CONS CHECK	RQST IN CRIT ARRAY	RQST IN FAILED ARRAY	RQST REBUILD/ REMAP	RQST R/R ABORT
2	RQST ACTIVE	DO NOT REMOVE	Reserved	RQST MISSING	RQST INSERT	RQST REMOVE	RQST IDENT	Reserved
3	Reserved		RQST FAULT	DEVICE OFF	ENABLE BYP A	ENABLE BYP B	Reserved	

The COMMON CONTROL field is defined in 7.2.2.

A RQST OK (request OK) bit set to one specifies that the "device okay" indicator be turned on. A RQST OK bit set to zero specifies that the "device okay" indicator be turned off.

A RQST RSVD DEVICE (request reserved device) bit set to one specifies that the "reserved device" indicator be turned on. A RQST RSVD DEVICE bit set to zero specifies that the "reserved device" indicator be turned off.

A RQST HOT SPARE (request hot spare) bit set to one specifies that the "hot spare" indicator be turned on. A RQST HOT SPARE bit set to zero specifies that the "hot spare" indicator be turned off.

A RQST CONS CHECK (request consistency check in progress) bit set to one specifies that the "consistency check in progress" indicator be turned on. A RQST CONS CHECK bit set to zero specifies that the "consistency check in progress" indicator be turned off.

A RQST IN CRIT ARRAY (request in critical array) bit set to one specifies that the "in critical array" indicator be turned on. A RQST IN CRIT ARRAY bit set to zero specifies that the "in critical array" indicator be turned off.

A RQST IN FAILED ARRAY (request in failed array) bit set to one specifies that the "in failed array" indicator be turned on. A RQST IN FAILED ARRAY bit set to zero specifies that the "in failed array" indicator be turned off.

A RQST REBUILD/REMAP (request rebuild/remap) bit set to one specifies that the "rebuild/remap" indicator be turned on. A RQST REBUILD/REMAP bit set to zero specifies that the "rebuild/remap" indicator be turned off.

A RQST R/R ABORT (request rebuild/remap aborted) bit set to one specifies that the "rebuild/remap abort" indicator be turned on. A RQST R/R ABORT bit set to zero specifies that the "rebuild/remap abort" indicator be turned off.

The RQST ACTIVE (request device activity indication) bit, DO NOT REMOVE bit, RQST INSERT (request insert) bit, RQST REMOVE (request removal) bit, RQST MISSING (request device missing indication) bit, RQST IDENT (request identify) bit, RQST FAULT (request fault indication) bit, DEVICE OFF bit, ENABLE BYP A (enable bypass port A) bit, and ENABLE BYP B (enable bypass port B) bit are defined in the Device Slot control element (see 7.3.2).

Table 82 defines the Array Device Slot status element.

Table 82 — Array Device Slot status element

Byte\Bit	7	6	5	4	3	2	1	0
0	COMMON STATUS							
1	OK	RSVD DEVICE	HOT SPARE	CONS CHK	IN CRIT ARRAY	IN FAILED ARRAY	REBUILD/ REMAP	R/R ABORT
2	APP CLIENT BYPASSED A	DO NOT REMOVE	ENCLOSURE BYPASSED A	ENCLOSURE BYPASSED B	READY TO INSERT	RMV	IDENT	REPORT
3	APP CLIENT BYPASSED B	FAULT SENSED	FAULT REQSTD	DEVICE OFF	BYPASSED A	BYPASSED B	DEVICE BYPASSED A	DEVICE BYPASSED B

The COMMON STATUS field is defined in 7.2.3.

An OK bit set to one indicates that the "device okay" indicator is turned on. An OK bit set to zero indicates that the "device okay" indicator is turned off.

A RSVD DEVICE (reserved device) bit set to one indicates that the "reserved device" indicator is turned on. A RSVD DEVICE bit set to zero indicates that the "reserved device" indicator is turned off.

A HOT SPARE bit set to one indicates that the "hot spare" indicator is turned on. A HOT SPARE bit set to zero indicates that the "hot spare" indicator is turned off.

A CONS CHECK (consistency check in progress) bit set to one indicates that the “consistency check in progress” indicator is turned on, showing that the device is participating in an array consistency check activity. A CONS CHECK bit set to zero indicates that the “consistency check in progress” indicator is turned off.

An IN CRIT ARRAY (in critical array) bit set to one indicates that the “in critical array” indicator is turned on, showing that the device is participating in an array which would be degraded or become unavailable if the device were removed. An IN CRIT ARRAY bit set to zero indicates that the “in critical array” indicator is turned off.

An IN FAILED ARRAY bit set to one indicates that the “in failed array” indicator is turned on, showing that the device is a member of an array that has failed. The IN FAILED ARRAY bit set to zero indicates that the “in failed array” indicator is turned off.

A REBUILD/REMAP bit set to one indicates that the “rebuild/remap” indicator is turned on, showing that the device is participating in a rebuild or remap of the array contents. A REBUILD/REMAP bit set to zero indicates that the “rebuild/remap” indicator is turned off.

An R/R ABORT (rebuild/remap abort) bit set to one indicates that the “rebuild/remap abort” indicator is on, showing that a rebuild or remap of the array contents has been unsuccessfully terminated. An R/R ABORT bit set to zero indicates that the “rebuild/remap abort” indicator is turned off.

The DO NOT REMOVE bit, READY TO INSERT bit, RMV (remove) bit, IDENT (identify) bit, and REPORT bit are defined in the Device Slot status element (see 7.3.2).

The FAULT SENSED bit, FAULT REQSTD bit, and DEVICE OFF bit are defined in the Device Slot status element (see 7.3.2).

The APP CLIENT BYPASSED A bit, APP CLIENT BYPASSED B bit, ENCLOSURE BYPASSED A bit, ENCLOSURE BYPASSED B bit, BYPASSED A bit, BYPASSED B bit, DEVICE BYPASSED A bit, and DEVICE BYPASSED B bit are defined in the Device Slot status element (see 7.3.2).

7.3.4 Power Supply element

The Power Supply element manages a power supply (e.g., providing power to device slots (see 7.3.2), array device slots (see 7.3.3), enclosure services controller electronics (see 7.3.9), and/or SCC controller electronics (see 7.3.10)).

Table 83 defines the Power Supply control element.

Table 83 — Power Supply control element

Byte\Bit	7	6	5	4	3	2	1	0
0	COMMON CONTROL							
1	RQST IDENT	DO NOT REMOVE	Reserved					
2	Reserved							
3	Reserved	RQST FAIL	RQST ON	Reserved				

The COMMON CONTROL field is defined in 7.2.2.

A RQST IDENT (request identify) bit set to one specifies that the enclosure services process identify the element by a visual indication. A RQST IDENT bit set to zero specifies that the enclosure services process not identify the element by a visual indication.

A DO NOT REMOVE bit set to one specifies that the power supply should not be removed. A DO NOT REMOVE bit set to zero specifies that the application client has not provided a recommendation and the value in the corresponding DO NOT REMOVE status bit is determined by the device server. The DO NOT REMOVE bit may control mechanical interlocks or visual indications that the power supply should not be removed.

A RQST FAIL (request failure indication) bit set to one specifies that the enclosure services process shall enable a visual indication that a failure is present in the element. A RQST FAIL bit set to zero specifies that the enclosure services process shall disable a visual indication that a failure is present in the element, unless the enclosure services process is itself detecting a failure in the element. Some failure indications in the STATUS INFORMATION field are latched. Setting the RQST FAIL bit to one and then setting it to zero shall reset any latched failure indications.

A RQST ON (request power supply on) bit set to one specifies that the power supply be turned on or remain on. If the RQST ON bit is set to zero, the power supply is requested to turn off or remain off.

Table 84 defines the Power Supply status element.

Table 84 — Power Supply status element

Byte\Bit	7	6	5	4	3	2	1	0
0	COMMON STATUS							
1	IDENT	DO NOT REMOVE	Reserved					
2	Reserved				DC OVER VOLTAGE	DC UNDER VOLTAGE	DC OVER CURRENT	Reserved
3	HOT SWAP	FAIL	RQSTED ON	OFF	OVERTMP FAIL	TEMP WARN	AC FAIL	DC FAIL

The COMMON STATUS field is defined in 7.2.3.

An IDENT (identify) bit set to one indicates that the enclosure services process is identifying the element by a visual indication because the RQST IDENT bit was set to one in the control element. An IDENT bit set to zero indicates that the enclosure services process is not identifying the element by a visual indication based on the RQST IDENT bit in the control element, or a visual indication is not implemented.

A DO NOT REMOVE bit set to one indicates that:

a) the corresponding bit in the Power Supply control element has been set to one or that the device server has determined that the power supply element should not be removed; and
b) mechanical interlocks or visual signals may be present and activated to indicate that the power supply element should not be removed.

A DO NOT REMOVE bit set to zero indicates that:

a) the corresponding bit in the Power Supply control element has been set to zero or has not been implemented;
b) the device server has not determined that power supply element removal is not recommended; and
c) mechanical interlocks or visual signals are not present and activated to indicated that power supply element removal is not recommended.

A DC OVERVOLTAGE bit set to one indicates an overvoltage condition has been detected at the power supply output. A DC OVERVOLTAGE bit set to zero indicates that the RQST FAIL bit has been set to one in the Power Supply control element and then set to zero, or that a power on has occurred.

A DC UNDERVOLTAGE bit set to one indicates an undervoltage condition has been detected at the power supply output. A DC UNDERVOLTAGE bit set to zero indicates that the RQST FAIL bit has been set to one in the Power Supply control element and then set to zero, or that a power on has occurred.

A DC OVERCURRENT bit set to one indicates an overcurrent condition has been detected at the power supply output. The DC OVERCURRENT bit set to zero indicates that the RQST FAIL bit has been set to one in the Power Supply control element and then set to zero, or that a power on has occurred.

A HOT SWAP bit set to one indicates that the element may be replaced without removing power from the subenclosure that contains the element. A HOT SWAP bit set to zero may or may not indicate that the element is not a replaceable element or power is required to be removed from the subenclosure before the element is replaced.

A FAIL bit set to one indicates that the enclosure services process is identifying the element with a visual failure indication based on the RQST FAIL bit in the control element or its own detection of a failure. A FAIL bit set to zero indicates that:

a) the enclosure services process is not identifying the element with a visual failure indication based on the RQST FAIL bit in the control element or its own detection of a failure (e.g., the ELEMENT STATUS CODE field is not set to 1h (i.e., OK)); or
b) a visual failure indication is not implemented.

A RQSTED ON (requested on) bit set to one indicates that the power supply has been manually turned on or has been requested to turn on by setting the RQST ON bit to one in the Power Supply control element. A RQSTED ON bit set to zero indicates that the RQST ON bit has been set to zero in the Power Supply control element.

An OFF bit set to one indicates the power supply is not providing power. The OFF bit shall be set to one if:

a) the RQST ON bit is set to zero in the Power Supply control element to request the power supply be turned off;
b) the power supply is turned off manually; or
c) a failure has caused the power supply to stop providing power.

An OFF bit set to zero indicates the power supply is providing its specified output.

An OVERTMP FAIL (over temperature failure) bit set to one indicates the power supply has detected a temperature above the safe operating temperature range. The power supply may shut down. An OVERTMP FAIL bit set to zero indicates that the RQST FAIL bit has been set to one in the Power Supply control element then set to zero, or that a power on has occurred.

A TEMP WARN (over temperature warning) bit set to one indicates the power supply has detected a temperature within the safe operating temperature range, but above the normal operating temperature range. A TEMP WARN bit set to zero indicates that the temperature is within the normal operating temperature range.

An AC FAIL bit set to one indicates that the power supply is not receiving the specified A.C. power. An AC FAIL bit set to zero indicates that normal A.C. power is being received.

A DC FAIL bit set to one indicates that the power supply is unable to supply the specified D.C. power. A DC FAIL bit set to zero indicates that normal D.C. power is being provided.

7.3.5 Cooling element

The Cooling element manages a fan, blower, or other cooling mechanism.

Table 85 defines the Cooling control element.

Table 85 — Cooling control element

Byte\Bit	7	6	5	4	3	2	1	0
0	COMMON CONTROL							
1	RQST IDENT	DO NOT REMOVE	Reserved					
2	Reserved							
3	Reserved	RQST FAIL	RQST ON	Reserved		REQUESTED SPEED CODE		

The COMMON CONTROL field is defined in 7.2.2.

A RQST IDENT (request identify) bit set to one specifies that the enclosure services process identify the element by a visual indication. A RQST IDENT bit set to zero specifies that the enclosure services process not identify the element by a visual indication.

A DO NOT REMOVE bit set to one specifies that the cooling element should not be removed. A DO NOT REMOVE bit set to zero specifies that the application client has not provided a recommendation and the value in the corresponding DO NOT REMOVE status bit is determined by the device server. The DO NOT REMOVE bit may control mechanical interlocks or visual indications that the cooling element should not be removed.

A RQST FAIL (request failure indication) bit set to one specifies that the enclosure services process shall enable a visual indication that a failure is present in the element. A RQST FAIL bit set to zero specifies that the enclosure services process shall disable a visual indication that a failure is present in the element, unless the enclosure services process is itself detecting a failure in the element.

A RQST ON (request cooling mechanism on) bit set to one specifies that the cooling mechanism be turned on or remain on. If the RQST ON bit is set to zero, the cooling mechanism is requested to turn off or remain off.

The REQUESTED SPEED CODE field specifies the requested speed or rate of cooling of the cooling mechanism, and is defined in table 86.

Table 86 — REQUESTED SPEED CODE field

Code	Description
000b	Leave fan at current speed
001b	Set cooling mechanism to at lowest speed
010b	Set cooling mechanism to second lowest speed
011b	Set cooling mechanism to third lowest speed
100b	Set cooling mechanism to intermediate speed
101b	Set cooling mechanism to third highest speed
110b	Set cooling mechanism to second highest speed
111b	Set cooling mechanism to highest speed

Table 87 defines the Cooling status element.

Table 87 — Cooling status element

<table>
<tr><th>Byte\Bit</th><th>7</th><th>6</th><th>5</th><th>4</th><th>3</th><th>2</th><th>1</th><th>0</th></tr>
<tr><td>0</td><td colspan="8">COMMON STATUS</td></tr>
<tr><td>1</td><td>IDENT</td><td>DO NOT REMOVE</td><td colspan="3">Reserved</td><td colspan="3" rowspan="2">(MSB)
ACTUAL FAN SPEED
(LSB)</td></tr>
<tr><td>2</td><td colspan="5"></td></tr>
<tr><td>3</td><td>HOT SWAP</td><td>FAIL</td><td>RQSTED ON</td><td>OFF</td><td>Reserved</td><td colspan="3">ACTUAL SPEED CODE</td></tr>
</table>

The COMMON STATUS field is defined in 7.2.3.

The IDENT bit, HOT SWAP bit, and FAIL bit are defined in the Power Supply element (see 7.3.4).

A DO NOT REMOVE bit set to one indicates that:

a) the corresponding bit has been set to one in the Cooling control element or that the device server has determined that the cooling element should not be removed; and
b) mechanical interlocks or visual signals may be present and activated to indicate that the cooling element should not be removed.

A DO NOT REMOVE bit set to zero indicates that:

a) the corresponding bit has been set to zero in the Cooling control element or has not been implemented;
b) the device server has not determined that cooling element removal is not recommended; and

c) mechanical interlocks or visual signals are not present and activated to indicated that cooling element removal is not recommended.

The ACTUAL FAN SPEED field indicates the actual fan speed in revolutions per minute when multiplied by a factor of 10 (e.g., 000h indicates 0 rpm and 7FFh indicates 20 470 rpm).

A RQSTED ON (requested on) bit set to one indicates that the cooling mechanism has been manually turned on or has been requested to be turned on by setting the RQST ON bit to one in the Cooling control element. The RQSTED ON bit is set to zero if the RQST ON bit is set to zero in the Cooling control element.

An OFF bit set to one indicates that the cooling mechanism is not providing cooling. The OFF bit shall be set to one if the RQST ON bit is set to zero in the Cooling control element to request the cooling element be turned off. The OFF bit shall be set to one if the cooling mechanism is turned off manually. The OFF bit shall be set to one if a failure has caused the cooling mechanism to stop operating. An OFF bit set to zero indicates that the cooling mechanism is operating.

The ACTUAL SPEED CODE field indicates the actual speed or rate of cooling of the cooling mechanism, as defined in table 88.

Table 88 — ACTUAL SPEED CODE field

Code	Description
000b	Cooling mechanism is stopped
001b	Cooling mechanism is at its lowest speed
010b	Cooling mechanism is at its second lowest speed
011b	Cooling mechanism is at its third lowest speed
100b	Cooling mechanism is at its intermediate speed
101b	Cooling mechanism is at its third highest speed
110b	Cooling mechanism is at its second highest speed
111b	Cooling mechanism is at its highest speed

7.3.6 Temperature Sensor element

The Temperature Sensor element manages a temperature sensor.

Threshold control and threshold status elements (see 7.2.4 and 7.2.5) are supported for temperature sensors. Table 89 defines the Temperature Sensor threshold control element fields.

Table 89 — Temperature Sensor threshold control element field definitions

Field(s)	Description
REQUESTED HIGH CRITICAL THRESHOLD field REQUESTED HIGH WARNING THRESHOLD field REQUESTED LOW WARNING THRESHOLD field REQUESTED LOW CRITICAL THRESHOLD field	Same units as the TEMPERATURE field in the status element

Table 90 defines the Temperature Sensor threshold status element fields.

Table 90 — Temperature Sensor threshold status element field definitions

Field(s)	Description
HIGH CRITICAL THRESHOLD field HIGH WARNING THRESHOLD field LOW WARNING THRESHOLD field LOW CRITICAL THRESHOLD field	Compared to the TEMPERATURE field in the status element

Table 91 defines the Temperature Sensor control element.

Table 91 — Temperature Sensor control element

Byte\Bit	7	6	5	4	3	2	1	0
0	COMMON CONTROL							
1	RQST IDENT	RQST FAIL	Reserved					
2	Reserved							
3								

The COMMON CONTROL field is defined in 7.2.2. If the DISABLE bit in the COMMON CONTROL field is set to one, the temperature sensor's output is ignored (i.e., not tested against any threshold values. No noncritical, critical, or unrecoverable conditions are indicated because of the temperature values sensed). If the DISABLE bit is set to zero, the temperature sensor's output is not ignored.

The RQST IDENT bit and the RQST FAIL bit are defined in the Cooling element (see 7.3.5).

Table 92 defines the Temperature Sensor status element.

Table 92 — Temperature Sensor status element

Byte\Bit	7	6	5	4	3	2	1	0
0	COMMON STATUS							
1	IDENT	FAIL	Reserved					
2	TEMPERATURE							
3	Reserved				OT FAILURE	OT WARNING	UT FAILURE	UT WARNING

The COMMON STATUS field is defined in 7.2.3.

The IDENT bit and the FAIL bit are defined in the Power Supply element (see 7.3.4).

The TEMPERATURE field indicates the temperature at the sensor in degrees Celsius, offset by +20^{o} C. The range of the value expresses a temperature between -19^{o} C and +235^{o} C. A value of 00h is reserved.

An OT FAILURE (over temperature failure) bit set to one indicates that the temperature is above the safe operating temperature range or higher than the value indicated by the high critical threshold. An OT FAILURE bit set to zero indicates that the temperature is within the safe operating temperature range or below the value specified by the HIGH CRITICAL THRESHOLD field.

An OT WARNING (over temperature warning) bit set to one indicates that the temperature is above the normal operating temperature range or higher than the value indicated by the high warning threshold. An OT WARNING bit set to zero indicates that the temperature is within the normal operating temperature range or below the value specified by the HIGH WARNING THRESHOLD field.

A UT FAILURE (under temperature failure) bit set to one indicates that the temperature is below the safe operating temperature range or lower than the value indicated by the low critical threshold. A UT FAILURE bit set to zero indicates that the temperature is within the safe operating temperature range or above the value specified by the LOW CRITICAL THRESHOLD field.

A UT WARNING (under temperature warning) bit set to one indicates that the temperature is below the normal operating temperature range or lower than the value indicated by the low warning threshold. A UT WARNING bit set to zero indicates that the temperature is within the normal operating temperature range or above the value specified by the LOW WARNING THRESHOLD field.

7.3.7 Door element

The Door element manages a door.

Table 93 defines the Door control element.

Table 93 — Door control element

Byte\Bit	7	6	5	4	3	2	1	0
0	COMMON CONTROL							
1	RQST IDENT	RQST FAIL	Reserved					
2	Reserved							
3	Reserved							UNLOCK

The COMMON CONTROL field is defined in 7.2.2.

The RQST IDENT bit and the RQST FAIL bit are defined in the Cooling element (see 7.3.5).

An UNLOCK bit set to one specifies that the door latch be unlocked or remain unlocked. An UNLOCK bit set to zero specifies that the door latch be locked or remain locked.

Table 94 defines the Door status element.

Table 94 — Door status element

Byte\Bit	7	6	5	4	3	2	1	0
0	COMMON STATUS							
1	IDENT	FAIL	Reserved					
2	Reserved							
3	Reserved						OPEN	UNLOCKED

The COMMON STATUS field is defined in 7.2.3.

The IDENT bit and the FAIL bit are defined in the Power Supply element (see 7.3.4).

An UNLOCKED bit set to one indicates that the door latch is unlocked. An UNLOCKED bit set to zero indicates that the door latch is locked or in its normal operating state.

An OPEN bit set to one indicates that the door is open. An OPEN bit set to zero indicates that the door is closed or the state of the door is not reported. If the OPEN bit is set to one, then the UNLOCKED bit, if implemented, shall be set to one.

7.3.8 Audible Alarm element

The Audible Alarm element manages an audible alarm.

Table 95 defines the Audible Alarm control element.

Table 95 — Audible Alarm control element

Byte\Bit	7	6	5	4	3	2	1	0
0	COMMON CONTROL							
1	RQST IDENT	RQST FAIL	Reserved					
2	Reserved							
3	Reserved	SET MUTE	Reserved	SET REMIND	TONE URGENCY CONTROL			
					INFO	NON-CRIT	CRIT	UNRECOV

The COMMON CONTROL field is defined in 7.2.2. If the DISABLE bit in the COMMON CONTROL field is set to one, the audible alarm shall be disabled and emit no sound regardless of the error condition that exists. If the DISABLE bit is set to zero, the audible alarm is enabled and may emit sound if an error condition exists.

The RQST IDENT bit and the RQST FAIL bit are defined in the Cooling element (see 7.3.5).

A SET MUTE bit set to one specifies that the alarm be placed in the muted state. The alarm shall emit no sound if in the muted state. If the SET MUTE bit is set to zero, the alarm is set to the un-muted state and the tone appropriate to the most urgent condition present shall be generated. If the SET MUTE bit is set to one, the reminding tone is also muted.

A SET REMIND bit set to one specifies that the alarm emit a tone suitable for reminding the user that other tones are active. If the SET REMIND bit is set to zero, the alarm emits the tone appropriate to the most urgent condition that is present.

Each of the TONE URGENCY CONTROL bits requests that the audible alarm emit a tone of increasing urgency (bit 3, least urgent). If more than one bit is set to one, the tone that signals the most urgent of the selected conditions is activated.

The quality of each tone and the use of separate tones is vendor specific. The bits and tones may be set either by the TONE URGENCY CONTROL bits or by the enclosure services process. The TONE URGENCY CONTROL bits set by the enclosure are not affected by the SET MUTE bit or the SET REMIND bit, although the tone emitted by the alarm is modified by the bits.

If a new error condition occurs while the audible alarm is set in the remind or muted state, the state is cleared and the normal alarm conditions occur for that error condition, but not the previous error condition.

If all bits are set to zero, the audible alarm is silent until a new error condition occurs.

An INFO (informational condition tone urgency control) bit set to one specifies that the audible alarm emit a tone suitable to warn of an information condition. The INFO bit is set to zero to stop requesting the audible alarm to emit the tone.

A NON-CRIT (noncritical condition tone urgency control) bit set to one specifies that the audible alarm emit a tone suitable to warn of a noncritical condition. The NON-CRIT bit is set to zero to stop requesting the audible alarm to emit the tone.

A CRIT (critical condition tone urgency control) bit set to one specifies that the audible alarm emit a tone suitable to warn of a critical condition. The CRIT bit is set to zero to stop requesting the audible alarm to emit the tone.

An UNRECOV (unrecoverable condition tone urgency control) bit set to one specifies that the audible alarm emit a tone suitable to warn of an unrecoverable condition. The UNRECOV bit is set to zero to stop requesting the audible alarm to emit the tone.

Table 96 defines the Audible Alarm status element.

Table 96 — Audible Alarm status element

Byte\Bit	7	6	5	4	3	2	1	0
0	COMMON STATUS							
1	IDENT	FAIL	Reserved					
2	Reserved							
3	RQST MUTE	MUTED	Reserved	REMIND	TONE URGENCY INDICATOR			
					INFO	NON-CRIT	CRIT	UNRECOV

The COMMON STATUS field is defined in 7.2.3.

The IDENT bit and the FAIL bit are defined in the Power Supply element (see 7.3.4).

A RQST MUTE (request mute) bit set to one indicates that a panel control has been manipulated to request that the audible alarm be muted. A RQST MUTE bit set to zero indicates that the SET MUTE bit has been set to one in the Audible Alarm control element.

A MUTED bit set to one indicates that the audible alarm is in the muted state. A MUTED bit set to zero indicates that the audible alarm is in the un-muted state. No sound is emitted by the audible alarm if it is in the muted state.

A REMIND bit set to one indicates that the audible alarm is in the remind state. A REMIND bit set to zero indicates that the audible alarm is not in the remind state.

Each bit indicates a tone of increasing urgency (bit 3 is least urgent). If more than one bit is set to one, the tone that signals the most urgent of the indicated conditions is active.

If all bits are set to zero or if the MUTED bit is set to one, the audible alarm is silent. If the REMIND bit is set to one, the audible alarm tone is modified to the remind tone.

An INFO (information condition tone urgency indicator) bit set to one indicates that the audible alarm is emitting a tone suitable to warn of an information condition unless a more urgent tone is also indicated. An INFO bit set to zero indicates that the audible alarm is not emitting the corresponding tone.

A NON-CRIT (noncritical condition tone urgency indicator) bit set to one indicates that the audible alarm is emitting a tone suitable to warn of a noncritical condition unless a more urgent tone is also indicated. A NON-CRIT bit set to zero indicates that the audible alarm is not emitting the corresponding tone.

A CRIT (critical condition tone urgency indicator) bit set to one indicates that the audible alarm is emitting a tone suitable to warn of a critical condition unless a more urgent tone is also indicated. A CRIT bit set to zero indicates that the audible alarm is not emitting the corresponding tone.

An UNRECOV (unrecoverable condition tone urgency indicator) bit set to one indicates that the audible alarm is emitting a tone suitable to warn of an unrecoverable condition. An UNRECOV bit set to zero indicates that the audible alarm is not emitting the corresponding tone.

7.3.9 Enclosure Services Controller Electronics element

The Enclosure Services Controller Electronics element manages the processor circuitry used by the enclosure services process.

Table 97 defines the Enclosure Services Controller Electronics control element.

Table 97 — Enclosure Services Controller Electronics control element

Byte\Bit	7	6	5	4	3	2	1	0
0	COMMON CONTROL							
1	RQST IDENT	RQST FAIL	DO NOT REMOVE	RQST REMOVE	Reserved			
2	Reserved							SELECT ELEMENT
3	Reserved							

The COMMON CONTROL field is defined in 7.2.2.

The RQST IDENT bit and the RQST FAIL bit are defined in the Cooling element (see 7.3.5).

A DO NOT REMOVE bit set to one specifies that the enclosure services controller electronics element should not be removed. A DO NOT REMOVE bit set to zero specifies that the application client has not provided a recommendation and the value in the corresponding DO NOT REMOVE status bit is determined by the device server. The DO NOT REMOVE bit may control mechanical interlocks or visual indications that the enclosure services controller electronics element should not be removed.

A RQST REMOVE bit set to one requests that the enclosure services controller electronics element be prepared for removal. A RQST REMOVE bit set to zero specifies that the application client is not requesting that the enclosure services controller electronics element be prepared for removal. The RQST REMOVE bit may control mechanical interlocks or visual indications that the enclosure services controller electronics element may be removed.

If the RQST REMOVE bit is set to one and the DO NOT REMOVE bit is set to one in the Enclosure Services Controller Electronics status element (see table 98), then the device server:

a) should:
   1) prepare the enclosure services controller electronics element for removal;
   2) set the DO NOT REMOVE bit to zero in the Enclosure Services Controller Electronics status element (see table 98); and
   3) set the RMV bit to one in the Enclosure Services Controller Electronics status element;

   or

b) may terminate the command with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to COMMAND SEQUENCE ERROR (e.g., the device server requires the condition that caused the DO NOT REMOVE bit to be set to one to be resolved before it is able to prepare the element for removal).

A SELECT ELEMENT bit set to one specifies that the enclosure services process represented by the specified Enclosure Services Controller Electronics element be assigned to be the active enclosure services process. The active enclosure services process prepares all the status-type diagnostic pages and interprets all control-type diagnostic pages. It may make use of or operate in parallel with other Enclosure Services Controller Electronics elements. The selection may be overridden by vendor specific conventions among multiple Enclosure Services Controller Electronics elements. A SELECT ELEMENT bit set to zero specifies that the specified Enclosure Services Controller Electronics element shall not be the active enclosure services process. If no element has been selected as the active enclosure services process or if multiple elements have been selected, the choice of the active element is vendor specific.

Table 98 defines the Enclosure Services Controller Electronics status element.

Table 98 — Enclosure Services Controller Electronics status element

Byte\Bit	7	6	5	4	3	2	1	0
0	COMMON STATUS							
1	IDENT	FAIL	DO NOT REMOVE	RMV	Reserved			
2	Reserved							REPORT
3	HOT SWAP	Reserved						

The COMMON STATUS field is defined in 7.2.3.

The IDENT bit, FAIL bit, and HOT SWAP bit are defined in the Power Supply element (see 7.3.4).

A DO NOT REMOVE bit set to one indicates that:

a) the corresponding bit has been set to one in the Enclosure Services Controller Electronics control element or that the device server has determined that the enclosure services controller electronics element should not be removed; and
b) mechanical interlocks or visual signals may be present and activated to indicate that the enclosure services controller electronics element should not be removed.

A DO NOT REMOVE bit set to zero indicates that:

a) the corresponding bit has been set to zero in the Enclosure Services Controller Electronics control element or has not been implemented;
b) the device server has not determined that enclosure services controller electronics element removal is not recommended; and
c) mechanical interlocks or visual signals are not present and activated to indicated that enclosure services controller electronics element removal is not recommended.

A RMV bit set to one indicates that the enclosure services controller electronics element has been prepared for removal. A RMV bit set to zero indicates that the enclosure services controller electronics element has not been prepared for removal or the RQST REMOVE bit in the Enclosure Services Controller Electronics control element has not been implemented.

A REPORT bit set to one indicates that the processor circuitry described by this status element is the active enclosure services process for the subenclosure. A REPORT bit set to zero indicates the processor circuitry described by this status element is not the active enclosure services process for the subenclosure.

7.3.10 SCC Controller Electronics element

The SCC Controller Electronics element manages the processor circuitry used by a SCSI Controller Commands (SCC) device server (e.g., in a RAID controller, the RAID controller processor).

Table 99 defines the SCC Controller Electronics control element.

Table 99 — SCC Controller Electronics control element

Byte\Bit	7	6	5	4	3	2	1	0
0	COMMON CONTROL							
1	RQST IDENT	RQST FAIL	Reserved					
2	Reserved							
3								

The COMMON CONTROL field is defined in 7.2.2.

The RQST IDENT bit and the RQST FAIL bit are defined in the Cooling element (see 7.3.5).

Table 100 defines the SCC Controller Electronics status element.

Table 100 — SCC Controller Electronics status element

Byte\Bit	7	6	5	4	3	2	1	0
0	COMMON STATUS							
1	IDENT	FAIL	Reserved					
2	Reserved							REPORT
3	Reserved							

The COMMON STATUS field is defined in 7.2.3.

The IDENT bit and the FAIL bit are defined in the Power Supply element (see 7.3.4).

A REPORT bit set to one indicates that the enclosure services process is not using this processor circuity to return the Enclosure Status diagnostic page. This relates the SCSI target port and logical unit addressed by the RECEIVE DIAGNOSTIC RESULTS command to the SCC Controller Electronics element. A REPORT bit set to zero indicates that it is not using this processor circuity to return the Enclosure Status diagnostic page.

7.3.11 Nonvolatile Cache element

The Nonvolatile Cache element manages a nonvolatile cache (e.g., in a RAID controller, a battery-backed write cache).

Table 101 defines the Nonvolatile Cache control element.

Table 101 — Nonvolatile Cache control element

Byte\Bit	7	6	5	4	3	2	1	0
0	COMMON CONTROL							
1	RQST IDENT	RQST FAIL	Reserved					
2	Reserved							
3								

The COMMON CONTROL field is defined in 7.2.2.

The RQST IDENT bit and the RQST FAIL bit are defined in the Cooling element (see 7.3.5).

Table 102 defines the Nonvolatile Cache status element.

Table 102 — Nonvolatile Cache status element

Byte\Bit	7	6	5	4	3	2	1	0
0	COMMON STATUS							
1	IDENT	FAIL	Reserved				SIZE MULTIPLIER	
2	(MSB)	NONVOLATILE CACHE SIZE						
3								(LSB)

The COMMON STATUS field is defined in 7.2.3.

The IDENT bit and the FAIL bit are defined in the Power Supply element (see 7.3.4).

The NONVOLATILE CACHE SIZE field and the SIZE MULTIPLIER field indicate the approximate size of the nonvolatile cache. The SIZE MULTIPLIER field indicates the units of the NONVOLATILE CACHE SIZE field as defined in table 103.

Table 103 — SIZE MULTIPLIER field and NONVOLATILE CACHE SIZE field

Code	Units of nonvolatile cache size
00b	Bytes
01b	Kibibytes [a] (2^{10} bytes)
10b	Mebibytes [a] (2^{20} bytes)
11b	Gibibytes [a] (2^{30} bytes)
[a] This nomenclature is defined in IEC 60027-2:2005.	

Failures of the Nonvolatile Cache may require immediate changes in the operating mode of elements in the enclosure. Information in the cache may be corrupted after such a failure.

7.3.12 Invalid Operation Reason element

The Invalid Operation Reason element is used to report information about the reason that the INVOP bit is set to one in the Enclosure Status diagnostic page (see 6.1.4) or the Threshold In Status diagnostic page (see 6.1.9).

Table 104 defines the Invalid Operation Reason threshold control element fields.

Table 104 — Invalid Operation Reason threshold control element field definitions

Field(s)	Description
HIGH CRITICAL THRESHOLD field HIGH WARNING THRESHOLD field LOW WARNING THRESHOLD field LOW CRITICAL THRESHOLD field	Ignored

Table 105 defines the Invalid Operation Reason threshold status element fields.

Table 105 — Invalid Operation Reason threshold status element field definitions

Field(s)	Description
HIGH CRITICAL THRESHOLD field	Reserved
HIGH WARNING THRESHOLD field	Same as byte 1 of the Invalid Operation Reason status element (see table 107). If the INVOP TYPE field is set to 00b, then the PAGE NOT SUPPORTED bit shall be set to zero.
LOW WARNING THRESHOLD field	Same as byte 2 of the Invalid Operation Reason status element (see table 107)
LOW CRITICAL THRESHOLD field	Same as byte 3 of the Invalid Operation Reason status element (see table 107)

Table 106 defines the Invalid Operation Reason control element.

Table 106 — Invalid Operation Reason control element

Byte\Bit	7	6	5	4	3	2	1	0
0	COMMON CONTROL							
1	Reserved							
•••								
3								

The COMMON CONTROL field is defined in 7.2.2.

Table 107 defines the Invalid Operation Reason status element.

Table 107 — Invalid Operation Reason status element

Byte\Bit	7	6	5	4	3	2	1	0
0	COMMON STATUS							
1	INVOP TYPE		Invalid operation type specific bytes					
2								
3								

The COMMON STATUS field is defined in 7.2.3.

Table 108 defines the INVOP TYPE field, which defines the format of the invalid operation type-specific bytes.

Table 108 — INVOP TYPE field

Code	Description	Reference
00b	SEND DIAGNOSTIC page code error	Table 109
01b	SEND DIAGNOSTIC page format error	Table 110
10b	Reserved	
11b	Vendor specific error	Table 111

The format of the Invalid Operation Reason status element if the INVOP TYPE field is set to 00b is defined in table 109.

Table 109 — Invalid Operation Reason status element with the INVOP TYPE field set to 00b

Byte\Bit	7	6	5	4	3	2	1	0
0	COMMON STATUS							
1	INVOP TYPE (00b)		Reserved					PAGE NOT SUPPORTED
2	Reserved							
3								

The COMMON STATUS field is defined in 7.2.3.

A PAGE NOT SUPPORTED bit set to one indicates that a SEND DIAGNOSTIC command requested a diagnostic page that is not supported by the enclosure services process. A PAGE NOT SUPPORTED bit set to zero indicated that a SEND DIAGNOSTICS command requested a diagnostic page that is supported.

The format of the Invalid Operation Reason status element if the INVOP TYPE field is set to 01b is defined in table 110.

Table 110 — Invalid Operation Reason status element with the INVOP TYPE field set to 01b

Byte\Bit	7	6	5	4	3	2	1	0
0	COMMON STATUS							
1	INVOP TYPE (01b)		Reserved			BIT NUMBER		
2	(MSB)	BYTE OFFSET						
3								(LSB)

The COMMON STATUS field is defined in 7.2.3.

The BIT NUMBER field indicates the bit number of the most significant bit of the field responsible for the INVOP bit being set to one.

The BYTE OFFSET field indicates the byte offset of the most significant byte of the field responsible for the INVOP bit being set to one.

The format of the Invalid Operation Reason status element if the INVOP TYPE field is set to 11b is defined in table 111.

Table 111 — Invalid Operation Reason status element with the INVOP TYPE field set to 11b

Byte\Bit	7	6	5	4	3	2	1	0
0	COMMON STATUS							
1	INVOP TYPE (11b)		Vendor specific					
2								
3								

The COMMON STATUS field is defined in 7.2.3.

7.3.13 Uninterruptible Power Supply element

The Uninterruptible Power Supply element manages an uninterruptible power supply (e.g., a device inputting A.C. power and outputting D.C. power to a power supply represented by a Power Supply element (see 7.3.4)) and its battery.

Threshold control and threshold status elements (see 7.2.4 and 7.2.5) are supported for uninterruptible power supplies. Table 112 defines the Uninterruptible Power Supply threshold control element fields.

Table 112 — Uninterruptible Power Supply threshold control element field definitions

Field(s)	Description
REQUESTED HIGH CRITICAL THRESHOLD field REQUESTED HIGH WARNING THRESHOLD field	Ignored
REQUESTED LOW WARNING THRESHOLD field REQUESTED LOW CRITICAL THRESHOLD field	Same units as the BATTERY STATUS field in the status element. A threshold of 00h specifies that a vendor specific threshold shall be used. A threshold between 01h and FFh specifies that the corresponding number of minutes of remaining battery capacity shall be used as the threshold.

Table 113 defines the Uninterruptible Power Supply threshold status element fields.

Table 113 — Uninterruptible Power Supply threshold status element field definitions

Field(s)	Description
HIGH CRITICAL THRESHOLD field HIGH WARNING THRESHOLD field	Reserved
LOW WARNING THRESHOLD field LOW CRITICAL THRESHOLD field	Compared to BATTERY STATUS field in the status element. A threshold of 00h indicates that a vendor specific threshold is being used. A threshold between 01h and FFh indicates that the corresponding number of minutes of remaining battery capacity is being used as the threshold.

Table 114 defines the Uninterruptible Power Supply control element.

Table 114 — Uninterruptible Power Supply control element

Byte\Bit	7	6	5	4	3	2	1	0
0	COMMON CONTROL							
1	Reserved							
2								
3	RQST IDENT	RQST FAIL	DO NOT REMOVE	Reserved				

The COMMON CONTROL field is defined in 7.2.2.

The RQST IDENT bit and the RQST FAIL bit are defined in the Cooling element (see 7.3.5).

A DO NOT REMOVE bit set to one specifies that the uninterruptible power supply element should not be removed. A DO NOT REMOVE bit set to zero specifies that the application client has not provided a recommendation and the value in the corresponding DO NOT REMOVE status bit is determined by the device server. The DO NOT REMOVE bit may control mechanical interlocks or visual indications that the uninterruptible power supply element should not be removed.

Table 115 defines the Uninterruptible Power Supply status element.

Table 115 — Uninterruptible Power Supply status element

Byte\Bit	7	6	5	4	3	2	1	0
0	COMMON STATUS							
1	BATTERY STATUS							
2	AC LO	AC HI	AC QUAL	AC FAIL	DC FAIL	UPS FAIL	WARN	INTF FAIL
3	IDENT	FAIL	DO NOT REMOVE	Reserved			BATT FAIL	BPF

The COMMON STATUS field is defined in 7.2.3.

The BATTERY STATUS field indicates the amount of time in minutes for which the battery is capable of providing power in the event of an A.C. supply failure and is defined in table 116.

Table 116 — BATTERY STATUS field

Code	Description
00h	The battery is discharged or the battery's status is unknown
01h to FFh	The battery has at least the indicated number of minutes of capacity remaining

An AC LO bit set to one indicates that the A.C. line voltage is lower than its specified range. An AC LO bit set to zero indicates that the A.C. line voltage is within its specified range.

An AC HI bit set to one indicates that the A.C. line voltage is higher than its specified range. An AC HI bit set to zero indicates that the A.C. line voltage is within its specified range.

An AC QUAL (A.C. quality) bit set to one indicates that the quality of the A.C. line voltage is outside its specified range. The definition of the quality parameters and specification is vendor specific. An AC QUAL bit set to zero indicates that the A.C. line voltage quality is within its specified range.

An AC FAIL (A.C. failure) bit set to one indicates that the A.C. line voltage has failed. The definition of A.C. line voltage failure is vendor specific. An AC FAIL bit set to zero indicates that the A.C. line voltage is provided.

A DC FAIL (D.C. failure) bit set to one indicates that the D.C. line voltage has failed. The definition of D.C. line voltage failure is vendor specific. A DC FAIL bit set to zero indicates that the D.C. line voltage is provided.

A UPS FAIL (uninterruptible power supply failure) bit set to one indicates that the uninterruptible power supply has failed and is not able to provide power. A UPS FAIL bit set to zero indicates that the uninterruptible power supply failure is corrected.

A WARN (warning) bit set to one indicates that the uninterruptible power supply is unable to provide output power for the number of minutes specified by the LOW WARNING THRESHOLD field or a vendor specific default time. A WARN bit set to zero indicates that the uninterruptible power support is able to provide output power for at least the number of minutes specified by the LOW WARNING THRESHOLD field or a vendor specific default time.

An INTF FAIL (interface failure) bit set to one indicates that the interface from the enclosure services process to the uninterruptible power supply has failed. An INTF FAIL bit set to zero indicates that the interface from the enclosure services process to the uninterruptible power supply is operational.

The IDENT bit and the FAIL bit are defined in the Power Supply element (see 7.3.4).

A DO NOT REMOVE bit set to one indicates that:

a) the corresponding bit has been set to one in the Uninterruptible Power Supply control element or that the device server has determined that the uninterruptible power supply element should not be removed; and

b) mechanical interlocks or visual signals may be present and activated to indicate that the uninterruptible power supply element should not be removed.

A DO NOT REMOVE bit set to zero indicates that:

a) the corresponding bit has been set to zero in the Uninterruptible Power Supply control element or has not been implemented;
b) the device server has not determined that uninterruptible power supply element removal is not recommended; and
c) mechanical interlocks or visual signals are not present and activated to indicated that uninterruptible power supply element removal is not recommended.

A BATT FAIL (battery failure) bit set to one indicates that the battery has failed. The definition of battery failure is vendor specific. A BATT FAIL bit set to zero indicates that the battery is operating correctly.

A BPF (battery predicted failure) bit set to one indicates that the battery is approaching a failure condition. The definition of battery predicted failure is vendor specific. Predicted failures of the uninterruptible power supply are indicated by the PRDFAIL bit (see 7.2.2 and 7.2.3). A BPF bit set to zero indicates that the battery is operating correctly.

7.3.14 Display element

The Display element manages a visible display (e.g., seven-segment LED) represents a part of a display device or a whole display device in the enclosure (e.g., an LCD panel or a seven-segment LED). For Display elements that support the DISPLAY CHARACTER field, if more than one Display elements share the same type descriptor header in the Configuration diagnostic page (see 6.1.2), then the order of the Display elements shall match the order for displaying a string of characters in the appropriate language (e.g., to display “45” on two LEDs each represented by a Display element, the first Display element displays “4” and the second Display element displays “5”).

Table 117 defines the Display control element.

Table 117 — Display control element

Byte\Bit	7	6	5	4	3	2	1	0
0	COMMON CONTROL							
1	RQST IDENT	RQST FAIL	Reserved				DISPLAY MODE	
2	DISPLAY CHARACTER							
3								

The COMMON CONTROL field is defined in 7.2.2.

The RQST IDENT bit and the RQST FAIL bit are defined in the Cooling element (see 7.3.5).

The DISPLAY MODE field is defined in table 118.

Table 118 — DISPLAY MODE field

Code	Description
00b	No change to the display.
01b	Allow the enclosure services process to control the display and ignore the DISPLAY CHARACTER field.
10b	Display the character specified in the DISPLAY CHARACTER field.
11b	Reserved

The DISPLAY CHARACTER field specifies the character to display. If a Language element (see 7.3.18) is present, the DISPLAY CHARACTER field shall contain a character using the language and character set indicated by the Language element. If a Language element is not available, the first byte of the DISPLAY CHARACTER field (i.e., byte 2 of the Display element) contains a US-ASCII character encoded in 8 bits per ISO/IEC 8859-1 and the enclosure services process shall ignore the second byte (i.e., byte 3 of the Display element).

Table 119 defines the Display status element.

Table 119 — Display status element

Byte\Bit	7	6	5	4	3	2	1	0
0	COMMON STATUS							
1	IDENT	FAIL	Reserved				DISPLAY MODE STATUS	
2	DISPLAY CHARACTER STATUS							
3								

The COMMON STATUS field is defined in 7.2.3.

The IDENT bit and the FAIL bit are defined in the Power Supply element (see 7.3.4).

The DISPLAY MODE STATUS field is defined in table 120.

Table 120 — DISPLAY MODE STATUS field

Code	Description
00b	The enclosure services process is controlling the display. Display element control of the display is not supported.
01b	The enclosure services process is controlling the display. Display element control of the display is supported.
10b	The display is being controlled based on the Display element.
11b	Reserved

If the DISPLAY MODE STATUS field is set to 01b or 10b and a Language element (see 7.3.18) is present, then the DISPLAY CHARACTER STATUS field indicates the character being displayed in the language and character set indicated by the Language element. If the DISPLAY MODE STATUS field is set to 01b or 10b and a Language element is not available, then the first byte of the DISPLAY CHARACTER STATUS field (i.e., byte 2 of the Display element) indicates the US-ASCII character encoded in 8 bits per ISO/IEC 8859-1 and the second byte (i.e., byte 3 of the Display element) is reserved. If the DISPLAY MODE STATUS field is set to 00b or 11b, then the DISPLAY CHARACTER STATUS field is reserved.

7.3.15 Key Pad Entry element

The Key Pad element manages a key pad.

Table 121 defines the Key Pad Entry control element.

Table 121 — Key Pad Entry control element

Byte\Bit	7	6	5	4	3	2	1	0
0	COMMON CONTROL							
1	RQST IDENT	RQST FAIL	Reserved					
2	Reserved							
3								

The COMMON CONTROL field is defined in 7.2.2.

The RQST IDENT bit and the RQST FAIL bit are defined in the Cooling element (see 7.3.5).

Table 122 defines the Key Pad Entry status element.

Table 122 — Key Pad Entry status element

Byte\Bit	7	6	5	4	3	2	1	0
0	COMMON STATUS							
1	IDENT	FAIL	Reserved					
2	Reserved							
3								

The COMMON STATUS field is defined in 7.2.3.

The IDENT bit and the FAIL bit are defined in the Power Supply element (see 7.3.4).

7.3.16 Enclosure element

The Enclosure element manages the enclosure itself.

Table 123 defines the Enclosure control element.

Table 123 — Enclosure control element

Byte\Bit	7	6	5	4	3	2	1	0
0	COMMON CONTROL							
1	RQST IDENT	Reserved						
2	POWER CYCLE REQUEST		POWER CYCLE DELAY					
3	POWER OFF DURATION						REQUEST FAILURE	REQUEST WARNING

The COMMON CONTROL field is defined in 7.2.2.

The RQST IDENT bit is defined in the Cooling element (see 7.3.5).

The POWER CYCLE REQUEST field is defined in table 124. A request to begin a power cycle while a previous request is still active shall override the previous request.

Table 124 — POWER CYCLE REQUEST field

Code	Description
00b	No power cycle request.
01b	The enclosure shall begin a power cycle beginning when specified in the DELAY TO POWER CYCLE field for the duration specified in the POWER OFF DURATION field.
10b	The enclosure shall cancel any scheduled power cycle.
11b	Reserved

The POWER CYCLE DELAY field is defined in table 125.

Table 125 — POWER CYCLE DELAY field

Code	Description
0 to 60	The enclosure shall begin a power cycle after the specified number of minutes after completing the SEND DIAGNOSTIC command.
61 to 63	Reserved

The POWER OFF DURATION field is defined in table 126.

Table 126 — POWER OFF DURATION field

Code	Description
0	The enclosure: a) shall turn the power off; and b) should keep the power off for less than one minute. Manual power restoration shall override this value.
1 to 60	The enclosure: a) shall keep power off for at least the specified number of minutes; and b) should keep power off for no longer than the specified number of minutes. Manual power restoration shall override this value.
61 to 62	Reserved
63	The enclosure shall keep power off until it is manually restored.

If the REQUEST FAILURE bit is set to one, the enclosure shall enable a visual indication of enclosure failure (e.g., a failure LED). If the REQUEST FAILURE bit is set to zero, the enclosure may enable a visual indication of enclosure failure if the failure is self-detected.

If the REQUEST WARNING bit is set to one, the enclosure shall enable a visual indication of enclosure warning (e.g., a flashing LED or a second LED in addition to a failure LED). If the REQUEST WARNING bit is set to zero, the enclosure may enable a visual indication of enclosure warning if the warning is self-detected.

Table 127 defines the Enclosure status element.

Table 127 — Enclosure status element

Byte\Bit	7	6	5	4	3	2	1	0
0	COMMON STATUS							
1	IDENT	Reserved						
2	TIME UNTIL POWER CYCLE						FAILURE INDICATION	WARNING INDICATION
3	REQUESTED POWER OFF DURATION						FAILURE REQUESTED	WARNING REQUESTED

The COMMON STATUS field is defined in 7.2.3.

The IDENT bit is defined in the Power Supply element (see 7.3.4).

The TIME UNTIL POWER CYCLE field indicates the amount of time until the enclosure's power is scheduled to be removed and is defined in table 128.

Table 128 — TIME UNTIL POWER CYCLE field

Code	Description
0	No power cycle is scheduled.
1 to 60	The enclosure is scheduled to begin a power cycle after the indicated number of minutes.
61 to 62	Reserved
63	The enclosure is scheduled to begin a power cycle after zero minutes.

The REQUESTED POWER OFF DURATION field indicates the amount of time that power is scheduled to remain off if power is cycled and is defined in table 129.

Table 129 — REQUESTED POWER OFF DURATION field

Code	Description
0	Either: a) no power cycle is scheduled (i.e., the power cycle request field was not set to 01b in the last Enclosure control element processed); or b) power is scheduled to be kept off for less than one minute.
1 to 60	Power is scheduled to be kept off for at least the indicated number of minutes.
61 to 62	Reserved
63	Power is scheduled to be kept off until manually restored.

A FAILURE INDICATION bit set to one indicates that a failed condition was detected by the enclosure and that the visual indication of enclosure failure is enabled. A FAILURE INDICATION bit set to zero indicates that a failed condition was not detected by the enclosure.

A WARNING INDICATION bit set to one indicates that a warning condition was detected by the enclosure and that the visual indication of enclosure warning is enabled. A WARNING INDICATION bit set to zero indicates that a warning condition was not detected by the enclosure.

A FAILURE REQUESTED bit set to one indicates that a failed condition has been requested by an application client with the Enclosure Control diagnostic page (see 6.1.3) and that the visual indication of enclosure failure is enabled. A FAILURE REQUESTED bit set to zero indicates that a failed condition has not been requested by an application client.

A WARNING REQUESTED bit set to one indicates that a warning condition has been requested by an application client with the Enclosure Control diagnostic page and that the visual indication of enclosure warning is enabled. A WARNING REQUESTED bit set to zero indicates that a warning condition has not been requested by an application client.

7.3.17 SCSI Port/Transceiver element

The SCSI Port/Transceiver element manages standalone electronics used by one or more SCSI ports.

Table 130 defines the SCSI Port/Transceiver control element.

Table 130 — SCSI Port/Transceiver control element

Byte\Bit	7	6	5	4	3	2	1	0
0	COMMON CONTROL							
1	RQST IDENT	RQST FAIL	Reserved					
2	Reserved							
3	Reserved			DISABLE	Reserved			

The COMMON CONTROL field is defined in 7.2.2.

The RQST IDENT bit and the RQST FAIL bit are defined in the Cooling element (see 7.3.5).

A DISABLE bit set to one specifies that the SCSI port/transceiver be disabled. A DISABLE bit set to zero specifies that the SCSI port/transceiver be enabled.

Table 131 defines the SCSI Port/Transceiver status element.

Table 131 — SCSI Port/Transceiver status element

Byte\Bit	7	6	5	4	3	2	1	0
0	COMMON STATUS							
1	IDENT	FAIL	Reserved					
2	Reserved							REPORT
3	Reserved			DISABLED	Reserved		LOL	XMIT FAIL

The COMMON STATUS field is defined in 7.2.3.

The IDENT bit and the FAIL bit are defined in the Power Supply element (see 7.3.4).

A REPORT bit set to one indicates that the enclosure services process is using this SCSI port/transceiver to return the Enclosure Status diagnostic page. A REPORT bit set to zero indicates that it is not using this SCSI port/transceiver to return the Enclosure Status diagnostic page.

A DISABLED bit set to one indicates that the SCSI port/transceiver has been disabled. A DISABLED bit set to zero indicates that the SCSI port/transceiver is enabled.

An LOL (loss of link) bit set to one indicates that the SCSI port/transceiver is not receiving any input signals at its receiver. An LOL bit set to zero indicates that the SCSI port/transceiver is receiving normal signals.

An XMIT FAIL (transmitter failure) bit set to one indicates that the SCSI port/transceiver transmitter has failed or is operating outside its specification. An XMIT FAIL bit set to zero indicates that the SCSI port/transceiver transmitter is operating within its specification.

7.3.18 Language element

The Language element manages the language used for visual displays.

Table 132 defines the Language control element.

Table 132 — Language control element

Byte\Bit	7	6	5	4	3	2	1	0
0	COMMON CONTROL							
1	RQST IDENT	Reserved						
2	(MSB)	LANGUAGE CODE						
3								(LSB)

The COMMON CONTROL field is defined in 7.2.2.

The RQST IDENT bit is defined in the Power Supply element (see 7.3.4).

The LANGUAGE CODE field specifies the language and character encoding to be used in all fields that are defined as being modified by the Language element and is defined in table 133. The enclosure should provide external indications in the requested language.

Table 133 — LANGUAGE CODE field

Code	Description
0000h	The enclosure services process shall use the default language of English with the US-ASCII character set encoding as defined by ISO/IEC 8859-1 (i.e., encoded as 8-bit characters with each MSB set to zero)
Two characters containing the ISO 639-1 two-letter code for a language that is supported by the enclosure services process expressed as US-ASCII characters as defined by ISO/IEC 8859-1 (i.e., encoded as 8-bit characters each with its MSB set to zero) [a]	The enclosure services process shall use UCS-2 as defined by ISO/IEC 10646 (i.e., encode using 16-bit characters)
All others	The enclosure services process shall use the default language of English with the US-ASCII character set encoded as defined by ISO/IEC 8859-1 (i.e., encoded as 8-bit characters with each MSB set to zero) and shall report an invalid field error (see 4.5)
[a] (e.g., “en” for English, “fr” for French, “de” for German, or “jp” for Japanese)	

Table 134 defines the Language status element.

Table 134 — Language status element

Byte\Bit	7	6	5	4	3	2	1	0
0	COMMON STATUS							
1	IDENT	Reserved						
2	(MSB)	LANGUAGE CODE						
3								(LSB)

The COMMON STATUS field is defined in 7.2.3.

The IDENT bit is defined in the Power Supply element (see 7.3.4). Since the Language element may not represent a physical element, the visual indication may be an indication of the language being used.

The LANGUAGE CODE field indicates the language and character encoding that the enclosure services process uses for those fields that have the capability of being modified by the Language element and is defined in table 135.

Table 135 — LANGUAGE CODE field

Code	Description
0000h	The enclosure services process is using the default language of English and the US-ASCII character set encoded as defined by ISO/IEC 8859-1 (i.e., encoded as 8-bit characters with each MSB set to zero)
Two characters containing the ISO 639-1 two-letter code for a language expressed as US-ASCII characters as defined by ISO/IEC 8859-1 (i.e., encoded as 8-bit characters each with its MSB set to zero) [a]	The enclosure services process is using the indicated language and is using UCS-2 as defined by ISO/IEC 10646 (i.e., encoding using 16-bit characters)
[a] (e.g., "en" for English, "fr" for French, "de" for German, or "jp" for Japanese)	

7.3.19 Communication Port element

The Communications Port element manages a communications port (e.g., serial port).

Table 136 defines the Communication Port control element.

Table 136 — Communication Port control element

Byte\Bit	7	6	5	4	3	2	1	0
0	COMMON CONTROL							
1	RQST IDENT	RQST FAIL	Reserved					
2	Reserved							
3	Reserved							DISABLE

The COMMON CONTROL field is defined in 7.2.2.

The RQST IDENT bit and the RQST FAIL bit are defined in the Cooling element (see 7.3.5).

A DISABLE bit set to one specifies that the communication port be disabled. A DISABLE bit set to zero specifies that the communication port be enabled.

Table 137 defines the Communication Port status element..

Table 137 — Communication Port status element

Byte\Bit	7	6	5	4	3	2	1	0
0	COMMON STATUS							
1	IDENT	FAIL	Reserved					
2	Reserved							
3	Reserved							DISABLED

The COMMON STATUS field is defined in 7.2.3.

The IDENT bit and the FAIL bit are defined in the Power Supply element (see 7.3.4).

A DISABLED bit set to one indicates that the communication port has been disabled. A DISABLED bit set to zero indicates that the communication port is enabled.

7.3.20 Voltage Sensor element

The Voltage Sensor element manages a voltage sensor.

Threshold control and threshold status elements (see 7.2.4 and 7.2.5) are supported for voltage sensors. Table 138 defines the Voltage Sensor threshold control element fields.

Table 138 — Voltage Sensor threshold control element field definitions

Field(s)	Description
REQUESTED HIGH CRITICAL THRESHOLD field REQUESTED HIGH WARNING THRESHOLD field REQUESTED LOW WARNING THRESHOLD field REQUESTED LOW CRITICAL THRESHOLD field	A percentage of the nominal voltage in units of 0.5 %.

Table 139 defines the Voltage Sensor threshold status element fields.

Table 139 — Voltage Sensor threshold status element field definitions

Field(s)	Description
HIGH CRITICAL THRESHOLD field HIGH WARNING THRESHOLD field LOW WARNING THRESHOLD field LOW CRITICAL THRESHOLD field	Compared to the VOLTAGE field in the status element as a percentage of the nominal voltage in units of 0.5 % (e.g., a HIGH CRITICAL THRESHOLD field set to 14 indicates that a critical condition is indicated if the voltage is 7 % over the nominal maximum supply voltage, and a LOW WARNING THRESHOLD field set to 10 indicates that a noncritical condition is indicated if the voltage is 5 % under the nominal minimum supply voltage)

Table 140 defines the Voltage Sensor control element.

Table 140 — Voltage Sensor control element

Byte\Bit	7	6	5	4	3	2	1	0
0	COMMON CONTROL							
1	RQST IDENT	RQST FAIL	Reserved					
2	Reserved							
3								

The COMMON CONTROL field is defined in 7.2.2. If the DISABLE bit in the COMMON CONTROL field (see 7.2.2) is set to one, the voltage sensor's output is ignored (i.e., not tested against any threshold values. No noncritical, critical, or unrecoverable conditions are indicated because of the voltage values sensed). If the DISABLE bit is set to zero, the voltage sensor's output is not ignored.

The RQST IDENT bit and the RQST FAIL bit are defined in the Cooling element (see 7.3.5).

Table 141 defines the Voltage Sensor status element.

Table 141 — Voltage Sensor status element

Byte\Bit	7	6	5	4	3	2	1	0
0	COMMON STATUS							
1	IDENT	FAIL	Reserved		WARN OVER	WARN UNDER	CRIT OVER	CRIT UNDER
2	(MSB)	VOLTAGE						
3								(LSB)

The COMMON STATUS field is defined in 7.2.3.

The IDENT bit and the FAIL bit are defined in the Power Supply element (see 7.3.4).

A WARN OVER (over voltage warning) bit set to one indicates that the voltage indicated by the VOLTAGE field is above the high warning threshold. A WARN OVER bit set to zero indicates that the voltage indicated by the VOLTAGE field is below the high warning threshold.

A WARN UNDER (under voltage warning) bit set to one indicates that the voltage indicated by the VOLTAGE field is below the low warning threshold. A WARN UNDER bit set to zero indicates that the voltage indicated by the VOLTAGE field is above the low warning threshold.

A CRIT OVER (critical over voltage) bit set to one indicates that the voltage indicated by the VOLTAGE field is above the high critical threshold. A CRIT OVER bit set to zero indicates that the voltage indicated by the VOLTAGE field is below the high critical threshold.

A CRIT UNDER (critical under voltage) bit set to one indicates that the voltage indicated by the VOLTAGE field is below the low critical threshold. A CRIT UNDER bit set to zero indicates that the voltage indicated by the VOLTAGE field is above the low critical threshold.

The VOLTAGE field indicates the voltage detected by the voltage sensor, measured in units of 10 mV. A.C. voltages are measured in volts A.C., RMS. The value is expressed as a 16-bit number using two's complement notation to indicate negative numbers. The largest positive voltage that is able to be expressed is 327.67 V and the largest negative voltage that is able to be expressed is -327.67 V.

7.3.21 Current Sensor element

The Current Sensor element manages a current sensor.

Threshold control and threshold status elements (see 7.2.4 and 7.2.5) are supported for current sensors. Table 142 defines the Current Sensor threshold control element fields.

Table 142 — Current Sensor threshold control element field definitions

Field(s)	Description
REQUESTED HIGH CRITICAL THRESHOLD field REQUESTED HIGH WARNING THRESHOLD field	A percentage of the nominal current in units of 0.5 %
REQUESTED LOW WARNING THRESHOLD field REQUESTED LOW CRITICAL THRESHOLD field	Ignored

Table 143 defines the Current Sensor threshold status element fields.

Table 143 — Current Sensor threshold status element field definitions

Field(s)	Description
HIGH CRITICAL THRESHOLD field HIGH WARNING THRESHOLD field	Compared to the CURRENT field in the status element as a percentage of the nominal current in units of 0.5 % (e.g., a HIGH CRITICAL THRESHOLD field set to 14 indicates that a critical condition is indicated if the current is 7 % over the nominal maximum supply current, and a LOW WARNING THRESHOLD field set to 10 indicates that a noncritical condition is indicated if the current is 5 % under the nominal minimum supply current)
LOW WARNING THRESHOLD field LOW CRITICAL THRESHOLD field	Reserved

Table 144 defines the Current Sensor control element.

Table 144 — Current Sensor control element

Byte\Bit	7	6	5	4	3	2	1	0
0	COMMON CONTROL							
1	RQST IDENT	RQST FAIL	Reserved					
2	Reserved							
3								

The COMMON CONTROL field is defined in 7.2.2. If the DISABLE bit in the COMMON CONTROL field (see 7.2.2) is set to one, the current sensor's output is ignored (i.e., not tested against any threshold values. No noncritical, critical, or unrecoverable conditions are indicated because of the current values sensed). If the DISABLE bit is set to zero, the current sensor's output is not ignored.

The RQST IDENT bit and the RQST FAIL bit are defined in the Cooling element (see 7.3.5).

Table 145 defines the Current Sensor status element.

Table 145 — Current Sensor status element

Byte\Bit	7	6	5	4	3	2	1	0
0	COMMON STATUS							
1	IDENT	FAIL	Reserved		WARN OVER	Reserved	CRIT OVER	Reserved
2	(MSB)	CURRENT						
3								(LSB)

The COMMON STATUS field is defined in 7.2.3.

The IDENT bit and the FAIL bit are defined in the Power Supply element (see 7.3.4).

A WARN OVER (over current warning) bit set to one indicates that the current indicated by the CURRENT field is above the high warning threshold. A WARN OVER bit set to zero indicates that the current indicated by the CURRENT field is below the high warning threshold.

A CRIT OVER (critical over current bit is set to one indicates that the current indicated by the CURRENT field is above the high critical threshold. A CRIT OVER bit set to zero indicates that the current indicated by the CURRENT field is below the high critical threshold.

The CURRENT field indicates the current detected by the current sensor, measured in units of 10 mA. A.C. currents are measured in amperes A.C., RMS. The value is expressed as a 16-bit number using two's complement notation to indicate negative numbers. The largest positive current that is able to be expressed is 327.67 A and the largest negative current that is able to be expressed is -327.67 A.

7.3.22 SCSI Target Port element

The SCSI Target Port element manages a SCSI target port (e.g., the target port providing for external access to a RAID controller).

If a SCSI port contains both a SCSI target port and a SCSI initiator port (see SAM-4), it may be represented by either a SCSI Target Port element or a SCSI Initiator Port element but not both. It should be represented by the element that most reflects its functionality (e.g., in an SCC controller, a front-side SCSI port should be represented by a SCSI Target Port element even if the SCSI port also has SCSI initiator port functionality and a back-side SCSI port should be represented by a SCSI Initiator Port element even if the SCSI port also has SCSI target port functionality).

Additional information about a SCSI Target Port element may be reported in the Additional Element Status diagnostic page (see 6.1.13).

Table 146 defines the SCSI Target Port control element.

Table 146 — SCSI Target Port control element

Byte\Bit	7	6	5	4	3	2	1	0
0	COMMON CONTROL							
1	RQST IDENT	RQST FAIL	Reserved					
2	Reserved							
3	Reserved							ENABLE

The COMMON CONTROL field is defined in 7.2.2.

The RQST IDENT bit and the RQST FAIL bit are defined in the Cooling element (see 7.3.5).

An ENABLE bit set to one specifies that the SCSI target port be enabled. An ENABLE bit set to zero specifies that the SCSI target port be disabled.

Table 147 defines the SCSI Target Port status element.

Table 147 — SCSI Target Port status element

Byte\Bit	7	6	5	4	3	2	1	0
0	COMMON STATUS							
1	IDENT	FAIL	Reserved					
2	Reserved							REPORT
3	Reserved							ENABLED

The COMMON STATUS field is defined in 7.2.3.

The IDENT bit and the FAIL bit are defined in the Power Supply element (see 7.3.4).

A REPORT bit set to one indicates that the enclosure services process is using this SCSI target port to return the Enclosure Status diagnostic page. A REPORT bit set to zero indicates that it is not using this SCSI target port to return the Enclosure Status diagnostic page.

An ENABLED bit set to one indicates that the SCSI target port is enabled. An ENABLED bit set to zero indicates that the SCSI target port is disabled.

7.3.23 SCSI Initiator Port element

The SCSI Initiator Port element manages a SCSI initiator port (e.g., the initiator port used by a RAID controller to access disk drives).

See 7.3.22 for requirements for SCSI target/initiator ports.

Additional information about a SCSI Initiator Port element may be reported in the Additional Element Status diagnostic page (see 6.1.13).

Table 148 defines the SCSI Initiator Port control element.

Table 148 — SCSI Initiator Port control element

Byte\Bit	7	6	5	4	3	2	1	0
0	COMMON CONTROL							
1	RQST IDENT	RQST FAIL	Reserved					
2	Reserved							
3	Reserved							ENABLE

The COMMON CONTROL field is defined in 7.2.2.

The RQST IDENT bit and the RQST FAIL bit are defined in the Cooling element (see 7.3.5).

An ENABLE bit set to one specifies that the SCSI initiator port be enabled. An ENABLE bit set to zero specifies that the SCSI initiator port be disabled.

Table 149 defines the SCSI Initiator Port status element.

Table 149 — SCSI Initiator Port status element

Byte\Bit	7	6	5	4	3	2	1	0
0	COMMON STATUS							
1	IDENT	FAIL	Reserved					
2	Reserved							REPORT
3	Reserved							ENABLED

The COMMON STATUS field is defined in 7.2.3.

The IDENT bit and the FAIL bit are defined in the Power Supply element (see 7.3.4).

A REPORT bit set to one indicates that the enclosure services process is using this SCSI initiator port to return the Enclosure Status diagnostic page. A REPORT bit set to zero indicates that it is not using this SCSI initiator port to return the Enclosure Status diagnostic page.

An ENABLED bit set to one indicates that the SCSI initiator port is enabled. An ENABLED bit is set to zero indicates that the SCSI initiator port is disabled.

7.3.24 Simple Subenclosure element

The Simple Subenclosure element manages a secondary subenclosure that is also a simple subenclosure (see 4.3.3).

Table 150 defines the Simple Subenclosure control element.

Table 150 — Simple Subenclosure control element

Byte\Bit	7	6	5	4	3	2	1	0
0	COMMON CONTROL							
1	RQST IDENT	RQST FAIL	Reserved					
2	Reserved							
3								

The COMMON CONTROL field is defined in 7.2.2.

The RQST IDENT bit and the RQST FAIL bit are defined in the Cooling element (see 7.3.5).

Table 151 defines the Simple Subenclosure status element.

Table 151 — Simple Subenclosure status element

Byte\Bit	7	6	5	4	3	2	1	0
0	COMMON STATUS							
1	IDENT	FAIL	Reserved					
2	Reserved							
3	SHORT ENCLOSURE STATUS							

The COMMON STATUS field is defined in 7.2.3.

The IDENT bit and the FAIL bit are defined in the Power Supply element (see 7.3.4).

The SHORT ENCLOSURE STATUS field contains the contents of the SHORT ENCLOSURE STATUS field of the Short Enclosure Status diagnostic page (see 6.1.11) from the secondary subenclosure.

7.3.25 SAS Expander element

The SAS Expander element manages a SAS expander device.

Additional information about a SAS Expander element may be reported in the Additional Element Status diagnostic page (see 6.1.13).

Table 152 defines the SAS Expander control element.

Table 152 — SAS Expander control element

Byte\Bit	7	6	5	4	3	2	1	0
0	COMMON CONTROL							
1	RQST IDENT	RQST FAIL	Reserved					
2	Reserved							
3								

The COMMON CONTROL field is defined in 7.2.2.

The RQST IDENT bit and the RQST FAIL bit are defined in the Cooling element (see 7.3.5).

Table 153 defines the SAS Expander status element.

Table 153 — SAS Expander status element

Byte\Bit	7	6	5	4	3	2	1	0
0	COMMON STATUS							
1	IDENT	FAIL	Reserved					
2	Reserved							
3								

The COMMON STATUS field is defined in 7.2.3.

The IDENT bit and the FAIL bit are defined in the Power Supply element (see 7.3.4).

7.3.26 SAS Connector element

The SAS Connector element manages a SAS connector or a portion of a SAS connector.

Table 154 defines the SAS Connector control element.

Table 154 — SAS Connector control element

Byte\Bit	7	6	5	4	3	2	1	0
0	COMMON CONTROL							
1	RQST IDENT	Reserved						
2	Reserved							
3	Reserved	RQST FAIL	Reserved					

The COMMON CONTROL field is defined in 7.2.2.

The RQST IDENT bit and the RQST FAIL bit are defined in the Cooling element (see 7.3.5).

Table 155 defines the SAS Connector status element.

Table 155 — SAS Connector status element

Byte\Bit	7	6	5	4	3	2	1	0
0	COMMON STATUS							
1	IDENT	CONNECTOR TYPE						
2	CONNECTOR PHYSICAL LINK							
3	MATED	FAIL	OC	Reserved				

The COMMON STATUS field is defined in 7.2.3.

The IDENT bit is defined in the Power Supply element (see 7.3.4).

The CONNECTOR TYPE field indicates the type of connector and is defined in table 156.

Table 156 — CONNECTOR TYPE field

Code	Description	Maximum number of physical links (informative)
00h	No information	unknown
External connectors		
01h	SAS 4x receptacle (see SAS-2 and SFF-8470)	4
02h	Mini SAS 4x receptacle (see SAS-4 and SFF-8088)	4
03h	QSFP+ receptacle (see SAS-4 and SFF-8436)	4
04h	Mini SAS 4x active receptacle (see SAS-4 and SFF-8088)	4
05h	Mini SAS HD 4x receptacle (see SAS-4 and SFF-8644)	4
06h	Mini SAS HD 8x receptacle (see SAS-4 and SFF-8644)	8
07h	Mini SAS HD 16x receptacle (see SAS-4 and SFF-8644)	16
08h to 0Eh	Reserved for external connectors	
0Fh	Vendor specific external connector	unknown
Internal wide connectors		
10h	SAS 4i plug (see SAS-4 and SFF-8484)	4
11h	Mini SAS 4i receptacle (see SAS-4 and SFF-8087)	4
12h	Mini SAS HD 4i receptacle (see SAS-4 and SFF-8643)	4
13h	Mini SAS HD 8i receptacle (see SAS-4 and SFF-8643)	8
	Editor's Note 1: Mini SAS HD 16i receptacle appears to be missing.	

Table 156 — CONNECTOR TYPE field

Code	Description	Maximum number of physical links (informative)
14h to 1Fh	Reserved for internal wide connectors	
Internal connectors to end devices		
20h	SAS Drive backplane receptacle (see SAS-4 and SFF-8482)	2
21h	SATA host plug (see SAS-4 and SATA)	1
22h	SAS Drive plug (see SAS-4 and SFF-8482)	2
23h	SATA device plug (see SAS-4 and SATA)	1
24h	Micro SAS receptacle (see SAS-4)	2
25h	Micro SATA device plug (see SAS-4 and SATA)	1
26h	Micro SAS plug (see SAS-4 and SFF-8486)	2
27h	Micro SAS/SATA plug (see SAS-4 and SFF-8486)	2
28h	12 Gbit/s SAS Drive backplane receptacle (see SAS-4 and SFF-8680)	2
29h	12Gbit/s SAS Drive Plug (see SAS-4 and SFF-8680)	2
2Ah	Multifunction 12 Gbit/s 6x Unshielded receptacle connector receptacle (see SAS-4 and SFF-8639)	6
2Bh	Multifunction 12 Gbit/s 6x Unshielded receptable connector plug (see SAS-4 and SFF-8639)	6
2Ch to 2Eh	Reserved for internal connectors to end devices	
2Fh	SAS virtual connector	1
Internal connectors		
30h to 3Eh	Reserved for internal connectors	
3Fh	Vendor specific internal connector	unknown
Other		
40h to 6Fh	Reserved	
70h to 7Fh	Vendor specific	

The CONNECTOR PHYSICAL LINK field indicates the physical link in the connector represented by this element. A CONNECTOR PHYSICAL LINK field set to FFh indicates that the element represents the entire connector, not just one physical link in the connector. Physical links in a connector shall be numbered starting with zero. If a connector has only one physical link, the CONNECTOR PHYSICAL LINK field should be set to 00h rather than FFh.

A MATED bit set to one indicates that the connector represented by this element is mated (i.e., mechanically connected). A MATED bit set to zero indicates that the connector represented by this element is not mated or does not report connector mating status.

The FAIL bit is defined in the Power Supply element (see 7.3.4).

An overcurrent (OC) bit set to one indicates that an overcurrent condition exists on the connector represented by this element. An OC bit set to zero indicates that an overcurrent condition does not exist on the connector represented by this element or the connector does not report overcurrent conditions.