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dpANS X3.xxx-1997
X3T10/Project 1212-D/Rev 8a
Printed: January 18, 1997

SES

SCSI-3 Enclosure Services

Command Set

(SES)

REV 8a

working draft proposed
American National Standard
for Information Systems

January 16, 1997

Secretariat:
Information Technology Industry Council

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.

POINTS OF CONTACT:

John B. Lohmeyer (X3T10 Chair)
Symbios Logic Inc.
1635 Aeroplaza Drive
Colorado Springs, CO 80916-3899
(719) 573-3362 Fax: (719)-597-8225
E-Mail: john.lohmeyer@symbios.com

Lawrence J. Lamers (X3T10 Vice Chair)
Adaptec
691 South Milpitas Blvd.
Milpitas, CA 95035
(408) 957-7817 Fax: (408) 957-7193
E-Mail: ljlamers@aol.com

Robert Snively (Technical Editor)
Sun Microsystems
MPK12-204
2550 Garcia Ave.
Mountain View, CA 94045
(415) 786-6694 Fax: (415) 786-7816
E-Mail: bob.snively@sun.com

ANSI ®
dpANS X3.xxx-1997

draft proposed American National Standard for Information Technology — SCSI Enclosure Services (SES) Command Set

Secretariat

Information Technology Industry Council

Approved month dd, 1997

American National Standards Institute, Inc.

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.

American National Standard

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Published by

American National Standards Institute
11 W. 42nd Street, New York, New York 10036

Printed in the United States of America

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Foreword (This Foreword is not part of dpANS X3.xxx-1997.)

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 was developed by Technical Committee X3T10 of Accredited Standards Committee X3 during 1996. The standards approval process started in 1996. This standard includes annexes, which are informative, and are not considered part of the standard.

Requests for interpretation, suggestions for improvement or addenda, or defect reports are welcome. They should be sent to the X3 Secretariat, Information Technology Industry Council, 1250 Eye Street, NW, Suite 200, Washington, DC 20005.

This standard was processed and approved for submittal to ANSI by Accredited Standard Committee on Information Processing Systems, X3. Committee approval of the standard does not necessarily imply that all committee members voted for approval. At the time it approved this standard, the X3 Committee had the following members:

Richard Gibson, Chair
Donald C. Loughry, Vice-Chair
Joanne M. Flanagan, Secretary

Organization Represented	*Name of Representative*
(list to be added)	(list to be added)

Technical Committee X3T10 on Lower Level Interfaces, which developed this standard, had the following participants:

John B. Lohmeyer, Chair
Larry J. Lamers, Vice-Chair
Ralph Weber, Secretary

(list to be added)

Introduction

The SCSI Enclosure Services (SES) command set document is divided into 7 clauses and 2 annexes:

Clause 1 is the scope.

Clause 2 enumerates the references that apply to this standard.

Clause 3 describes the definitions, symbols, abbreviations, and other conventions used in this standard.

Clause 4 describes the SCSI device model for SCSI devices that provide enclosure services.

Clause 5 defines the command set for a SCSI Enclosure Services device.

Clause 6 defines the parameter data formats that may be implemented by a SCSI enclosure services device.

Clause 7 defines the individual element formats that can be presented in an enclosure services page.

Annex A is a normative annex that defines an alternate mechanism for accessing enclosure services for sub-enclosures

Annex B is an informative annex describing the error conditions that are unique to SCSI enclosure services devices.

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SCSI Enclosure Services (SES) command set

1 Scope

The SCSI Enclosure Services (SES) command set 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 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.

2 Normative references

The following American National Standards contain provisions which, through reference in this text, constitute provisions of SES. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards listed below.

Copies of the following documents can be obtained from ANSI: Approved ANSI standards, approved and draft international and regional standards (ISO, IEC, CEN/CENELEC, ITUT), and approved and draft foreign standards (including BSI, JIS, and DIN). For further information, contact ANSI Customer Service Department at 212-642-4900 (phone), 212-302-1286 (fax) or via the World Wide Web at http://www.ansi.org.

Additional availability contact information is provided below as needed.

2.1 Approved references

ANSI X3.230-1995*, Fibre Channel Physical and Signaling Interface (FC-PH)*

ANSI X3.270-1996*, SCSI-3 Architecture Model (SAM)*

ISO 639:1988 (E/F), *Code for the Representation of names of languages*

ISO 8859-1:1987, *Information processing -- 8-bit single-byte coded graphic character set-Part 1, Latin alphabet No.1*

2.2 References under development

At the time of publication, the following referenced standards were still under development by X3T10. For information on the current status of the document, or regarding availability, contact the X3 Secretariat, Information Technology Industry Council (ITI) at 202-737-8888 (phone) or by mail at 1250 Eye Street NW, Suite 200, Washington, DC 20005-3922.

ANSI X3.276-199X*, SCSI-3 Controller Commands (SCC)*

ANSI X3.301-199X, *SCSI-3 Primary Commands (SPC)*

Copies of these X3T10 draft documents are available for purchase from Global Engineering Documents. For further information, contact Global Engineering Documents at 800-854-7179 (phone) or 303-792-2181 (phone) or by mail at 15 Inverness Way East, Englewood, CO 80122-5704

2.3 Other references

The following reference is the product of the Small Form Factor committee. For information on the current status and availability of the document, contact the Small Form Factor committee at 408-867-6630 (phone) or by mail at 14426 Black Walnut Court, Saratoga, CA 95070.

Small Form Factor (SFF) document SFF-8045*, SCA-2 connector for FC-AL.*

The following reference is the product of the Unicode Consortium. For information on the current status and availability of the document, contact the Unicode Consortium at P.O. Box 700519, San Jose, CA 95170-0519.

Unicode Consortium document, *Unicode Standard, Version 2*

3 Definitions and conventions

For SES, the following definitions, abbreviations, acronyms, symbols, keywords, and editorial conventions apply.

3.1 Definitions

3.1.1 application client: An object that is the source of SCSI commands and destination for responses to commands. See SAM.

3.1.2 byte: A group of eight bits.

3.1.3 command descriptor block: The structure up to 16 bytes in length used to communicate commands from application client to a device server. See SPC.

3.1.4 critical condition: An enclosure condition established when one or more elements inside the enclosure have failed or are operating outside of their specifications. The failure of the 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.

3.1.5 device: A mechanical, electrical, or electronic contrivance with a specific purpose. See SAM.

3.1.6 device slot: A position into which a SCSI device may be inserted in an enclosure. 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.

3.1.7 device server: An object within a logical unit that executes SCSI tasks according to the rules of task management. See SAM.

3.1.8 device service request: A request, submitted by an application client, conveying a SCSI command to a device server. See SAM.

3.1.9 device type: The type of device (or device model) implemented by the device server. See SAM.

3.1.10 element: An object related to an enclosure. The object can be controlled, interrogated, or described by the enclosure services process.

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

3.1.12 enclosure services: Those services that establish the mechanical environment, electrical environment, and external indicators and controls for the proper operation and maintenance of devices within an enclosure.

3.1.13 enclosure services device: An SCSI device that monitors and controls enclosure services.

3.1.14 enclosure services process: The object that manages and implements the enclosure services. For an enclosure services device, the enclosure services process also implements the device server.

3.1.15 enclosure services processor: The physical entity that implements the enclosure services process.

3.1.16 information condition: An enclosure condition that should be made known to the application client. The condition is not an error and does not reduce the capabilities of the devices in the enclosure.

3.1.17 indicator: A machine readable bit that optionally generates an externally visible indication when set.

3.1.18 initiator: An SCSI device containing application clients that originate device service requests to be processed by device servers. See SAM

3.1.19 logical unit: A target-resident entity which implements a device model and executes SCSI commands originated by an application client.

3.1.20 noncritical condition: An enclosure condition established when one or more elements inside the enclosure have failed or are operating outside of their specifications. The failure of the elements does not affect continued normal operation of the enclosure. All SCSI devices in the enclosure continue to operate according to their specifications. The ability of the devices to operate correctly if additional failures occur may be reduced by a noncritical condition.

3.1.21 SCSI device: A device that may be connected to a service delivery subsystem and supports an SCSI application protocol. See SAM.

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

3.1.23 target: An SCSI device which receives SCSI commands and directs such commands to one or more logical units for execution. See SAM

3.1.24 unit attention condition: A state that a logical unit maintains while it has asynchronous status information to report to one or more initiators. See SAM

3.1.25 unrecoverable condition: An enclosure condition established when one or more elements inside the enclosure have failed and have disabled some functions of the enclosure. The enclosure may be incapable of recovering or bypassing the failure and will require repairs to correct the condition.

3.2 Abbreviations, acronyms and symbols

Abbreviations, acronyms and symbols applicable to this standard are listed. Definitions of several of these items are included in 3.1. The index at the back of the standard provides help in locating these terms in the body of the standard.

3.2.1 Acronyms and other abbreviations

CDB	command descriptor block
ES	enclosure services
FRU	field-replaceable unit
hex	hexadecimal notation
LED	light emitting diode
LOL	loss of link
LSB	least significant bit
LU	logical unit
ms	millisecond
MSB	most significant bit
N/A	not applicable
rsrvd	reserved
VS	vendor specific

3.3 Keywords

Several keywords are used to define states and to differentiate among various levels of requirements. The keywords are defined below.

3.3.1 cleared - A keyword indicating that a value of zero has been placed in a single bit field.

3.3.2 expected - A keyword used to describe the behavior of the hardware or software in the design models assumed by this standard. Other hardware and software design models may also be implemented.

3.3.3 ignored: An adjective describing a data field that is not interpreted by the receiver.

3.3.4 mandatory - A keyword indicating items required to be implemented as defined by this standard.

3.3.5 may - A keyword that indicates flexibility of choice with no implied preference.

3.3.6 optional - A keyword that describes features which are not required to be implemented by this standard. However, if any optional feature defined by the standard is implemented, it shall be implemented as defined by the standard.

3.3.7 reserved - A keyword referring to bits, bytes, words, fields and code values that are set aside for future standardization. Their use and interpretation may be specified by future extensions to this or other standards. A reserved bit, byte, word, or field shall be set to zero, or in accordance with a future extension to this standard. The recipient should not check or interpret reserved bits or fields unless otherwise noted. Receipt of reserved code values in defined fields shall be treated as an error or in accordance with future extensions.

3.3.8 set - A keyword indicating that a value of one has been placed in a single bit field.

3.3.9 shall - A keyword indicating a mandatory requirement. Designers are required to implement all such mandatory requirements to ensure interoperability with other standard conformant products.

3.3.10 should - A keyword indicating flexibility of choice with a strongly preferred alternative. Equivalent to the phrase “it is recommended”.

3.3.11 vendor specific - Functions, code values, and bits not defined by a standard and set aside for private usage between parties using SES. Caution: Different implementations of SES may assign different meanings to these functions, code values, and bits.

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 3.1 or in the text where they first appear. Names of commands, statuses, sense keys, additional sense codes, and additional sense code qualifiers are in all uppercase (e.g. REQUEST SENSE). Lower case is used for words having the normal English meaning.

Fields containing only one bit are usually referred to as the [named] bit instead of the [named] field.

Field and bit names are in small caps (e.g. STATUS CODE)

In case of any conflict between figure, table, and text, the text, then tables, and finally figures take precedence.

3.4.1 Binary notation

Binary notation is used to represent relatively short fields. For example, a three-bit field containing a binary value of 010 is shown in binary format as 010b.

3.4.2 Hexadecimal notation

Hexadecimal notation is used to represent relatively long fields. For example, a two-byte field containing a binary value of 11000100 00000011 is shown in hexadecimal format as C403h.

4 SCSI enclosure services model

4.1 Model for access to enclosure services process

SCSI devices reside in enclosures that provide power, cooling, and protection for the devices. In addition, the enclosures provide external indicators about the state of the enclosure and devices. The indicators may identify the enclosure, may identify proper operation of the devices and enclosure elements, may provide indications of the state of RAID devices in the enclosure, and may provide failure and maintenance information. Many 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 processor. As an example, an uninterruptible power supply element may be located remotely and attached to the enclosure services processor by a serial link.

The application client has two mechanisms for accessing the enclosure services process. It may access the process through an enclosure services device or through a logical unit of another device type. The enclosure services command set uses the RECEIVE DIAGNOSTIC RESULTS and SEND DIAGNOSTIC commands so that the services may be available to any device type.

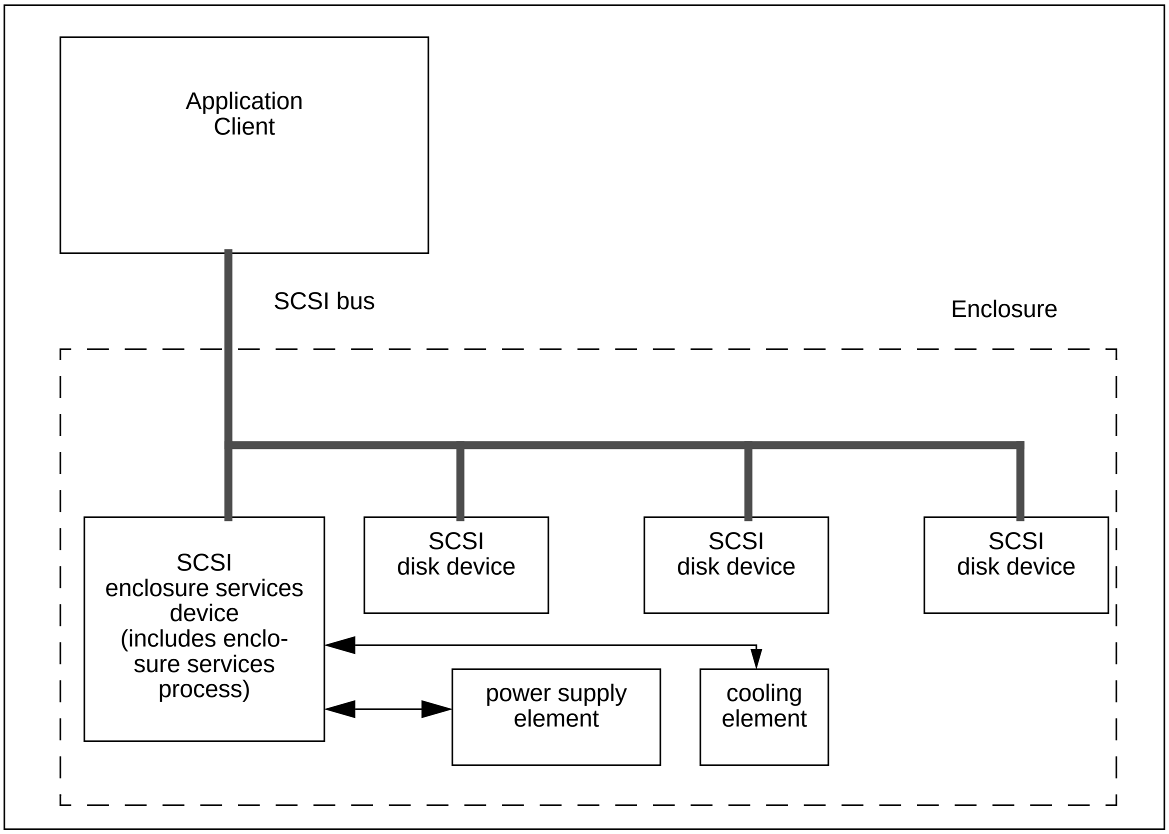
4.1.1 Access through enclosure services device

An application client may address the enclosure services process as a logical unit having the peripheral device type of enclosure services device. The commands for this device type are described in clause 5.

The model uses the SEND DIAGNOSTIC command and the enclosure services outbound diagnostic pages 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 may request information from the enclosure services device using the RECEIVE DIAGNOSTIC RESULTS command and the enclosure services inbound diagnostic pages to examine various status and warning information available from the enclosure. Enclosure services devices shall set the enclosure services bit (ENCSERV) in the INQUIRY command (see SPC) to indicate that they are capable of transporting enclosure services information. The diagnostic pages and page formats are defined in 6.1. The enclosure services management mode page may be implemented by an enclosure services device.

An example of a SCSI initiator accessing the enclosure services process through an enclosure services device is shown in figure 1.

Figure 1 – Example of access through enclosure services device

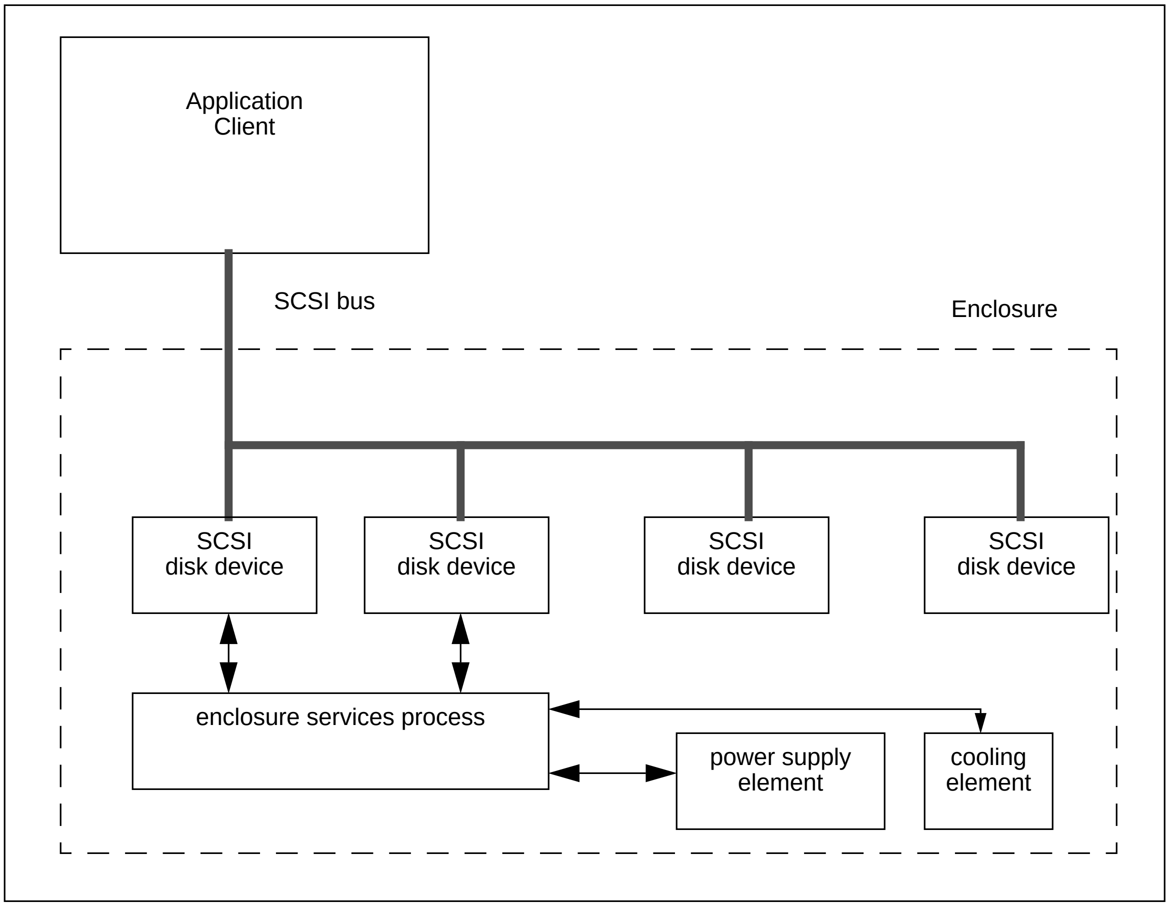


4.1.2 Access through non-enclosure services device

An application client may also be able to address the enclosure services using some other peripheral device type as a transport for enclosure services information to and from the application client. Such peripheral devices have a vendor specific communications connection to the enclosure services process. The actual enclosure services device is not visible as a SCSI device or logical unit, but merely transports the standard enclosure services information through the addressed SCSI device. Such devices shall use the same SEND DIAGNOSTIC and RECEIVE DIAGNOSTIC RESULTS commands and page formats used by an enclosure services device, but otherwise support the device model specified by their peripheral device type value. SCSI device servers set the enclosure services bit (ENCSERV) in the standard INQUIRY data (see SPC) to indicate that they are capable of transporting enclosure services information if an enclosure services process is connected to the device. An application client determines that an enclosure services process is actually connected to the device by using the RECEIVE DIAGNOSTIC RESULTS command to request a configuration page. If the SCSI device is not able to communicate with an enclosure services process, a CHECK CONDITION status is returned and the sense data is set appropriately. The enclosure services management mode page may be implemented by an SCSI device that allows access to the enclosure services process.

An example of a SCSI initiator accessing the enclosure services process through a non-enclosure services device is shown in figure 2.

Figure 2 – Example of access through non-enclosure services device



4.1.3 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 or cleared by any application client. The instructions of the application client may be ignored or overridden by the enclosure services processor to assure that the proper state information is available to any application client that wants to sense an indicator. As an example, an application client may clear the CRIT bit to indicate 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 processor if the instructions request an operation not implemented by the enclosure. Enclosure services processors 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 processor 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 processor 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 PF bit set 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.

4.1.4 Use of short status page

Some simple enclosure processors are not capable of reporting any enclosure service page except the short status page, defined in 6.1.12. Such devices shall always provide the short status page, regardless of which enclosure services page is requested by a RECEIVE DIAGNOSTIC RESULTS command. Such devices shall terminate any SEND DIAGNOSTIC command using an enclosure services page code with CHECK CONDITION. The sense key shall be set to ILLEGAL REQUEST and the additional sense code shall be set to UNSUPPORTED ENCLOSURE FUNCTION.

4.1.5 Invalid field errors

Any invalid fields included in the CDB or parameters of a SEND DIAGNOSTIC command and any invalid fields in the CDB of a RECEIVE DIAGNOSTIC RESULTS command shall be detected by the device server in an enclosure services device. An enclosure services device shall analyze these parameters before performing the requested operations and, if there is an error, the command shall be terminated with a CHECK CONDITION status. The sense key shall be set to ILLEGAL REQUEST and the additional sense code shall identify the location of the invalid fields, CDB or parameter data.

The device server in a non-enclosure services device does not have the capability of analyzing the validity of the CDB and the parameters. Instead, the device server shall pass the parameters through to the enclosure services process without testing the validity of the parameters and shall return GOOD status. The invalid op bit (INVOP) (see 6.1.3) shall be set in the next enclosure status page or array status page returned to any initiator. No other indication of the invalid data shall be given.

4.1.6 Reporting of enclosure failure information

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.

4.1.6.1 Polling

The application client may periodically poll the enclosure by executing a READ DIAGNOSTIC RESULTS command requesting an enclosure status page or an array status page with a minimum allocation length greater than 1. The information returned in byte 1 of the appropriate page includes 5 bits that summarize the status of the enclosure and its elements as described in 6.1.3 and 6.1.10. If one of these bits is set, detailed information may then be obtained by the application client by executing a READ DIAGNOSTIC RESULTS command requesting a complete enclosure status page, array status page, or help text page.

4.1.6.2 Timed Disconnect Polling

The application client may enable the optional timed disconnect function using the enclosure services management mode page. The application client may then periodically poll the enclosure by executing a READ DIAGNOSTIC RESULTS command requesting an enclosure status page or array status page with a minimum allocation length greater than 1. The return of the page may be delayed until one or more of the bits in byte 1 of the page are set. The command shall be completed by the enclosure services device before the MAXIMUM TASK COMPLETION TIME is exceeded whether or not one of these bits is set. 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.

4.1.6.3 CHECK CONDITION

For commands other than READ DIAGNOSTIC RESULTS and REQUEST SENSE sent to an enclosure services type device the device may indicate invalid operations, warning conditions, and failure conditions by terminating the command with CHECK CONDITION status. The sense key and additional sense code shall describe the indication. Subsequent execution of a READ DIAGNOSTIC RESULTS command requesting an enclosure status or an array status page may be required to clarify the indication and to identify the element causing the indication. The device may use the rules defined for informational exception conditions defined by SPC to indicate conditions that do not require any recovery action.

Commands executed on device types other than enclosure services devices shall not terminate with CHECK CONDITION status to indicate the presence of information from the enclosure services process. Application clients shall use polling to access the enclosure information through such devices.

4.1.6.4 Asynchronous Event Reporting

Enclosure services devices may use the asynchronous event reporting function to execute a SEND command with the AER bit set. (See SPC). The SEND command data contains the sense key and additional sense code that defines the reason for the notification as defined in SPC. Subsequent execution of a READ DIAGNOSTIC RESULTS command requesting an enclosure status or an array status page may be required to clarify the indication and to identify the element causing the indication.

5 Commands for enclosure services devices

The commands for enclosure services devices shall be as shown in table 1. All remaining operation codes are reserved for future standardization.

Table 1 – Commands for Enclosure Services type devices

Command name	Operation Code	Type	Document
INQUIRY	12h	M	SPC
MODE SELECT (6)	15h	O	SPC
MODE SELECT (10)	55h	O	SPC
MODE SENSE (6)	1Ah	O	SPC
MODE SENSE (10)	5Ah	O	SPC
PERSISTENT RESERVE IN	5Eh	O	SPC
PERSISTENT RESERVE OUT	5Fh	O	SPC
RECEIVE DIAGNOSTIC RESULTS[a]	1Ch	M	SPC
RELEASE(6)	17h	O	SPC
RELEASE(10)	57h	O	SPC
REQUEST SENSE	03h	M	SPC
RESERVE(6)	16h	O	SPC
RESERVE(10)	56h	O	SPC
SEND DIAGNOSTIC[b]	1Dh	M	SPC
TEST UNIT READY	00h	M	SPC
WRITE BUFFER	3Bh	O	SPC
Key: M = Command implementation is mandatory O = Command implementation is optional.			

a. All enclosure services inbound diagnostic pages shall be transferred by the RECEIVE DIAGNOSTIC RESULTS command using the PF bit set.
b. Enclosure services outbound diagnostic pages shall be transferred by the SEND DIAGNOSTIC command. Device servers are only required to accept a single diagnostic page in each command.

All the above commands are completely described in SPC. The special enclosure services diagnostic pages are defined in 6.1. The format for each of the defined types of enclosure element is defined in clause 7. The format for the mode parameters and the enclosure services management page are defined in 6.2.

6 Parameters for enclosure services devices

6.1 Diagnostic Parameters

This clause describes 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. Each diagnostic page provides either control (outbound) or status (inbound) data transmission to or from the enclosure process.

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

The PAGE CODE field identifies the enclosure services page being sent or requested. The page codes are defined in table 2.

Table 2 – Diagnostic page codes for enclosure service devices

Page Code	Description	Control or Status	Reference
00h	Supported diagnostics	Status	SPC
01h	Configuration	Status	6.1.1
02h	Enclosure Control	Control	6.1.2
02h	Enclosure Status	Status	6.1.3
03h	Help Text	Status	6.1.4
04h	String Out	Control	6.1.5
04h	String In	Status	6.1.6
05h	Threshold Out	Control	6.1.7
05h	Threshold In	Status	6.1.8
06h	Array Control	Control	6.1.9
06h	Array Status	Status	6.1.10
07h	Element Descriptor	Status	6.1.11
08h	Short Enclosure Status	Status	6.1.12
09h-0Fh	Reserved for SES	N/A	6.1
10h-3Fh	Reserved (applies to all device type pages)	N/A	SPC
40h-7Fh	See specific device type for definition	N/A	SPC
80h-FFh	Vendor-specific pages	N/A	SPC

The supported page list specified by SPC shall contain a list of all diagnostic page codes implemented by the device server in ascending order beginning with PAGE CODE 00h. If the device is capable of accessing a diagnostic function or enclosure function that may temporarily or permanently be unavailable to the device, the PAGE CODE associated with that information shall be included in the list. The unavailability of the resources necessary to transfer a page shall not result in an error until a diagnostic command that requests the transfer of an enclosure service page is executed. The pages 09 - 0Fh are reserved for future SES standardization. Non-enclosure services devices supporting access to an enclosure services process (see 4.1.2) may include pages 00-0Fh in the supported page list.

6.1.1 Configuration page

The enclosure services configuration page returns a list of elements in an enclosure. This page shall be implemented if the device supports enclosure services and does not use the short enclosure status page. The element list shall include all elements with defined element status or controls and may list any other elements in the enclosure. The configuration page provides enclosure descriptor information and parameters. The configuration page optionally provides descriptive text that applications clients may use to identify elements in more detail. The configuration page shall be read by the RECEIVE DIAGNOSTIC RESULTS command. If a PAGE CODE of 01h is transmitted using a SEND DIAGNOSTIC command, the command shall be treated as having an invalid field error (see 4.1.5).

Table 3 provides an overview of the components of the enclosure services configuration page.

Table 3 – Layout of configuration page

Component name	Description	Reference
Diagnostic page header	Describes diagnostic page	SPC
Generation Code	Generation Code	6.1.1
Enclosure descriptor header	Describes enclosure descriptor	6.1.1
Enclosure descriptor	Enclosure identification information	6.1.1
Type descriptor header list for device elements	Contains type descriptor headers for device elements (see 7.2.2 and 7.2.3) in the enclosure.	6.1.1
Type descriptor header list for other elements	Identifies all other element types included in enclosure	6.1.1
Type descriptor text	Provides optional text descriptions for each element type in the enclosure.	6.1.1

The format of the enclosure services configuration page is described in table 4.

Table 4 – Configuration page

Component name	Bytes	Field Name
Diagnostic page header	0	PAGE CODE (01h)
	1	NUMBER OF SUB-ENCLOSURES
	2 - 3	(MSB) PAGE LENGTH (n-3) (LSB)
Generation Code	4-7	(MSB) GENERATION CODE (LSB)
Enclosure descriptor header	8	Reserved
	9	SUB-ENCLOSURE IDENTIFIER
	10	NUMBER OF ELEMENT TYPES SUPPORTED (T)
	11	ENCLOSURE DESCRIPTOR LENGTH (m)
Enclosure descriptor	12 - 19	ENCLOSURE LOGICAL IDENTIFIER
	20 - 27	ENCLOSURE VENDOR IDENTIFICATION
	28-43	PRODUCT IDENTIFICATION
	44-47	PRODUCT REVISION LEVEL
	48 - (11+m)	VENDOR-SPECIFIC ENCLOSURE INFORMATION
Type descriptor header list	(4 bytes)	TYPE DESCRIPTOR HEADER (first element type)
	•••	
	(4 bytes)	TYPE DESCRIPTOR HEADER (Tth element type)
Type descriptor text	variable	TYPE DESCRIPTOR TEXT (first element type)
	•••	
	last byte = n	TYPE DESCRIPTOR TEXT (Tth element type)

NUMBER OF SUB-ENCLOSURES: Unless sub-enclosures are defined (see Annex A), the NUMBER OF SUB-ENCLOSURES field shall be 0.

GENERATION CODE: The GENERATION CODE field is a four byte counter that shall be incremented by one by the enclosure services process every time the enclosure configuration is modified such that the configuration page changes. The counter shall not be changed by status changes for elements already described by the configuration page. Enclosures that do not change in configuration may use a fixed value of zero for the GENERATION CODE.

Enclosure services type devices shall establish a unit attention condition (see SAM and SPC) for all initiators when there is a change in the GENERATION CODE field's value. 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 initiators without being reported by the execution of a READ DIAGNOSTIC RESULTS command that requests a configuration page (PAGE CODE of 01h).

Application clients accessing an enclosure services process through a device other than an enclosure services type device should verify that the value of the GENERATION CODE field has not unexpectedly changed, since no unit attention condition is established by such devices.

SUB-ENCLOSURE IDENTIFIER: Unless sub-enclosures are defined (see Annex A), the SUB-ENCLOSURE IDENTIFIER FIELD shall be 0.

NUMBER OF ELEMENT TYPES SUPPORTED: The NUMBER OF ELEMENT TYPES SUPPORTED field defines the number of TYPE DESCRIPTOR HEADER fields that follow the enclosure descriptor.

ENCLOSURE DESCRIPTOR LENGTH: The ENCLOSURE DESCRIPTOR LENGTH field specifies the number of bytes contained 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.

ENCLOSURE LOGICAL IDENTIFIER: The ENCLOSURE LOGICAL IDENTIFIER field shall use one of the 8-byte world wide name formats defined by FC-PH. The ENCLOSURE LOGICAL IDENTIFIER is unique to the enclosure and may be different from the world wide name of the device providing the enclosure services.

ENCLOSURE VENDOR IDENTIFICATION: The ENCLOSURE VENDOR IDENTIFICATION field shall contain the identification string for the vendor of the enclosure in the same format as specified for the vendor identification field of the standard INQUIRY data (see SPC). The ENCLOSURE VENDOR IDENTIFICATION may be different from the vendor identification of the device providing the enclosure services.

PRODUCT IDENTIFICATION: The PRODUCT IDENTIFICATION field shall contain the product identification string for the enclosure in the same format as specified for the product identification field of the standard INQUIRY data (see SPC). The PRODUCT IDENTIFICATION field may be different from the product identification of the device providing the enclosure services.

PRODUCT REVISION LEVEL: The PRODUCT REVISION LEVEL field shall contain the product revision level string for the enclosure in the same format as specified for the product revision level field of the standard INQUIRY data (See SPC). The PRODUCT REVISION LEVEL may be different from the product revision level of the device providing the enclosure services.

VENDOR-SPECIFIC ENCLOSURE INFORMATION: The VENDOR-SPECIFIC ENCLOSURE INFORMATION field is optional.

TYPE DESCRIPTOR HEADER: The TYPE DESCRIPTOR HEADER field indicates the element type being described, the number of such elements, and the length of an optional text describing the element type. The format of the TYPE DESCRIPTOR HEADER is shown in table 5. The elements of an enclosure shall be listed in the same order in the configuration page, the type descriptor text of the configuration page, the enclosure and array status pages, the enclosure and array control pages, and the threshold in and threshold out pages. All those elements defining SCSI devices shall be listed before elements of other types, regardless of SUB-ENCLOSURE IDENTIFIER. Type descriptor headers for elements other than device elements may be listed in any order in the configuration page. The type descriptor text strings shall be placed after all type descriptor headers.

TYPE DESCRIPTOR TEXT: The TYPE DESCRIPTOR TEXT is an optional text string from zero to 255 bytes for each type descriptor header. 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. The TYPE DESCRIPTOR TEXT items shall be placed in the same order as the type descriptor headers, except that text items of 0 length shall be omitted.

Examples of information that may be included in the TYPE DESCRIPTOR TEXT field include 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 specified by the language element. (see 7.2.16)

Table 5 – Type descriptor header format

Bytes \ Bits	7	6	5	4	3	2	1	0
0	ELEMENT TYPE							
1	NUMBER OF POSSIBLE ELEMENTS							
2	SUB-ENCLOSURE IDENTIFIER							
3	TYPE DESCRIPTOR TEXT LENGTH							

ELEMENT TYPE: The ELEMENT TYPE field indicates the element type being described in the header. The list of element types is shown in table 22.

More than one type descriptor header may contain a given ELEMENT TYPE value. As an example, there may be two power supplies that provide +12 volts, and five power supplies that provide +5 volts. In this case, a separate TYPE DESCRIPTOR HEADER may be used for the +12 volt power supplies and for the +5 volt power supplies.

NUMBER OF POSSIBLE ELEMENTS: The NUMBER OF POSSIBLE ELEMENTS field indicates the number of elements of the indicated type that it is possible to install in the enclosure. The actual number of elements installed may be smaller than the number that the configuration is capable of accepting. The NUMBER OF POSSIBLE ELEMENTS may be zero, indicating that only the OVERALL CONTROL, OVERALL STATUS, or OVERALL THRESHOLD field is present in the applicable control, status, or threshold page, but that individual ELEMENT CONTROL, ELEMENT STATUS, or ELEMENT THRESHOLD fields are absent (see 6.1.2, 6.1.3, 6.1.7, 6.1.8, 6.1.9, and 6.1.10). The maximum number of elements referenced by a single type descriptor header shall be 255.

SUB-ENCLOSURE IDENTIFIER: The SUB-ENCLOSURE IDENTIFIER field specifies a vendor specific identifier for the enclosure where the elements described by this type descriptor reside. For an enclosure services process that is directly accessed as an enclosure services device or through a logical unit of another type, the SUB-ENCLOSURE IDENTIFIER shall be 00h. Such an enclosure is defined as a primary sub-enclosure. The alternative accessing structure for sub-enclosures is described in Annex A.

TYPE DESCRIPTOR TEXT LENGTH: The TYPE DESCRIPTOR TEXT LENGTH field specifies the length in bytes of the type descriptor text string for the names element. Vendor specific element types shall have a TYPE DESCRIPTOR TEXT LENGTH field that is nonzero and shall have a TYPE DESCRIPTOR TEXT field adequate to identify the element to an application client. Other element types may have a TYPE DESCRIPTOR TEXT LENGTH of zero.

6.1.2 Enclosure control page

The enclosure control page provides control information to each of the elements identified by the configuration page. In addition, a separate control field is provided for the collection of elements of the same type as defined by each type descriptor header. The data allows the application client to control many functions within the addressed enclosure.

The enclosure control page contains a type control field for each element type described by a type descriptor header in the enclosure services configuration page, and an ELEMENT CONTROL field for each of the elements of that type that have been allowed for by the NUMBER OF POSSIBLE ELEMENTS field of the configuration page. The list of fields shall be in the order defined by the configuration page. The relationship between the order of the ELEMENT CONTROL fields and the physical location of the element within the enclosure is vendor specific. The relationship may be described by the descriptor fields of the configuration page, by the descriptors in the element descriptor page, or by external references. The relationship shall not change unless the GENERATION CODE is incremented (see 6.1.1).

The enclosure control page shall be implemented if the device supports enclosure services and does not use the short enclosure status page (see 6.1.12). The control page is transmitted by the SEND DIAGNOSTIC command. The request of a page using the RECEIVE DIAGNOSTIC RESULTS command using PAGE CODE 02h is defined as the request for an enclosure services enclosure status page. Table 6 describes the enclosure control page.

Table 6 – Enclosure control page

Bits Bytes	7	6	5	4	3	2	1	0
0	PAGE CODE (02h)							
1	Reserved				INFO	NON-CRIT	CRIT	UNRECOV
2	(MSB)							
3	PAGE LENGTH (n-3)							(LSB)
4-7	GENERATION CODE							
8-11	OVERALL CONTROL (first element type)							
12-15	ELEMENT CONTROL (first element of first element type)							
•••								
(4 bytes)	ELEMENT CONTROL (last element of first element type)							
(4 bytes)	OVERALL CONTROL (second element type)							
(4 bytes)	ELEMENT CONTROL (first element of second element type)							
•••								
n-3 to n	ELEMENT CONTROL (last element of last element type)							

The INFO, NON-CRIT, CRIT, and UNRECOV bits are mandatory and are set in the enclosure by the application client when the application client has detected that one or more of the elements in the enclosure are not operating normally.

INFO: The Informational condition bit (INFO) may be set by the application client to indicate the presence of an informational condition (see 3.1.16). Transmitting an enclosure control page with the INFO bit cleared shall not clear the bit in the enclosure. Enclosure services type devices shall maintain a copy of the bit for transmission to each attached initiator. Enclosure services processes which are accessed through another device type may clear the bit after the first request for enclosure status or array status is performed.

NON-CRIT: The noncritical condition bit (NON-CRIT) may be set by the application client to indicate the presence of a noncritical condition (see 3.1.20). The NON-CRIT bit may be cleared by an application client. If the enclosure services process has independently determined that a noncritical condition is present, a request from the application client to clear the NON-CRIT bit shall be ignored by the enclosure services process.

CRIT: The critical condition bit (CRIT) may be set by the application client to indicate the presence of a critical condition (see 3.1.4). The CRIT bit may be cleared by an application client. If the enclosure services process has independently determined that a critical condition is present, a request from the application client to clear the CRIT bit shall be ignored by the enclosure services process.

UNRECOV: The unrecoverable condition bit (UNRECOV) may be set by the application client to indicate the presence of an unrecoverable condition (see 3.1.25). The UNRECOV bit may be cleared by an application client. If the enclosure services process has independently determined that an unrecoverable condition is present, a request from the application client to clear the UNRECOV bit shall be ignored by the enclosure services process.

GENERATION CODE: The GENERATION CODE field shall have the value expected to be found in the GENERATION CODE field of the configuration page (see 6.1.1). To prevent the misinterpretation of the OVERALL CONTROL and ELEMENT CONTROL fields, the enclosure services process shall verify that the value of the GENERATION CODE field matches the generation code value known by the enclosure services process. If there is a mismatch, the application client shall be notified that the GENERATION CODE field is invalid by the mechanisms described in 4.1.5 and the enclosure services process shall ignore the remainder of the enclosure control page.

OVERALL CONTROL: The OVERALL CONTROL field for each element type has the same format as the corresponding ELEMENT CONTROL field. There is exactly one OVERALL CONTROL field for each TYPE DESCRIPTOR HEADER in the configuration page (see table 4). The OVERALL CONTROL field provides control for all elements described in the ELEMENT CONTROL fields. Control values may be applied using either the OVERALL CONTROL field or the ELEMENT CONTROL field. Except as required by the enclosure services processor, requests in the ELEMENT CONTROL field shall override requests in the OVERALL CONTROL field.

ELEMENT CONTROL: Following the OVERALL CONTROL field, there shall be one ELEMENT CONTROL field for each of the possible elements identified by the NUMBER OF POSSIBLE ELEMENTS field in the corresponding TYPE DESCRIPTOR HEADER. Each ELEMENT CONTROL field optionally contains control information for the element. Each element type has a standard fixed format for its control field. The general format for an ELEMENT CONTROL field is defined by table 23 of 7.1.

6.1.3 Enclosure status page

The enclosure status page returns status information for each of the elements identified by the configuration page. In addition, an OVERALL STATUS field is provided to collect information about the collection of elements of the same type defined by each TYPE DESCRIPTOR HEADER. The information provides the status about many functions within the addressed enclosure.

The enclosure status page returns an OVERALL STATUS field for each element type described by a TYPE DESCRIPTOR HEADER in the enclosure services configuration page and an ELEMENT STATUS field for each of the elements of that type that have been allowed for by the NUMBER OF POSSIBLE ELEMENTS field in the configuration page. The fields shall be in the order defined by the configuration page. The relationship between the order of the ELEMENT STATUS fields and the physical location of the element within the enclosure is vendor specific. The relationship may be described by the descriptor fields of the configuration page, by the descriptors in the element descriptor page, or by external references. The relationship shall not change unless the GENERATION CODE is incremented.

This page shall be implemented if the device supports enclosure services and does not use the short enclosure status page (see 6.1.12). The status page is read by the RECEIVE DIAGNOSTIC RESULTS command. The transmission of a page using the SEND DIAGNOSTIC command with PAGE CODE 02h is defined as the transmission of an enclosure services enclosure control page.

Table 7 describes the enclosure status page.

Table 7 – Enclosure status page

Bits Bytes	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)
4-7	(MSB) GENERATION CODE							(LSB)
8 -11	OVERALL STATUS (first element type)							
12 - 15	ELEMENT STATUS (first element of first element type)							
•••								
(4 bytes)	ELEMENT STATUS (last element of first element type)							
(4 bytes)	OVERALL STATUS (second element type)							
(4 bytes)	ELEMENT STATUS (first element of second element type)							
•••								
n-3 to n	ELEMENT STATUS (last element of last element type)							

The INVOP, INFO, NON-CRIT, CRIT, and UNRECOV bits returned in normal status pages and are mandatory. The bits may be read with an allocation length greater than 1 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 page.

INVOP: The Invalid Operation Requested bit (INVOP) shall be set if an enclosure control page or an array control 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. For enclosure service devices, the INVOP bit shall be set one time in the first enclosure status page or array status page read by the same initiator that transmitted the invalid control page. If the application client was notified by a CHECK CONDITION when the SEND DIAGNOSTIC command transmitted the invalid control page, the INVOP bit shall not be set. Enclosure services processes which are accessed through another device type shall set the INVOP bit one time in the first enclosure status or array status page read by any application client.

INFO: The information bit (INFO) shall be set if one or more information conditions (see 3.1.16) have been detected or set in the enclosure. Enclosure services type devices shall maintain a copy of the INFO bit to be presented one time to each initiator. Enclosure services processes which are accessed through another device type may clear the bit after the first request of enclosure status or array status is performed. The INFO bit shall be set once as an indication to the application client that an information condition is available and not set again until a new information condition occurs.

NON-CRIT: The noncritical condition bit (NON-CRIT) shall be set if one or more noncritical conditions (see 3.1.20) have been detected or set in the enclosure. The NON-CRIT bit shall be cleared when both the following conditions are met:

a) all noncritical conditions have been corrected in the enclosure, and

b) the application client has cleared any NON-CRIT bit state that has been set using the enclosure control page or the array control page.

CRIT: The critical condition bit (CRIT) shall be set if one or more critical conditions (see 3.1.4) have been detected or set in the enclosure. The CRIT bit shall be cleared when both the following conditions are met:

a) all critical conditions have been corrected in the enclosure, and

b) the application client has cleared any CRIT bit state that has been set using the enclosure control page or the array control page.

UNRECOV: The unrecoverable condition bit (UNRECOV) shall be set if one or more unrecoverable conditions (see 3.1.25) have been detected or set in the enclosure. The UNRECOV bit shall be cleared when both the following conditions are met:

a) all unrecoverable conditions have been corrected in the enclosure, and

b) the application client has cleared any UNRECOV bit state that has been set using the enclosure control page or the array control page.

GENERATION CODE: The GENERATION CODE shall have the same value as the GENERATION CODE in the configuration page, described in 6.1.1.

OVERALL STATUS: The OVERALL STATUS field for each element type has the same format as the corresponding ELEMENT STATUS field. There is exactly one OVERALL STATUS field for each TYPE DESCRIPTOR HEADER in the configuration page. The OVERALL STATUS optionally indicates a summary of the status for all of the elements of that type. The OVERALL STATUS also may be used to indicate the status of those elements whose individual status is not available, but that do have a measurable overall status.

An example of an enclosure that uses the OVERALL STATUS field is an enclosure with three temperature sensor FRUs. If the enclosure only reports the average of the three sensors, the OVERALL STATUS field contains the temperature information. If the enclosure reports the output of each sensor separately, the ELEMENT STATUS fields contain the information. Both the OVERALL STATUS field and the ELEMENT STATUS field may contain information.

ELEMENT STATUS: Zero or more ELEMENT STATUS fields are provided immediately after the OVERALL STATUS field for that element type. The number of ELEMENT STATUS fields shall be equal to the NUMBER OF POSSIBLE ELEMENTS specified by the corresponding TYPE DESCRIPTOR HEADER in the configuration page. Each ELEMENT STATUS field optionally indicates the status for the particular element. The general format for an ELEMENT STATUS field is defined by table 24 and by 7.2.

6.1.4 Help text page

The enclosure services help text page contains a string of characters from the enclosure that describes the present state of the enclosure and provides text indicating what corrective actions, if any, are desirable to bring the enclosure to its fully operational state. The help text page is intended to allow the writing of enclosure independent application clients that return enclosure specific text describing the state of the enclosure and explaining enclosure dependent corrective actions that may be required. The page is optional. The language and character set of the help text are defined by the language element (see 7.2.16).

The enclosure services help text page shall be read by the RECEIVE DIAGNOSTIC RESULTS command. If a PAGE CODE of 03h is transmitted using a SEND DIAGNOSTIC command, the command shall be treated as having an invalid field error (see 4.1.5).

Table 8 describes the enclosure services help text page.

Table 8 – Help text page

Bits Bytes	7	6	5	4	3	2	1	0
0	PAGE CODE (03h)							
1	NUMBER OF SUB-ENCLOSURES							
2	(MSB)							
3	PAGE LENGTH (n-3)							(LSB)
4 - n	HELP TEXT							

NUMBER OF SUB-ENCLOSURES: Unless sub-enclosures are defined (see Annex A), the NUMBER OF SUB-ENCLOSURES field shall be 0.

HELP TEXT: The HELP TEXT field shall contain the text describing what corrective actions should be performed on the enclosure to change it from its present state to a fully operational state. The text shall use the language and character set specified by the language element (see 7.2.16).

6.1.5 String out page

The enclosure services string out page transmits an enclosure dependent binary string from the application client to the enclosure services process. The string may contain bits describing indicator states, text or graphic display information, or control information outside the context of the enclosure elements defined in the enclosure services configuration page. The format is vendor specific. An application client may select the format of the string using the manufacturer name and mode from the standard INQUIRY data (see SPC) or using the enclosure header information in the configuration page. The request for a page using the RECEIVE DIAGNOSTIC RESULTS command with PAGE CODE 04h is defined as the request for a string in page.

Table 9 describes the enclosure services string out page transmitted using the SEND DIAGNOSTIC command.

Table 9 – String out page

Bits Bytes	7	6	5	4	3	2	1	0
0	PAGE CODE (04h)							
1	SUB-ENCLOSURE IDENTIFIER							
2	(MSB)			PAGE LENGTH (n-3)				
3								(LSB)
4 - n	VENDOR SPECIFIC							

SUB-ENCLOSURE IDENTIFIER: Unless sub-enclosures are defined (see Annex A), the SUB-ENCLOSURE IDENTIFIER field shall be 0.

VENDOR SPECIFIC: The VENDOR SPECIFIC field shall contain the vendor specific information to be transferred from the application client to the enclosure services process.

6.1.6 String in page

The enclosure services string in page transmits an enclosure dependent binary string from the enclosure services process to the application client. The string may contain bits describing keyboard states, switch states, or the content of other information provided through or by the enclosure to the application client. The format is vendor specific. An application client may determine the format of the string using the manufacturer name and mode from the standard INQUIRY data (see SPC) or using the enclosure header information in the configuration page. The transmission of a page using the SEND DIAGNOSTIC command with PAGE CODE 04h is defined as the transmission of a string out page. Table 10 describes the enclosure services string in page received using the RECEIVE DIAGNOSTIC RESULTS command.

Table 10 – String in page

Bits Bytes	7	6	5	4	3	2	1	0
0	PAGE CODE (04h)							
1	NUMBER OF SUB-ENCLOSURES							
2	(MSB)			PAGE LENGTH (n-3)				
3								(LSB)
4 - n	VENDOR SPECIFIC							

NUMBER OF SUB-ENCLOSURES: Unless sub-enclosures are defined (see Annex A), the NUMBER OF SUB-ENCLOSURES field shall be 0.

VENDOR SPECIFIC: The VENDOR SPECIFIC field shall contain the vendor specific information to be transferred from the enclosure services process to the application client.

6.1.7 Threshold Out page

The threshold out page is transmitted to the enclosure services process to establish threshold values for those elements that have limit sensing capability, for example voltage sensors, current sensors, and temperature sensors. The threshold out page is transmitted by the SEND DIAGNOSTIC command. The request for a page using the RECEIVE DIAGNOSTIC RESULTS command with PAGE CODE 05h is defined as the request for a threshold in page.

The format of the threshold out page is shown in table 11. Implementation of this page is optional.

Table 11 – Format of Threshold Out page

Bits Bytes	7	6	5	4	3	2	1	0
0	PAGE CODE (05h)							
1	Reserved							
2	(MSB)	PAGE LENGTH (n-3)						
3								(LSB)
4 - 7	GENERATION CODE							
8 - 11	OVERALL THRESHOLD (first element type)							
12 - 15	ELEMENT THRESHOLD (first element of first element type)							
•••								
(4 bytes)	ELEMENT THRESHOLD (last element of first element type)							
(4 bytes)	OVERALL THRESHOLD (second element type)							
(4 bytes)	ELEMENT THRESHOLD (first element of second element type)							
•••								
n-3 to n	ELEMENT THRESHOLD (last element of last element type)							

GENERATION CODE: The GENERATION CODE field shall have the value expected to be found in the GENERATION CODE field of the configuration page (see 6.1.1). To prevent the misinterpretation of the OVERALL THRESHOLD and ELEMENT THRESHOLD fields, the enclosure services process shall verify that the value of the GENERATION CODE field matches the generation code value known by the enclosure services process. If there is a mismatch, the application client shall be notified that the GENERATION CODE field is invalid by the mechanisms described in 4.1.5 and the enclosure services process shall ignore the remainder of the threshold out page.

OVERALL THRESHOLD: The OVERALL THRESHOLD field for each element type has the same format as the corresponding ELEMENT THRESHOLD field. There is exactly one OVERALL THRESHOLD field for each TYPE DESCRIPTOR HEADER in the configuration page (see table 4). The OVERALL THRESHOLD field provides threshold control for all elements described in the ELEMENT THRESHOLD fields. Threshold values may be applied using either the OVERALL THRESHOLD field or the ELEMENT THRESHOLD field. Except as required by the enclosure services processor, requests in the ELEMENT THRESHOLD field should override requests in the OVERALL THRESHOLD field.

ELEMENT THRESHOLD: Following the OVERALL THRESHOLD field, there shall be one ELEMENT THRESHOLD field for each of the possible elements identified by the NUMBER OF POSSIBLE ELEMENTS field in the corresponding TYPE DESCRIPTOR HEADER. The ELEMENT THRESHOLD field shall contain threshold information for the element.

The OVERALL THRESHOLD field and the ELEMENT THRESHOLD field have the format specified in table 12.

Table 12 – Format for OVERALL THRESHOLD and the ELEMENT THRESHOLD field

Bits Bytes	7	6	5	4	3	2	1	0
0	HIGH CRITICAL THRESHOLD							
1	HIGH WARNING THRESHOLD							
2	LOW WARNING THRESHOLD							
3	LOW CRITICAL THRESHOLD							

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

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

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

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

All threshold fields are advisory. The enclosure services process shall ignore the contents of the threshold field 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 accept the fields transmitted in the overall threshold or the element threshold, may set the actual thresholds to a more appropriate value, or may ignore the contents of any or all of the threshold fields. An OVERALL THRESHOLD field or ELEMENT THRESHOLD field with all four thresholds having a value of zero shall be ignored. Any zero value in a field in an OVERALL THRESHOLD field or ELEMENT THRESHOLD field shall be ignored.

Table 22 of clause 7 lists those element fields that contain fields subject to thresholds and provides references to the clauses that specify the units and meanings of the thresholds. As an example, voltage sensor elements provide a threshold based on the allowable percentage variation in the sensed voltage. The threshold value is defined by 7.2.18 as a percentage of the nominal voltage in units of 0.5%. A HIGH CRITICAL THRESHOLD field value of 14 indicates that a critical condition shall be indicated when the voltage is 7% over the nominal maximum supply voltage, while a LOW WARNING THRESHOLD field value of 10 indicates that a noncritical condition shall be indicated when the voltage is 5% under the nominal minimum supply voltage.

When the value of a sensed parameter increases above the actual high critical threshold value or falls below the actual low critical threshold value, a critical condition is indicated to the application client by one of the mechanisms defined in 4.1.6. For those devices that use CHECK CONDITION to indicate enclosure failures (see 4.1.6.3), 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.

When the value of a sensed parameter increases above the actual high warning threshold value or falls below the actual low warning threshold value, a noncritical condition is indicated to the application client by one of the mechanisms defined in 4.1.6. For those devices that use CHECK CONDITION to indicate enclosure failures (see 4.1.6.3), the command shall be completed and the sense key shall be set to RECOVERED ERROR and the additional sense code shall be set to WARNING - ENCLOSURE DEGRADED.

6.1.8 Threshold In page

The threshold in page is transmitted from the enclosure services process to the application client to report the actual threshold values for those elements that have limit sensing capability, for example voltage sensors, current sensors, and temperature sensors. The threshold in page is transmitted by the RECEIVE DIAGNOSTIC RESULTS command. The transmission of a page using the SEND DIAGNOSTIC command with PAGE CODE 05h is defined as the transmission of a threshold out page.

The format of the threshold in page is shown in table 13. Implementation of this page is optional.

Table 13 – Format of Threshold In page

Bits Bytes	7	6	5	4	3	2	1	0
0	PAGE CODE (05h)							
1	Reserved							
2	(MSB) PAGE LENGTH (n-3) (LSB)							
3								
4 - 7	GENERATION CODE							
8 - 11	OVERALL THRESHOLD (first element type)							
12 - 15	ELEMENT THRESHOLD (first element of first element type)							
•••								
(4 bytes)	ELEMENT THRESHOLD (last element of first element type)							
(4 bytes)	OVERALL THRESHOLD (second element type)							
(4 bytes)	ELEMENT THRESHOLD (first element of second element type)							
•••								
n-3 to n	ELEMENT THRESHOLD (last element of last element type)							

GENERATION CODE: The GENERATION CODE shall have the same value as the GENERATION CODE in the configuration page, described in 6.1.1

OVERALL THRESHOLD: The OVERALL THRESHOLD field for each element type has the same format as the corresponding ELEMENT THRESHOLD field. There is exactly one OVERALL THRESHOLD field for each TYPE DESCRIPTOR HEADER in the configuration page (see table 4). The OVERALL THRESHOLD optionally contains a summary of the threshold values for all of the elements of that type. The OVERALL THRESH-

OLD also may be used to contain the threshold values for those elements whose individual threshold values are not available, but that do have threshold values.

ELEMENT THRESHOLD: Following the OVERALL THRESHOLD field, there shall be one ELEMENT THRESHOLD field for each of the possible elements identified by the NUMBER OF POSSIBLE ELEMENTS field in the corresponding TYPE DESCRIPTOR HEADER. Each ELEMENT THRESHOLD field optionally contains the actual threshold information for the element.

The OVERALL THRESHOLD field and the ELEMENT THRESHOLD field have the format specified in table 14.

Table 14 – Format for OVERALL THRESHOLD and ELEMENT THRESHOLD fields

Bits Bytes	7	6	5	4	3	2	1	0
0	HIGH CRITICAL THRESHOLD							
1	HIGH WARNING THRESHOLD							
2	LOW WARNING THRESHOLD							
3	LOW CRITICAL THRESHOLD							

HIGH CRITICAL THRESHOLD: The HIGH CRITICAL THRESHOLD field indicates the value at which the enclosure shall indicate a critical condition if a higher value is detected by the sensor element. A value of zero indicates that the sensor element does not test a high critical threshold.

HIGH WARNING THRESHOLD: The HIGH WARNING THRESHOLD field indicates the value at which the enclosure shall indicate a noncritical condition if the sensor element detects a value higher than the specified threshold value. A value of zero indicates that the sensor element does not test a high warning threshold.

LOW WARNING THRESHOLD: The LOW WARNING THRESHOLD field indicates the value at which the enclosure shall indicate a noncritical condition if the sensor element detects a value lower than the specified threshold value. A value of zero indicates that the sensor element does not test a low warning threshold.

LOW CRITICAL THRESHOLD: The LOW CRITICAL THRESHOLD field indicates the value at which the enclosure shall indicate a critical condition if the sensor element detects a value lower than the specified threshold value. A value of zero indicates that the sensor element does not test a low critical threshold.

The threshold values represent the values that the enclosure is using at the time the command is executed.

Each 8-bit threshold value shall have the definition specified by the text describing the corresponding element field. As an example, voltage sensor elements measure voltage in units of 10 millivolts. The threshold value is defined by 7.2.18 as a percentage of the nominal voltage in units of 0.5%. A HIGH CRITICAL THRESHOLD field value of 14 indicates that a critical condition shall be indicated when the voltage is 7% over the nominal maximum supply voltage, while a LOW WARNING THRESHOLD field value of 10 indicates that a noncritical condition shall be indicated when the voltage is 5% under the nominal minimum supply voltage.

6.1.9 Array control page

The optional array control page provides control information to the device elements identified by the configuration page. This page sets the indicators and flags associated with each element's membership and status within a storage array. Some information is duplicated in both the enclosure control page’s device elements (see 7.2.2) and the array control page’s device elements (see 7.2.3). In those cases, the state of the device element shall be expressed by the logical ‘OR’ of the two page settings.

The array control page transmits an OVERALL CONTROL field for each TYPE DESCRIPTOR HEADER in the configuration page that defines a device element and an ELEMENT CONTROL field for each of the device elements that have been allowed for by the corresponding NUMBER OF POSSIBLE ELEMENTS field.

Only device elements are included in the array control page. The device elements shall be in the same order as the device elements in the enclosure control page.

The array control page is transmitted by the SEND DIAGNOSTIC command. The request of a page with the RECEIVE DIAGNOSTIC RESULTS command using PAGE CODE 06h is defined as the request for an enclosure services array status page.

Table 15 describes the enclosure services array control page.

Table 15 – Array control page

Bits Bytes	7	6	5	4	3	2	1	0
0	PAGE CODE (06h)							
1	Reserved				INFO	NON-CRIT	CRIT	UNRECOV
2	(MSB) PAGE LENGTH (n-3)							
3	(LSB)							
4-7	GENERATION CODE							
8-11	OVERALL CONTROL (first device element group)							
12-15	ELEMENT CONTROL (first device element of first group)							
•••								
(4 bytes)	ELEMENT CONTROL (last device element of first group)							
(4 bytes)	OVERALL CONTROL (second device element group)							
(4 bytes)	ELEMENT CONTROL (first device element of second group)							
•••								
n-3 to n	ELEMENT CONTROL (last device element of last group)							

The INFO, NON-CRIT, CRIT, and UNRECOV bits are implemented as in the enclosure control page, described in 6.1.2.

GENERATION CODE: The GENERATION CODE field shall have the value expected to be found in the GENERATION CODE field of the configuration page (see 6.1.1). To prevent the misinterpretation of the OVERALL CONTROL and ELEMENT CONTROL fields, the enclosure services process shall verify that the value of the GENERATION CODE field matches the generation code value known by the enclosure services process. If there is a mismatch, the application client shall be notified that the GENERATION CODE field is invalid by the mechanisms described in 4.1.5 and the enclosure services process shall ignore the remainder of the array control page.

OVERALL CONTROL: The OVERALL CONTROL field for each device element has the same format as the corresponding ELEMENT CONTROL field. There is exactly one OVERALL CONTROL field for each device element TYPE DESCRIPTOR HEADER in the configuration page (see table 4). The OVERALL CONTROL field provides control for all device elements described in the ELEMENT CONTROL fields. Control values may be applied using either the OVERALL CONTROL field or the ELEMENT CONTROL field. Except as required by the enclosure services processor, requests in the ELEMENT CONTROL field should override requests in the OVERALL CONTROL field.

ELEMENT CONTROL: Following the OVERALL CONTROL field, there shall be one device ELEMENT CONTROL field for each of the possible device type elements identified by the NUMBER OF POSSIBLE ELEMENTS field in the corresponding TYPE DESCRIPTOR HEADER. Each ELEMENT CONTROL field optionally contains control information for the element. Each ELEMENT CONTROL field has the format specified for array device elements in 7.2.3.

6.1.10 Array status page

The optional enclosure services array status page returns the array elements for the devices resident in the enclosure.

The page reports the state of indicators and flags associated with each device's membership and status within a storage array. Some information is duplicated in both the enclosure status page's device elements (see 7.2.2) and in the array status page's device elements (see 7.2.3). In those cases, the state of the device shall be reported similarly in both pages.

The array status page reports an OVERALL STATUS field for each TYPE DESCRIPTOR HEADER in the configuration page that defines a device element and an ELEMENT STATUS field for each of the device elements that have been allowed for by the corresponding NUMBER OF POSSIBLE ELEMENTS field.

Only device elements are included in the array status page. The device elements shall be in the same order as the device elements in the enclosure status page.

The array status page is read by the RECEIVE DIAGNOSTIC RESULTS command. The transmission of a SEND DIAGNOSTIC command with PAGE CODE 06h is defined as the transmission of an enclosure services array control page.

Table 16 describes the array status page.

Table 16 – Array status page

Bits Bytes	7	6	5	4	3	2	1	0
0	PAGE CODE (06h)							
1	Reserved			INVOP	INFO	NON-CRIT	CRIT	UNRECOV
2	(MSB) PAGE LENGTH (n-3)							
3								(LSB)
4-7	(MSB) GENERATION CODE (LSB)							
8 -11	OVERALL STATUS (first device element group)							
12 - 15	ELEMENT STATUS (first device element of first group)							
•••								
(4 bytes)	ELEMENT STATUS (last device element of first group)							
(4 bytes)	OVERALL STATUS (second device element group)							
(4 bytes)	ELEMENT STATUS (first device element of second group)							
•••								
n-3 to n	ELEMENT STATUS (last device element of last group)							

The INVOP, INFO, NON-CRIT, CRIT, and UNRECOV bits are implemented as in the enclosure status page, described in 6.1.3

GENERATION CODE: The GENERATION CODE shall have the same value as the GENERATION CODE in the configuration page, described in 6.1.1

OVERALL STATUS: The OVERALL STATUS field for each device element has the same format as the corresponding ELEMENT STATUS field. There is exactly one OVERALL STATUS field for each device element TYPE DESCRIPTOR HEADER in the configuration page (see table 4). The OVERALL STATUS optionally indicates a summary of the status for all device elements described in the ELEMENT STATUS fields. The OVERALL STATUS also may be used to indicate the status of those device elements whose individual status is not available, but that do have a measurable overall status.

ELEMENT STATUS: Zero or more ELEMENT STATUS fields are provided immediately after each OVERALL STATUS field. The number of ELEMENT STATUS fields shall be equal to the NUMBER OF POSSIBLE ELEMENTS specified by each device element TYPE DESCRIPTOR HEADER in the configuration page. Each ELEMENT STATUS field optionally indicates the status for the particular device element. The ELEMENT STATUS field format for a device element for the array status page is defined by table 31 and by 7.2.3.

6.1.11 Element descriptor page

The element descriptor page returns a list of variable length fields, one for each element in the enclosure status page. The fields return vendor specific descriptive text for each element. The element descriptor page shall be read by the RECEIVE DIAGNOSTIC RESULTS command. If a PAGE CODE of 07h is transmitted using a SEND DIAGNOSTIC command, the command shall be treated as having an invalid field error (see 4.1.5).

The element descriptor page is optional.

The format of the element descriptor page is shown in table 17.

Table 17 – Element descriptor page

Bits Bytes	7	6	5	4	3	2	1	0
0	PAGE CODE (07h)							
1	Reserved							
2	(MSB) PAGE LENGTH (n-3)							
3	(LSB)							
4-7	(MSB) GENERATION CODE (LSB)							
variable	OVERALL DESCRIPTOR (first element type)							
variable	ELEMENT DESCRIPTOR (first element of first element type)							
•••								
variable	ELEMENT DESCRIPTOR (last element of first element type)							
variable	OVERALL DESCRIPTOR (second element type)							
variable	ELEMENT DESCRIPTOR (first element of second element type)							
•••								
variable	ELEMENT DESCRIPTOR (last element of last element type)							

GENERATION CODE: The GENERATION CODE shall have the same value as the GENERATION CODE in the configuration page, described in 6.1.1

OVERALL DESCRIPTOR: The OVERALL DESCRIPTOR field contains any descriptor information applying to all elements or describing elements that have no individual descriptor information. The format of the OVERALL DESCRIPTOR field is defined in table 18.

ELEMENT DESCRIPTOR: Following the OVERALL DESCRIPTOR field, there shall be one ELEMENT DESCRIPTOR field for each of the possible device type elements identified by the NUMBER OF POSSIBLE ELEMENTS field in the corresponding TYPE DESCRIPTOR HEADER. Each ELEMENT DESCRIPTOR field contains the descriptive information for the element. The format of the ELEMENT DESCRIPTOR field is defined in table 18.

The format of the OVERALL DESCRIPTOR and the ELEMENT DESCRIPTOR is shown in table 18.

Table 18 – Format of OVERALL DESCRIPTOR and ELEMENT DESCRIPTOR

Bytes \ Bits	7	6	5	4	3	2	1	0
0	Reserved							
1	Reserved							
2	(LSB) DESCRIPTOR LENGTH (n-3)							
3								(MSB)
4 to n	DESCRIPTOR							

DESCRIPTOR LENGTH: The DESCRIPTOR LENGTH field indicates the length of the descriptor field in bytes. A DESCRIPTOR LENGTH of zero indicates that no DESCRIPTOR field is contained in the OVERALL DESCRIPTOR or ELEMENT DESCRIPTOR.

DESCRIPTOR : The DESCRIPTOR field contains vendor specific information for the element. The information shall use ASCII characters and shall not be modified by the language element.

6.1.12 Short enclosure status page

Some enclosure processors are not capable of reporting any enclosure service page except the short status page. Such enclosure processors shall return only the short status page, regardless of the enclosure services page requested. It shall not be an error to respond with a short status page when another enclosure services page has been requested by a RECEIVE DIAGNOSTIC RESULTS command.

A SEND DIAGNOSTIC command transmitting an enclosure control, array control, string out, or threshold out page to an enclosure services process that reports the short enclosure status page shall be terminated with a CHECK CONDITION status. The sense key shall be set to NOT READY and the additional sense code shall be set to UNSPECIFIED ENCLOSURE SERVICES FAILURE or UNSUPPORTED ENCLOSURE FUNCTION.

The format of the short enclosure status page is shown in table 19.

Table 19 – Short enclosure status page

Bytes \ Bits	7	6	5	4	3	2	1	0
0	PAGE CODE (08h)							
1	VENDOR SPECIFIC							
2	(MSB) PAGE LENGTH (0)							
3								(LSB)

VENDOR SPECIFIC: The VENDOR SPECIFIC field shall contain the vendor specific status to be transferred from the enclosure services process to the application client.

6.2 Parameters for enclosure services devices

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

6.2.1 Mode parameters

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.

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

The DEVICE SPECIFIC PARAMETER field is contained in the mode parameter header (see SPC). 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). Enclosure services devices have no BLOCK DESCRIPTOR field. For enclosure services devices, the BLOCK DESCRIPTOR LENGTH shall be 0.

The mode page codes for enclosure services devices are shown in table 20.

Table 20 – Mode Page Codes for enclosure services devices

Page Code	Description	Reference
0Ah	Disconnect-reconnect mode page	SPC
14h	Enclosure services management page	6.2.2
1Ch	Informational exceptions control page	SPC

6.2.2 Enclosure services management page.

The optional enclosure services management page provides controls over those features involving communication with an enclosure services device. If the enclosure services management page is not implemented, the enclosure services device shall not implement the timed completion function.

The page code selected for the enclosure services management page overlaps with the medium partition 04h page defined for tape drives, as shown in SPC. An SES device shall not be embedded in a tape drive. Tape drives shall not use the timed completion function specified by the enclosure services management page. Devices other than enclosure services devices and tape devices may implement this page and use the timed completion function if their interface to the enclosure services process allows this capability.

When a REQUEST DIAGNOSTIC RESULTS command is transmitted to a device server that supports enclosure services and the ENBLTC bit has been set, the device server may wait up to the time specified by the MAXIMUM TASK COMPLETION TIME field before returning the appropriate parameter page. The device server shall only perform this delay operation for enclosure status pages and array status pages. If a noncritical, critical, or unrecoverable condition exists or occurs during the waiting period, the device server shall report the event by returning the requested status page as soon as possible.

The format of the enclosure services management page is shown in table 21.

Table 21 – Enclosure services management page

Bits Bytes	7	6	5	4	3	2	1	0
0	PS	Rsrvd	PAGE CODE (14h)					
1	PAGE LENGTH (06h)							
2	Reserved							
3	Reserved							
4	Reserved							
5	Reserved							ENBLTC
6	(MSB) MAXIMUM TASK COMPLETION TIME							
7								(LSB)

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

PAGE CODE: The PAGE CODE field is defined in SPC. The PAGE CODE field shall have a value of 14h for the enclosure services management page.

PAGE LENGTH: The PAGE LENGTH field is defined in SPC. The PAGE LENGTH field shall have a value of 06h for the enclosure services management page.

ENBLTC: The enable timed completion bit (ENBLTC) indicates whether the timed completion function is enabled or disabled. If the ENBLTC bit is set, the device server shall enable the timed completion function. If the ENBLTC bit is cleared, the device server shall disable the timed completion function.

MAXIMUM TASK COMPLETION TIME: The MAXIMUM TASK COMPLETION TIME field indicates the maximum time that a device server may choose to wait before completing the SCSI task. The timing of the wait period shall begin when the transmission of REQUEST DIAGNOSTIC RESULTS command to the device server is complete. The completion of the SCSI task includes the transfer of the enclosure status or array status 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 SCSI target, including reconnection overheads, congestion latency, and protocol timeouts. The value is specified in units of 100 milliseconds. A value of zero specifies a vendor specific MAXIMUM TASK COMPLETION TIME, which may be infinite.

7 Element definitions

This clause contains the format definitions for the OVERALL CONTROL, ELEMENT CONTROL, OVERALL STATUS, and ELEMENT STATUS fields. The field formats generally are different for different element types. Field format definitions common to all element types and specific to different element types are contained in this clause. The definition of the OVERALL THRESHOLD and ELEMENT THRESHOLD fields are defined for those elements supporting threshold values.

Table 22 lists the elements and their ELEMENT TYPE codes. The table additionally indicates which elements accept the DISABLE bit (See 7.1.1) and which elements contain a value subject to comparison with a threshold.

Table 22 – Element type codes

Type Code	Type of element	DISABLE bit reference	Threshold	Reference
00h	Unspecified	not defined	none	7.2.1
01h	Device	not defined	none	7.2.2, 7.2.3
02h	Power supply	not defined	none	7.2.4
03h	Cooling element	not defined	none	7.2.5
04h	Temperature sensors	7.2.6	temperature	7.2.6
05h	Door lock	not defined	none	7.2.7
06h	Audible alarm	not defined	none	7.2.8
07h	Enclosure services controller electronics	not defined	none	7.2.9
08h	SCC controller electronics	not defined	none	7.2.10
09h	Nonvolatile cache	not defined	none	7.2.11
0Ah	Reserved	reserved	reserved	
0Bh	Uninterruptible power supply	not defined	battery status	7.2.12
0Ch	Display	not defined	none	7.2.13
0Dh	Key pad entry device	not defined	none	7.2.14
0Eh	Reserved	reserved	reserved	
0Fh	SCSI port/transceiver	not defined	none	7.2.15
10h	Language	not defined	none	7.2.16
11h	Communication port	not defined	none	7.2.17
12h	Voltage sensor	7.2.18	% voltage	7.2.18
13h	Current sensor	7.2.19	% current	7.2.19
14h	SCSI target port	not defined	none	7.2.20
15h	SCSI initiator port	not defined	none	7.2.21
16h	Simple sub-enclosure	not defined	none	7.2.22
17-7Fh	Reserved	reserved	reserved	
80h-FFh	Vendor-specific codes	VS	VS	

7.1 Formats for status and control fields

These clauses specify the general format for ELEMENT CONTROL and OVERALL CONTROL fields and for ELEMENT STATUS and OVERALL STATUS fields.

Unless otherwise specified, all status and control bits are optional. The enclosure is not required to return any optional status bit to the application client. The enclosure is not required to act on any optional control bit. All control bits are advisory and may be ignored or overridden to maintain a proper operating environment in the enclosure.

7.1.1 Format for all control fields

The format for the control field for all element types is shown in table 23.

Table 23 – Format of ELEMENT CONTROL and OVERALL CONTROL fields

Bits Bytes	7	6	5	4	3	2	1	0
0	COMMON CONTROL							
	SELECT	PRDFAIL	DISABLE	RST SWAP	Reserved			
1-3	CONTROL INFORMATION							

COMMON CONTROL: The COMMON CONTROL field contains those bits that may be used by any OVERALL CONTROL or ELEMENT CONTROL field. The bits of the COMMON CONTROL field, SELECT, PRDFAIL, DISABLE, and RST SWAP, are defined below.

SELECT: If the SELECT bit is set, the enclosure services process should perform the control functions defined by the other bits in the OVERALL CONTROL or ELEMENT CONTROL field. If the SELECT bit is cleared, the enclosure services process shall ignore all other bits in the OVERALL CONTROL or ELEMENT CONTROL field. The SELECT bit allows individual elements to be selected for the execution of control operations.

PRDFAIL: The predicted failure bit (PRDFAIL) shall be set to indicate that the application client wants to set the predicted failure state indicator for the element. The PRDFAIL bit shall be cleared to indicate that the application client wants to clear the predicted failure state indicator for the element. The element is not required to implement the PRDFAIL bit or the predicted failure state indicator.

DISABLE: The DISABLE bit shall be set to indicate that the application client wants to disable this element. The DISABLE bit shall be cleared to indicate that the application client wants 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 that implements the bit in the clause referenced in table 22.

RST SWAP: The reset swap bit (RST SWAP) is set to clear the SWAP bit one time if the SWAP bit is set. If the RST SWAP bit is cleared, the SWAP bit shall not be changed.

CONTROL INFORMATION: The CONTROL INFORMATION field is defined for each element type in 7.2. Control information containing conflicting bits may cause unpredictable behavior or may cause the enclosure services process to set the INVOP bit to the application client. (See 6.1.3).

7.1.2 Format for all status fields

The format for the status field for all element types is shown in table 24.

Table 24 – Format of ELEMENT STATUS and OVERALL STATUS fields

Bits Bytes	7	6	5	4	3	2	1	0
0	COMMON STATUS							
	Resrvd	PRDFAIL	Rsrved	SWAP	STATUS CODE			
1-3	STATUS INFORMATION							

COMMON STATUS: The COMMON STATUS field contains those bits that may be returned by any OVERALL STATUS or ELEMENT STATUS field. The bits of the COMMON STATUS field, PRDFAIL, SWAP, and STATUS CODE, are defined below.

PRDFAIL: The predicted failure bit (PRDFAIL), when set, indicates that this element of the enclosure 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 field. The PRDFAIL bit, when cleared, indicates that the predicted failure state is not set or that the predicted failure function is not implemented.

SWAP: The SWAP bit is set to indicate an element has been removed and the same or another element has been inserted in the same location since the last time the RST SWAP control bit was set in the corresponding COMMON CONTROL field. The SWAP bit is cleared when the RST SWAP control bit is set and remains cleared until a device has been both removed and inserted in the device slot. The SWAP bit provides an indication that an element's properties may have been changed without any change of configuration.

STATUS CODE: The STATUS CODE values and the definition of the STATUS CODE values are shown in table 25. The STATUS CODE values apply to ELEMENT STATUS fields. OVERALL STATUS fields shall have a STATUS CODE of 00h (Unsupported).

Table 25 – Table of STATUS CODE values

Status Code	Name	Condition	Mandatory Optional
00h	Unsupported	Status detection is not implemented for this element.	Optional
01h	OK	Element is installed and no error conditions are known.	Mandatory
02h	Critical	Critical condition is detected.	Optional
03h	Noncritical	Noncritical condition is detected.	Optional
04h	Unrecoverable	Unrecoverable condition is detected.	Optional
05h	Not installed	Element is not installed in enclosure.	Mandatory
06h	Unknown	Sensor has failed or element status is not available.	Optional
07h	Not Available	Element installed, no known errors, but the element has not been turned on or set into operation.	Optional
08 - 0Fh	Reserved	Reserved	Reserved

STATUS INFORMATION: The STATUS INFORMATION field is defined for each element type in 7.2.

7.2 Field definitions for all element types

7.2.1 Unspecified element type

The format of the CONTROL INFORMATION field for the unspecified element type is shown in table 26.

Table 26 – Unspecified element for enclosure control pages

Bits Bytes	7	6	5	4	3	2	1	0
0	COMMON CONTROL							
1-3	Reserved							

The format of the STATUS INFORMATION field for an unspecified element type is shown in table 27.

Table 27 – Unspecified element for enclosure status pages

Bits Bytes	7	6	5	4	3	2	1	0
0	COMMON STATUS							
1-3	Reserved							

7.2.2 Device element defined for enclosure pages

The format of the CONTROL INFORMATION field for a device element type in the enclosure control page is defined in table 28.

Table 28 – Device element for enclosure control page

Bits Bytes	7	6	5	4	3	2	1	0
0	COMMON CONTROL							
1	Reserved							
2	Rsrvd	DO NOT REMOVE	Reserved		RQST INSERT	RQST REMOVE	RQST IDENT	Rsrvd
3	Reserved		RQST FAULT	DEVICE OFF	ENABLE BYP A	ENABLE BYP B	Reserved	

DO NOT REMOVE: The DO NOT REMOVE bit is set to request the device not be removed. When the DO NOT REMOVE bit is cleared, the device may be removed. The DO NOT REMOVE bit may control mechanical interlocks or visual indications that the device should not be removed.

RQST INSERT: The request insert bit (RQST INSERT) is set to request that the device slot be prepared for the insertion of a device. When the RQST INSERT bit is cleared, the device slot takes 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.

RQST REMOVE: The request removal bit (RQST REMOVE) is set to request that the device slot be prepared for the removal of a device. When the RQST REMOVE bit is cleared, the device slot takes 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.

RQST IDENT: The request identify bit (RQST IDENT) is set to request that the device slot be identified by a visual indication. When the RQST IDENT bit is cleared, the visual indication is not present.

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

DEVICE OFF: The DEVICE OFF bit is set to request that the device be turned off. When the DEVICE OFF bit is cleared, the device may turn on if all other prerequisites are met.

ENABLE BYP A: The enable bypass A bit (ENABLE BYP A) is set to request that port A for that device be bypassed. When the ENABLE BYP A bit is cleared and 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.

ENABLE BYP B: The enable bypass B bit (ENABLE BYP B) is set to request that port B for that device be bypassed. When the ENABLE BYP B bit is cleared and 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.

The format of the STATUS INFORMATION field for a device element type in the enclosure status page is defined in table 29.

Table 29 – Device element for enclosure status page

Bits Bytes	7	6	5	4	3	2	1	0
0	COMMON STATUS							
1	SLOT ADDRESS							
2	Rsrvd	DO NOT REMOVE	Reserved		READY TO INSERT	RMV	IDENT	REPORT
3	Rsrvd	FAULT SENSED	FAULT REQSTD	DEVICE OFF	ENABLE BYP A	ENABLE BYP B	BYP A ENBLED	BYP B ENBLED

SLOT ADDRESS: For the element status field, the SLOT ADDRESS field is set to the value of the SCSI target address defined for the device slot.

For the OVERALL STATUS field, the SLOT ADDRESS field is vendor specific.

DO NOT REMOVE: The DO NOT REMOVE bit is set to indicate that the corresponding control bit has been set. The DO NOT REMOVE bit is cleared to indicate that the corresponding control bit has been cleared or has not been implemented. If the DO NOT REMOVE bit is set, it indicates that mechanical interlocks or visual signals are present and activated to indicate that a device should not be removed. If the DO NOT REMOVE bit is cleared, it indicates that mechanical interlocks or visual signals are not present or not activated, indicating that a device may be removed.

READY TO INSERT: The READY TO INSERT bit is set to indicate that the device slot has been prepared for the insertion of a device. The READY TO INSERT bit is cleared if the device slot is unable to accept the insertion of a device or if the RQST INSERT control bit is not implemented.

RMV: The remove bit (RMV) is set to indicate that the device slot has been prepared for the removal of a device. The RMV bit is cleared if the device cannot be removed from the device slot or if the RQST REMOVE control bit is not implemented.

IDENT: The identify bit (IDENT) is set to indicate that the RQST IDENT control bit has been set and that the device is providing a visual indication of its location. The IDENT bit is cleared when the RQST IDENT control bit is cleared or not implemented.

REPORT: The REPORT bit is set to indicate that the enclosure status page is being transferred through the device described by this ELEMENT STATUS field. The REPORT bit is cleared if the enclosure status page is being transferred through another device or through an enclosure services device.

FAULT SENSED: The FAULT SENSED bit is set to indicate that the enclosure or device has detected a fault condition and may be displaying a visual indication of the fault condition. The FAULT SENSED bit is cleared to indicate that there is no fault condition detected by the device or enclosure.

FAULT REQSTD: The fault requested bit (FAULT REQSTD) is set to indicate that the RQST FAULT control bit has requested that the device slot be identified by a visual fault indication. The FAULT REQSTD bit is cleared when the RQST FAULT control bit has been cleared or if the RQST FAULT control bit is not implemented.

DEVICE OFF: The DEVICE OFF bit is set to indicate that the device is turned off. The DEVICE OFF bit is cleared to indicate that the device is turned on.

ENABLE BYP A: The enable bypass A bit (ENABLE BYP A) is set to indicate that Port A has been bypassed by request of the application client, the device, or the enclosure. The ENABLE BYP A bit is cleared if the port bypass is disabled and the device is included on the device interface.

ENABLE BYP B: The enable bypass B bit (ENABLE BYP B) is set to indicate that Port B has been bypassed by request of the application client, the device, or the enclosure. The ENABLE BYP B bit is cleared if the port bypass is disabled and the device is included on the device interface.

BYP A ENABLED: The bypass A enabled bit (BYP A ENABLED) is set to indicate that port A of the device is bypassed under control of the device. The device may be removed, turned off, not operational, or controlling the bypass signals under control of the device server. The BYP A ENABLED bit is cleared to indicate that Port A is not being bypassed under control of the device. The device may still be bypassed under control of the enclosure services process.

BYP B ENABLED: The bypass B enabled bit (BYP B ENABLED) is set to indicate that port B of the device is bypassed under control of the device. The device may be removed, turned off, not operational, or controlling the bypass signals under control of the device server. The BYP B ENABLED bit is cleared to indicate that Port B is not being bypassed under control of the device. The device may still be bypassed under control of the enclosure services process.

7.2.3 Device element defined for array pages

The device element for the array control page and the array status page contains information related to the device's use in a storage array. Those fields and bits common to the device element for the device enclosure control page shall have effect if they are set by either the enclosure control page or the array control page. The mapping between the visual indicators associated with the array control page and the requests to set those indicators is vendor specific.

The format of the CONTROL INFORMATION field for a device element in the array control page is defined in table 30.

Table 30 – Device element for array control page

Bits Bytes	7	6	5	4	3	2	1	0
0	COMMON CONTROL							
1	RQST OK	RQST RSRVD DEVICE	RQST HOT SPARE	RQST CONS CHECK	RQST IN CRIT ARRAY	RQST IN FAILED ARRAY	RQST REBUILD/ REMAP	RQST R/R ABORT
2	Rsrvd	DO NOT REMOVE	Reserved			RQST REMOVE	RQST IDENT	Rsrvd
3	Reserved				ENABLE BYP A	ENABLE BYP B	Reserved	

RQST OK: The request OK bit (RQST OK) is set to request the visual indicator that the device is okay be turned on. The RQST OK bit is cleared to request the visual indicator be turned off.

RQST RESERVED DEVICE: The request reserved device bit (RQST RSRVD DEVICE) is set to request the visual indicator that the device is reserved be turned on. The RQST RSRVD DEVICE bit is cleared to request that the visual indicator be turned off.

RQST HOT SPARE: The request hot spare bit (RQST HOT SPARE) is set to request the visual indicator that the device is assigned as a hot spare be turned on. The RQST HOT SPARE bit is cleared to request that the visual indicator be turned off.

RQST CONS CHECK: The request consistency check in progress bit (RQST CONS CHECK) is set to request the visual indicator that the device is participating in an array consistency check activity be turned on. The RQST CONS CHECK bit is cleared to request that the visual indicator be turned off.

RQST IN CRIT ARRAY: The request in critical array bit (RQST IN CRIT ARRAY) is set to request the visual indicator that the device is participating in an array which would be degraded or become unavailable if the device were removed be turned on. The RQST IN CRIT ARRAY bit is cleared to request that the visual indicator be turned off.

RQST IN FAILED ARRAY: The request in failed array bit (RQST IN FAILED ARRAY) is set to request the visual indicator that the device is a member of an array that has failed be turned on. The RQST IN FAILED ARRAY bit is cleared to request the visual indicator be turned off.

RQST REBUILD/REMAP: The request rebuild/remap bit (RQST REBUILD/REMAP) is set to request the visual indicator that the device is participating in a rebuild or remap of the array contents be turned on. The RQST REBUILD/REMAP bit is cleared to request the visual indicator be turned off.

RQST R/R ABORT: The request rebuild/remap aborted bit (RQST R/R ABORT) is set to request the visual indicator that a rebuild or remap of the array contents has been unsuccessfully terminated be turned on. The RQST R/R ABORT bit is cleared to request that the visual indicator be turned off.

DO NOT REMOVE: The DO NOT REMOVE bit is set to request the device not be removed. When the DO NOT REMOVE bit is cleared, the device may be removed. The DO NOT REMOVE bit may control mechanical interlocks or visual indications the device should not be removed.

RQST REMOVE: The request removal bit (RQST REMOVE) is set to request that the device slot be prepared for the removal of a device. When the bit is cleared, the device slot takes no action to prepare for the removal of a device. The RQST REMOVE bit may control mechanical interlocks or visual indications that a device may be removed from the device slot.

RQST IDENT: The request identify bit (RQST IDENT) is set to request that the device slot be identified by a visual indication. When the RQST IDENT bit is cleared, the visual indication is not present.

ENABLE BYP A: The enable bypass A bit (ENABLE BYP A) is set to request that port A for that device be bypassed. When the ENABLE BYP A bit is cleared and 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.

ENABLE BYP B: The enable bypass B bit (ENABLE BYP B) is set to request that port B for that device be bypassed. When the ENABLE BYP B bit is cleared and 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.

The format of the status information field for a device element type in the array status page is defined in table 31.

Table 31 – Device element for array status page

Bits Bytes	7	6	5	4	3	2	1	0
0	COMMON STATUS							
1	ok	RSRVD DEVICE	HOT SPARE	CONS CHK	IN CRIT ARRAY	IN FAILED ARRAY	REBUILD /REMAP	R/R ABORT
2	Rsrvd	DO NOT REMOVE	Reserved			RMV	IDENT	Rsrvd
3	Reserved				ENABLE BYP A	ENABLE BYP B	BYP A ENABLED	BYP B ENABLED

OK: The OK bit is set to indicate the visual indicator that the device is okay is turned on. The OK bit is cleared to indicate the visual indicator is turned off.

RSRVD DEVICE: The reserved device bit (RSRVD DEVICE) is set to indicate the visual indicator that the device is reserved is turned on. The RSRVD DEVICE bit is cleared to indicate the visual indicator is turned off.

HOT SPARE: The HOT SPARE bit is set to indicate the visual indicator that the device is assigned as a hot spare is turned on. The HOT SPARE bit is cleared to indicate that the visual indicator is turned off.

CONS CHECK: The consistency check in progress bit (CONS CHECK) is set to indicate the visual indicator that the device is participating in an array consistency check activity is turned on. The CONS CHECK bit is cleared to indicate that the visual indicator is turned off.

IN CRIT ARRAY: The in critical array bit (IN CRIT ARRAY) is set to indicate the visual indicator that the device is participating in an array which would be degraded or become unavailable if the device were removed is turned on. The IN CRIT ARRAY bit is cleared to request that the visual indicator be turned off.

IN FAILED ARRAY: The IN FAILED ARRAY bit is set to indicate the visual indicator that the device is a member of an array that has failed is turned on. The IN FAILED ARRAY bit is cleared to indicate that the visual indicator is turned off.

REBUILD/REMAP: The REBUILD/REMAP bit is set to indicate the visual indicator that the device is participating in a rebuild or remap of the array contents is turned on. The REBUILD/REMAP bit is cleared to indicate that the visual indicator is turned off.

R/R ABORT: The rebuild/remap abort bit (R/R ABORT) is set to indicate the visual indicator that a rebuild or remap of the array contents has been unsuccessfully terminated is turned on. The R/R ABORT bit is cleared to indicate that the visual indicator is turned off.

DO NOT REMOVE: The DO NOT REMOVE bit is set to indicate that the corresponding control bit has been set. The DO NOT REMOVE bit is cleared to indicate that the corresponding control bit has been cleared or has not been implemented. If the DO NOT REMOVE bit is set, it indicates that mechanical interlocks or visual signals are present and activated to indicate that a device should not be removed. If the DO

NOT REMOVE bit is cleared, it indicates that mechanical interlocks or visual signals are not present or not activated, indicating that a device may be removed.

RMV: The remove bit (RMV) is set to indicate that the device slot has been prepared for the removal of a device. The RMV bit is cleared if the device cannot be removed from the device slot or if the RQST REMOVE control bit is not implemented.

IDENT: The identify bit (IDENT) is set to indicate that the RQST IDENT control bit has been set and that the device is providing a visual indication of its location. The IDENT bit is cleared when the RQST IDENT control bit is cleared or not implemented.

ENABLE BYP A: The enable bypass A bit (ENABLE BYP A) is set to indicate that Port A has been bypassed by request of the application client, the device, or the enclosure. The ENABLE BYP A bit is cleared if the port bypass is disabled and the device is included on the device interface.

ENABLE BYP B: The enable bypass B bit (ENABLE BYP B) is set to indicate that Port B has been bypassed by request of the application client, the device, or the enclosure. The ENABLE BYP B bit is cleared if the port bypass is disabled and the device is included on the device interface.

BYP A ENABLED: The bypass A enabled bit (BYP A ENABLED) is set to indicate that port A of the device is bypassed under control of the device. The device may be removed, turned off, not operational, or controlling the bypass signals under control of the device server. The BYP A ENABLED bit is cleared to indicate that Port A is not being bypassed under control of the device. The device may still be bypassed under control of the enclosure services process.

BYP B ENABLED: The bypass B enabled bit (BYP B ENABLED) is set to indicate that port B of the device is bypassed under control of the device. The device may be removed, turned off, not operational, or controlling the bypass signals under control of the device server. The BYP B ENABLED bit is cleared to indicate that Port B is not being bypassed under control of the device. The device may still be bypassed under control of the enclosure services process.

7.2.4 Power supply element

The format of the CONTROL INFORMATION field for a power supply element is defined in table 32.

Table 32 – power supply element for enclosure control page

Bits Bytes	7	6	5	4	3	2	1	0
0	COMMON CONTROL							
1 - 2	Reserved							
3	Rsrvd	RQST FAIL	RQST ON	Reserved				

RQST FAIL: The request failure indication bit (RQST FAIL) is set to request that the power supply be identified by a visual indication that a failure is present. When the RQST FAIL bit is cleared, the failure indication may be turned off if the indication is not also being set by the power supply or the enclosure services process. Some failure indications in the STATUS INFORMATION field are latched. Setting the RQST FAIL bit and clearing it again shall reset any latched failure indications.

RQST ON: The request power supply on bit (RQST ON) is set to request that the power supply be turned on or remain on. When the RQST ON bit is cleared, the power supply is requested to turn off or remain off.

The format of the STATUS INFORMATION field for a power supply element is defined in table 33.

Table 33 – Power Supply element for enclosure status pages

Bits Bytes	7	6	5	4	3	2	1	0
0	COMMON STATUS							
1	Reserved							
2	Reserved				DC OVER-VOLTAGE	DC UNDER-VOLTAGE	DC OVER-CURRENT	Rsrvd
3	Rsrvd	FAIL	RQSTED ON	OFF	OVRTMP FAIL	TEMP WARN	AC FAIL	DC FAIL

DC OVERVOLTAGE: The DC OVERVOLTAGE bit is set to indicate an overvoltage condition has been detected at the power supply output. The DC OVERVOLTAGE bit is cleared by setting and clearing the RQST FAIL control bit or by a power on reset.

DC UNDERVOLTAGE: The DC UNDERVOLTAGE bit is set to indicate an undervoltage condition has been detected at the power supply output. The DC UNDERVOLTAGE bit is cleared by setting and clearing the RQST FAIL control bit or by a power on reset.

DC OVERCURRENT: The DC OVERCURRENT bit is set to indicate an overcurrent condition has been detected at the power supply output. The DC OVERCURRENT bit is cleared by setting and clearing the RQST FAIL control bit or by a power on reset.

FAIL : The FAIL bit is set to indicate that the failure indication is on or has been set on. If there are no additional failures detected by the enclosure, clearing the RQST FAIL control bit shall clear the FAIL bit.

RQSTED ON: The requested on bit (RQSTED ON) is set to indicate that the power supply has been manually turned on or has been requested to turn on by setting the RQST ON control bit. The RQSTED ON bit is cleared when the RQST ON control bit is cleared.

OFF : The OFF bit is set to indicate the power supply is not providing power. The OFF bit shall be set if the RQST ON control bit is cleared to request the power supply be turned off. The OFF bit shall be set if the power supply is turned off manually. The OFF bit shall be set if a failure has caused the power supply to stop providing power. The OFF bit shall be cleared when the power supply is providing its specified output.

OVERTMP FAIL: The overtemperature failure bit (OVERTMP FAIL) is set to indicate the power supply has detected a temperature higher than a safe operating temperature. The power supply may shut down. The OVERTMP FAIL bit is cleared by setting and clearing the RQST FAIL control bit or by a power on reset.

TEMP WARN: The overtemperature warning bit (TEMP WARN) is set to indicate the power supply has detected a temperature that is safe, but higher than normal operating temperature. The TEMP WARN bit is cleared when normal operating temperature is again detected.

AC FAIL: The AC FAIL bit is set to indicate that the power supply is not receiving the specified AC power. The AC FAIL bit is cleared when normal AC power is being received.

DC FAIL: The DC FAIL bit is set to indicate that the power supply is unable to supply the specified DC power. The DC FAIL bit is cleared when normal DC power is being provided.

7.2.5 Cooling element

Cooling elements include fans, blowers, and other cooling mechanisms. The format of the CONTROL INFORMATION field for a cooling element is defined in table 34.

Table 34 – Cooling element for enclosure control pages

Bits Bytes	7	6	5	4	3	2	1	0
0	COMMON CONTROL							
1 - 2	Reserved							
3	Rsrvd	RQST FAIL	RQST ON	Reserved		REQUESTED SPEED CODE		

RQST FAIL: The request failure indication bit (RQST FAIL) is set to request that the cooling element be identified by a visual indication that a failure is present. When the RQST FAIL bit is cleared, the failure indication may be turned off if the indication is not also being set by the enclosure services process.

RQST ON: The request cooling element on bit (RQST ON) is set to request that the cooling element be turned on or remain on. When the RQST ON bit is cleared, the cooling element is requested to turn off or remain off.

REQUESTED SPEED CODE: The REQUESTED SPEED CODE field is set to indicate the requested speed or rate of cooling of the fan or cooling device, as specified in table 35.

Table 35 – REQUESTED SPEED CODE values

Speed Code	Description
000b	Reserved
001b	Fan at lowest speed
010b	Fan at second lowest speed
011b	Fan at speed 3
100b	Fan at speed 4
101b	Fan at speed 5
110b	Fan at intermediate speed
111b	Fan at highest speed

The format of the STATUS INFORMATION field for a cooling element is defined in table 36.

Table 36 – Cooling element for enclosure status pages

Bits Bytes	7	6	5	4	3	2	1	0
0	COMMON STATUS							
1 - 2	Reserved							
3	Rsrvd	FAIL	RQSTED ON	OFF	Rsrvd	ACTUAL SPEED CODE		

FAIL : The FAIL bit is set to indicate that the failure indication is on or has been set on. If there are no additional failures detected by the enclosure, clearing the RQST FAIL control bit shall clear the FAIL bit.

RQSTED ON: The requested on bit (RQSTED ON) is set to indicate that the cooling element has been manually turned on or has been requested to turn on by setting the RQST ON control bit. The RQSTED ON bit is cleared when the RQST ON control bit is cleared.

OFF : The OFF bit is set to indicate the cooling element is not providing cooling. The OFF bit shall be set if the RQST ON control bit is cleared to request the cooling element be turned off. The OFF bit shall be set if the cooling element is turned off manually. The OFF bit shall be set if a failure has caused the cooling element to stop operating. The OFF bit shall be cleared when the cooling element is operating.

ACTUAL SPEED CODE: The ACTUAL SPEED CODE field indicates the actual speed or rate of cooling of the fan or cooling device, as defined in table 37.

Table 37 – ACTUAL SPEED CODE values

Speed Code	Description
000b	Fan stopped
001b	Fan at lowest speed
010b	Fan at second lowest speed
011b	Fan at speed 3
100b	Fan at speed 4
101b	Fan at speed 5
110b	Fan at intermediate speed
111b	Fan at highest speed

7.2.6 Temperature sensor element

The temperature sensor element provides temperature indications to the application client. The temperature values may be compared with values that correspond to over temperature and under temperature failures and warnings.

If variable threshold values are implemented, the optional threshold page may be used to override default temperature threshold values. (See 6.1.7). The threshold field for temperature sensor elements shall have the same format and units as the TEMPERATURE field.

When the DISABLE bit (see 7.1.1) is set, the temperature sensor's output is not tested against any threshold values and no noncritical, critical, or unrecoverable conditions are indicated because of the temperature values sensed. When the DISABLE bit is cleared, the temperature sensor's output is accepted normally by the enclosure services process.

The format of the CONTROL INFORMATION field for a temperature sensor element is defined in table 38.

Table 38 – Temperature sensor element for enclosure control pages

Bits Bytes	7	6	5	4	3	2	1	0
0	COMMON CONTROL							
1-3	Reserved							

The format of the STATUS INFORMATION field for a temperature sensor element is defined in table 39.

Table 39 – Temperature sensor element for enclosure status pages

Bits Bytes	7	6	5	4	3	2	1	0
0	COMMON STATUS							
1	Reserved							
2	TEMPERATURE							
3	Reserved				OT FAILURE	OT WARNING	UT FAILURE	UT WARNING

TEMPERATURE : The value in the TEMPERATURE field shall indicate the temperature at the sensor in degrees Celsius, offset by +20 degrees. The range of the value expresses a temperature between -19 and + 245 degrees Celsius. The value of 0 is reserved. Thresholds may be set for the temperature element. The threshold value uses the same units and format.

OT FAILURE: The overtemperature failure bit (OT FAILURE) is set to indicate the enclosure services process has detected a temperature higher than a safe operating temperature or higher than the value indicated by the threshold in page HIGH CRITICAL THRESHOLD field. The OT FAILURE bit is cleared when the temperature falls to a safe operating temperature or below the value specified by the HIGH CRITICAL THRESHOLD field.

OT WARNING: The overtemperature warning bit (OT WARNING) is set to indicate the enclosure services process has detected a temperature higher than a normal operating temperature or higher than the value indicated by the threshold in page HIGH WARNING THRESHOLD field. The OT WARNING bit is cleared when the temperature falls within the normal operating limits or below the value specified by the HIGH WARNING THRESHOLD field.

UT FAILURE: The undertemperature failure bit (UT FAILURE) is set to indicate the enclosure services process has detected a temperature lower than a safe operating temperature or lower than the value indicated by the threshold in page LOW CRITICAL THRESHOLD field. The UT FAILURE bit is cleared when the temperature rises to a safe operating temperature or the above the value specified by the LOW CRITICAL THRESHOLD field.

UT WARNING: The undertemperature warning bit (UT WARNING) is set to indicate the enclosure services process has detected a temperature lower than a normal operating temperature or lower than the value indicated by the threshold in page LOW WARNING THRESHOLD field. The UT WARNING bit is cleared when the temperature rises within the normal operating limits or above the value specified by the LOW WARNING THRESHOLD field.

7.2.7 Door lock element

The format of the CONTROL INFORMATION field for a door lock element is defined in table 40.

Table 40 – Door lock element for enclosure control pages

Bits Bytes	7	6	5	4	3	2	1	0
0	COMMON CONTROL							
1 - 2	Reserved							
3	Reserved							UNLOCK

UNLOCK: The UNLOCK bit is set to request that the door latch be unlocked or remain unlocked. The UNLOCK bit is cleared to request that the door latch be locked or remain locked.

The format of the STATUS INFORMATION field for a door lock element is defined in table 41.

Table 41 – Door lock element for enclosure status pages

Bits Bytes	7	6	5	4	3	2	1	0
0	COMMON STATUS							
1 - 2	Reserved							
3	Reserved							UNLOCKED

UNLOCKED: The UNLOCKED bit is set to indicate that the door latch is unlocked. The UNLOCKED bit is cleared to indicate that the door latch is locked or in its normal operating state.

7.2.8 Audible alarm element

The format of the CONTROL INFORMATION field for an audible alarm element is defined in table 42.

Table 42 – Audible alarm element for enclosure control pages

Bits Bytes	7	6	5	4	3	2	1	0
0	COMMON CONTROL							
1 - 2	Reserved							
3	Rsrvd	SET MUTE	Rsrvd	SET REMIND	TONE URGENCY CONTROL			
					INFO	NON-CRIT	CRIT	UNRECOV

SET MUTE: The SET MUTE bit is set to request that the alarm be placed in the muted state. The alarm shall emit no sound when in the muted state. When the SET MUTE bit is cleared, the alarm is set to the un-muted state and the tone appropriate to the most urgent condition present shall be generated. When the SET MUTE bit is set, the reminding tone is also muted.

SET REMIND: The SET REMIND bit is set to request the alarm emit a tone suitable for reminding the user that other tones are active. When the SET REMIND bit is cleared, the alarm emits the tone appropriate to the most urgent condition that is present.

TONE URGENCY CONTROL: 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, 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 reset 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 cleared, the audible alarm is silent until a new error condition occurs.

INFO: The informational condition tone urgency control bit (INFO) is set to request the audible alarm emit a tone suitable to warn of an information condition. The INFO bit is cleared to stop requesting the audible alarm to emit the tone.

NON-CRIT: The noncritical condition tone urgency control bit (NON-CRIT) is set to request the audible alarm emit a tone suitable to warn of a noncritical condition. The NON-CRIT bit is cleared to stop requesting the audible alarm to emit the tone.

CRIT: The critical condition tone urgency control bit (CRIT) is set to request the audible alarm emit a tone suitable to warn of a critical condition. The CRIT bit is cleared to stop requesting the audible alarm to emit the tone.

UNRECOV: The unrecoverable condition tone urgency control bit (UNRECOV) is set to request the audible alarm emit a tone suitable to warn of an unrecoverable condition. The UNRECOV bit is cleared to stop requesting the audible alarm to emit the tone.

The format of the STATUS INFORMATION field for an audible alarm element is defined in table 43.

Table 43 – Audible alarm element for enclosure status pages

Bits Bytes	7	6	5	4	3	2	1	0
0	COMMON STATUS							
1 - 2	Reserved							
3	RQST MUTE	MUTED	Rsrvd	REMIND	TONE URGENCY INDICATOR			
					INFO	NON-CRIT	CRIT	UNRECOV

RQST MUTE: The request mute bit (RQST MUTE) is set to indicate that a panel control has been manipulated to request that the audible alarm be muted. The RQST MUTE bit is cleared by the setting of the SET MUTE control bit.

MUTED: The MUTED bit is set to indicate that the audible alarm is in the muted state. The MUTED bit is cleared when the audible alarm is in the un-muted state. No sound is emitted by the audible alarm when it is in the muted state.

REMIND: The REMIND bit is set to indicate that the audible alarm is in the remind state. The REMIND bit is cleared when the remind state is cleared.

TONE URGENCY INDICATOR: Each bit indicates a tone of increasing urgency (bit 3 is least urgent). If more than one bit is set, the tone that signals the most urgent of the indicated conditions is active.

If all bits are cleared or if the MUTED bit is set, the audible alarm is silent. If the REMIND bit is set, the audible alarm tone is modified to the remind tone.

INFO: The information condition tone urgency indicator bit (INFO) is set to indicate the audible alarm is emitting a tone suitable to warn of an information condition unless a more urgent tone is also indicated. The INFO bit is cleared to indicate that the audible alarm is not emitting the corresponding tone.

NON-CRIT: The noncritical condition tone urgency indicator bit (NON-CRIT) is set to indicate the audible alarm is emitting a tone suitable to warn of a noncritical condition unless a more urgent tone is also indicated. The NON-CRIT bit is cleared to indicate that the audible alarm is not emitting the corresponding tone.

CRIT: The critical condition tone urgency indicator bit (CRIT) is set to indicate the audible alarm is emitting a tone suitable to warn of a critical condition unless a more urgent tone is also indicated. The CRIT bit is cleared to indicate that the audible alarm is not emitting the corresponding tone.

UNRECOV: The unrecoverable condition tone urgency indicator bit (UNRECOV) is set to indicate the audible alarm is emitting a tone suitable to warn of an unrecoverable condition. The UNRECOV bit is cleared to indicate that the audible alarm is not emitting the corresponding tone.

7.2.9 Enclosure services controller electronics element

The format of the CONTROL INFORMATION field for an enclosure services controller electronics element is defined in table 44.

Table 44 – ES controller electronics element for enclosure control pages

Bits Bytes	7	6	5	4	3	2	1	0
o	COMMON CONTROL							
1	Reserved							
2	Reserved							SELECT ELEMENT
3	Reserved							

SELECT ELEMENT: The SELECT ELEMENT bit is set to request the specified enclosure services controller electronics element be assigned to be the active enclosure services processor. The active enclosure services processor prepares all the status and configuration pages and interprets all control 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. The SELECT ELEMENT bit is cleared to request that the specified enclosure services controller electronics element is not the active enclosure services processor. If no element has been selected as the active enclosure services processor or if multiple elements have been selected, the choice of the active element is vendor specific.

The format of the STATUS INFORMATION field for an enclosure services controller electronics element is defined in table 45.

Table 45 – ES controller electronics element for enclosure status pages

Bits Bytes	7	6	5	4	3	2	1	0
0	COMMON STATUS							
1	Reserved							
2	Reserved							REPORT
3	Reserved							

REPORT: The REPORT bit is set to indicate the enclosure services controller electronics element described by this element status field is the active enclosure services processor for the sub-enclosure. The REPORT bit is cleared in all other cases.

7.2.10 SCC controller electronics element

The format of the CONTROL INFORMATION field for an SCC controller electronics element is defined in table 46.

Table 46 – SCC controller electronics element for enclosure control pages

Bits Bytes	7	6	5	4	3	2	1	0
0	COMMON CONTROL							
1 - 3	Reserved							

The format of the STATUS INFORMATION field for an SCC controller electronics element is defined in table 47.

Table 47 – SCC controller electronics element for enclosure status pages

Bits Bytes	7	6	5	4	3	2	1	0
0	COMMON STATUS							
1	Reserved							
2	Reserved							REPORT
3	Reserved							

REPORT: The REPORT bit is set to indicate this SCC controller electronics element provided the physical path for the transmission of the enclosure status page. This relates the target and LUN addressed by the RECEIVE DIAGNOSTIC RESULTS command to the SCC controller electronics element. The report bit is cleared to indicate that this SCC controller electronics element did not participate in the transmission of the enclosure status page.

7.2.11 Nonvolatile cache element

The format of the CONTROL INFORMATION field for nonvolatile cache element is defined in table 48.

Table 48 – Nonvolatile cache element for enclosure control pages

Bits Bytes	7	6	5	4	3	2	1	0
0	COMMON CONTROL							
1 - 3	Reserved							

The format of the STATUS INFORMATION field for a nonvolatile cache element is defined in table 49.

Table 49 – Nonvolatile cache element for enclosure status pages

Bits Bytes	7	6	5	4	3	2	1	0
0	COMMON STATUS							
1 - 3	Reserved							

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.

7.2.12 Uninterruptible power supply element

The format of the CONTROL INFORMATION field for an uninterruptible power supply element is defined in table 50.

Table 50 – Uninterruptible power supply element for enclosure control pages

Bits Bytes	7	6	5	4	3	2	1	0
0	COMMON CONTROL							
1 - 3	Reserved							

The uninterruptible power supply element reports the status of the uninterruptible power supply and its battery. The value in the BATTERY STATUS field may be compared against the threshold fields as defined in 6.1.7. Only the LOW WARNING THRESHOLD and the LOW CRITICAL THRESHOLD fields are used for comparisons against the battery status field. A value of zero in the threshold fields indicates that a vendor specific threshold shall be used. A value between 1 and 255 in the threshold field indicates that the corresponding number of minutes of remaining battery capacity shall be used as a threshold. The HIGH WARNING THRESHOLD and the HIGH CRITICAL THRESHOLD fields shall be ignored.

The format of the STATUS INFORMATION field for an uninterruptible power supply element is defined in table 51.

Table 51 – Uninterruptible power supply element for enclosure status pages

Bits Bytes	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	Reserved						BATT FAIL	BPF

BATTERY STATUS: The value of the BATTERY STATUS field indicates the time the battery could provide power in the event of an AC supply failure. The value in the BATTERY STATUS field is indicated in minutes of capability from 1 to 254 minutes. An indication of 255 minutes indicates that the battery has more capacity than 254 minutes remaining. An indication of 0 minutes indicates that the battery is discharged or that the battery's status is unknown.

AC LO: The AC LO bit is set to indicate the AC line voltage is lower than its specified range. The AC LO bit is cleared when the AC line voltage rises into its specified range.

AC HI: The AC HI bit is set to indicate the AC line voltage is higher than its specified range. The AC HI bit is cleared when the AC line voltage falls into its specified range.

AC QUAL: The AC quality bit (AC QUAL) is set to indicate the quality of the AC line voltage is outside the specified value. The definition of the quality parameters and specification is vendor specific. The AC QUAL bit is cleared when the AC line voltage quality returns to its specified value.

AC FAIL : The AC FAIL bit is set to indicate the AC line voltage has failed. The definition of a line voltage failure is vendor specific. The AC FAIL bit is cleared when the AC line voltage is again provided.

DC FAIL: The DC FAIL bit is set to indicate the DC line voltage has failed. The definition of a line voltage failure is vendor specific. The DC FAIL bit is cleared when the DC line voltage is again provided.

UPS FAIL: The UPS FAIL bit is set to indicate the uninterruptible power supply has failed and cannot provide power. The UPS FAIL bit is cleared when the uninterruptible power supply failure is corrected.

WARN : The WARN bit is set to indicate the output power will be available for less than the number of minutes specified by the LOW WARNING THRESHOLD field or less than the vendor specific default time. The WARN bit is cleared when output power will be available for at least the time specified by the LOW WARNING THRESHOLD field.

INTF FAIL: The interface failure bit (INTF FAIL) is set to indicate the enclosure services interface to the uninterruptible power supply has failed. The INTF FAIL bit is cleared when the enclosure services interface to the UPS is operational.

BATT FAIL : The battery failure bit (BATT FAIL) is set to indicate the battery has failed. The definition of battery failure is vendor specific. The BATT FAIL bit is cleared when the battery is operating correctly.

BPF : The battery predicted failure bit (BPF) is set to indicate the battery is approaching a failure condition. The definition of the prediction mechanism is vendor specific. Predicted failures of the uninterruptible power supply element are indicated by the PRDFAIL bit (see 7.1.1 and 7.1.2). The BPF bit is cleared when the battery is operating correctly.

7.2.13 Display element

The format of the CONTROL INFORMATION field for a display element is defined in table 52.

Table 52 – Display element for enclosure control page

Bits Bytes	7	6	5	4	3	2	1	0
0	COMMON CONTROL							
1 - 3	Reserved							

The format of the STATUS INFORMATION field for a display element is defined in table 53.

Table 53 – Display element for enclosure status page

Bits Bytes	7	6	5	4	3	2	1	0
0	COMMON STATUS							
1 - 3	Reserved							

7.2.14 Key pad entry device element

The format of the CONTROL INFORMATION field for key pad entry device element is defined in table 54.

Table 54 – Key pad entry device element for enclosure control page

Bits Bytes	7	6	5	4	3	2	1	0
0	COMMON CONTROL							
1 - 3	Reserved							

The format of the STATUS INFORMATION field for a key pad entry device element is defined in table 55.

Table 55 – Key pad entry device element for enclosure status page

Bits Bytes	7	6	5	4	3	2	1	0
0	COMMON STATUS							
1 - 3	Reserved							

7.2.15 SCSI port/transceiver element

The format of the CONTROL INFORMATION field for an SCSI port/transceiver element is defined in table 56.

Table 56 – SCSI port/transceiver for enclosure control page

Bits Bytes	7	6	5	4	3	2	1	0
0	COMMON CONTROL							
1 - 2	Reserved							
3	Reserved			DISABLE	Reserved			

DISABLE: The DISABLE bit is set to request the SCSI port/transceiver be disabled. The DISABLE bit is cleared to request the SCSI port/transceiver be enabled.

The format of the STATUS INFORMATION field for a SCSI port/transceiver element is defined in table 57.

Table 57 – SCSI port/transceiver for enclosure control status page

Bits Bytes	7	6	5	4	3	2	1	0
0	COMMON STATUS							
1	Reserved							
2	Reserved							REPORT
3	Reserved			DISABLD	Reserved		LOL	XMIT FAIL

REPORT: The REPORT bit is set to indicate the enclosure services process is using this SCSI port/transceiver as part of the path for transmitting the enclosure status page. The REPORT bit is cleared to indicate that this SCSI port/transceiver did not participate in the transmission of the enclosure status page.

DISABLD: The disabled bit (DISABLD) is set to indicate the SCSI port/transceiver has been disabled. The DISABLD bit is cleared when the SCSI port/transceiver is enabled.

LOL : The loss of link bit (LOL) is set to indicate the SCSI port/transceiver is not receiving any input signals at its receiver. The LOL bit is cleared to indicate the SCSI port/transceiver is receiving normal signals.

XMIT FAIL: The transmitter failure bit (XMIT FAIL) is set to indicate that the SCSI port/transceiver transmitter has failed or is operating outside its specification. The XMIT FAIL bit is cleared to indicate the SCSI port/transceiver transmitter is operating within its specification.

7.2.16 Language element

The format of the CONTROL INFORMATION field for a language element is defined in table 58.

Table 58 – Language element for enclosure control page

Bits Bytes	7	6	5	4	3	2	1	0
0	COMMON CONTROL							
1	Reserved							
2	LANGUAGE CODE							
3								

LANGUAGE CODE: The LANGUAGE CODE field requests the language and character encoding to be used in all fields that specify the capability of being modified by the language element. The enclosure should provide external indications in the requested language. The LANGUAGE CODE field shall contain either 0000h or the two-letter lowercase symbols defined by ISO 639:1988 to indicate which language is requested. The two-letter codes shall be expressed as US-ASCII characters as defined by ISO-8859-1. If the LANGUAGE CODE field has a value of 0000h, the language shall be the default of English, using the US-ASCII character set. If the two characters contain the ISO 639:1988 two-letter code for a language that is supported by the enclosure services process, the glyphs transmitted by the enclosure services process shall be encoded using the Unicode standard, UCS-2 canonical form. If the LANGUAGE CODE field contains a value other than 0000h or the two-letter code of a language supported by the enclosure services process, the default of English with the US-ASCII character set shall be used and an invalid operation indication shall be presented as described in 4.1.5.

The format of the STATUS INFORMATION field for a language element is defined in table 59.

Table 59 – Language element for enclosure status page

Bits Bytes	7	6	5	4	3	2	1	0
0	COMMON STATUS							
1	Reserved							
2	LANGUAGE CODE							
3								

LANGUAGE CODE: The value in the LANGUAGE CODE field indicates the language and character encoding that the enclosure services process shall use for those fields that specify the capability of being modified by the language element. The LANGUAGE CODE field shall contain either 0000h or the two-letter lowercase symbol defined by ISO 639:1988 for the language used by the enclosure services process. The two-letter code shall be expressed as US-ASCII characters as defined by ISO-8859-1. If the LANGUAGE CODE field has a value of 0000h, the enclosure services process indicates that it shall use the default of English, using the US-ASCII character set. If the two characters contain an ISO 639:1988 two-letter code, the glyphs transmitted by the enclosure services process shall be encoded using the Unicode standard, UCS-2 canonical form.

7.2.17 Communication port element

The format of the CONTROL INFORMATION field for a communication port element is defined in table 60.

Table 60 – Communication Port element for enclosure control page

Bits Bytes	7	6	5	4	3	2	1	0
0	COMMON CONTROL							
1 - 2	Reserved							
3	Reserved							DISABLE

DISABLE: The DISABLE bit is set to request the communication port be disabled. The DISABLE bit is cleared to request the communication port be enabled.

The format of the STATUS INFORMATION field for a communication port element is defined in table 61.

Table 61 – Communication port element for enclosure status page

Bits Bytes	7	6	5	4	3	2	1	0
0	COMMON STATUS							
1 - 2	Reserved							
3	Reserved							DISABLD

DISABLD: The disabled bit (DISABLD) is set to indicate the communication port has been disabled. The DISABLD bit is cleared when the communication port is enabled.

7.2.18 Voltage sensor element

The voltage sensor element provides voltage indications in the VOLTAGE field of the ELEMENT STATUS field. The voltage indications may be compared with threshold values. The threshold values may be vendor specific defaults or they may be set by the threshold out page (see 6.1.7).

The threshold fields are defined as tolerances, specified in units of 0.5% from a vendor specific nominal voltage or nominal voltage range. (See 6.1.7).

When the DISABLE bit in the COMMON CONTROL field (see 7.1.1) is set, the voltage sensor's output is not tested against any threshold values and no noncritical, critical, or unrecoverable conditions are indicated because of the voltage values sensed. When the DISABLE bit is cleared, the voltage sensor's output is accepted normally by the enclosure services process.

The format of the CONTROL INFORMATION field for a voltage sensor element is defined in table 62.

Table 62 – Voltage sensor element for enclosure control page

Bits Bytes	7	6	5	4	3	2	1	0
0	COMMON CONTROL							
1 - 3	Reserved							

The format of the STATUS INFORMATION field for a voltage sensor element is defined in table 63.

Table 63 – Voltage sensor element for enclosure status page

Bits Bytes	7	6	5	4	3	2	1	0
0	COMMON STATUS							
1	Reserved				WARN OVER	WARN UNDER	CRIT OVER	CRIT UNDER
2 - 3	(MSB) VOLTAGE (LSB)							

WARN OVER: The over voltage warning bit (WARN OVER) is set to indicate the VOLTAGE value has exceeded the actual high warning threshold value (see 6.1.7). The WARN OVER bit is cleared when the VOLTAGE value falls below the actual high warning threshold.

WARN UNDER: The under voltage warning bit (WARN UNDER) is set to indicate the VOLTAGE value has fallen below the actual low warning threshold value (see 6.1.7). The WARN UNDER bit is cleared when the VOLTAGE value rises above the actual low warning threshold.

CRIT OVER: The critical over voltage bit (CRIT OVER) is set to indicate the VOLTAGE value has exceeded the actual high critical threshold value (see 6.1.7). The CRIT OVER bit is cleared when the VOLTAGE value falls below the actual high critical threshold.

CRIT UNDER: The critical under voltage bit (CRIT UNDER) is set to indicate the VOLTAGE value has fallen below the actual low critical threshold value (see 6.1.7). The CRIT UNDER bit is cleared when the VOLTAGE value rises above the actual low critical threshold.

VOLTAGE: The VOLTAGE field indicates the voltage detected by the voltage sensor, measured in units of 10 millivolts. AC voltages are measured in Volts AC, RMS. The value is expressed as a 16-bit number using 2's complement notation to indicate negative numbers. The largest positive voltage that can be expressed is 327.67 volts and the largest negative voltage that can be expressed is -327.67 volts.

7.2.19 Current sensor element

The current sensor element provides current indications in the CURRENT field of the ELEMENT STATUS field. The current indications may be compared with threshold values. The threshold values may be vendor specific defaults or they may be set by the threshold out page (see 6.1.7).

The threshold fields are defined as tolerances, specified in units of 0.5% from a vendor specific maximum normal operation current. The low threshold fields are ignored. (See 6.1.7).

When the DISABLE bit (see 7.1.1) is set, the current sensor’s output is not tested against any threshold values and no noncritical, critical, or unrecoverable conditions are indicated because of the current values sensed. When the DISABLE bit is cleared, the current sensor’s output is accepted normally by the enclosure services process.

The format of the CONTROL INFORMATION field for a current sensor element is defined in table 64.

Table 64 – Current sensor element for enclosure control pages

Bits Bytes	7	6	5	4	3	2	1	0
0	COMMON CONTROL							
1 - 3	Reserved							

The format of the STATUS INFORMATION field for a current sensor element is defined in table 65.

Table 65 – Current sensor element for enclosure status pages

Bits Bytes	7	6	5	4	3	2	1	0
0	COMMON STATUS							
1	Reserved				WARN OVER	Rsrvd	CRIT OVER	Rsrvd
2 - 3	(MSB) CURRENT (LSB)							

WARN OVER: The over current warning bit (WARN OVER) is set to indicate the CURRENT value has exceeded the actual high warning threshold value (see 6.1.7). The WARN OVER bit is cleared when the CURRENT value falls below the actual high warning threshold.

CRIT OVER: The critical over current bit (CRIT OVER) is set to indicate the CURRENT value has exceeded the actual high critical threshold value (see 6.1.7). The CRIT OVER bit is cleared when the CURRENT value falls below the actual high critical threshold.

CURRENT: The CURRENT field indicates the current detected by the current sensor, measured in units of 10 milliamps. AC currents are measured in amps AC, RMS. The value is expressed as a 16-bit number using 2's complement notation to indicate negative numbers. The largest positive current that can be expressed is 327.67 amps and the largest negative current that can be expressed is -327.67 amps.

7.2.20 SCSI target port element

The format of the CONTROL INFORMATION field for an SCSI target port element is defined in table 66.

Table 66 – SCSI target port element for enclosure control pages

Bits Bytes	7	6	5	4	3	2	1	0
0	COMMON CONTROL							
1 - 2	Reserved							
3	Reserved							ENABLE

ENABLE: The ENABLE bit is set to request the SCSI target port be enabled. The ENABLE bit is cleared to request that the SCSI target port be disabled.

The format of the STATUS INFORMATION field for an SCSI target port element is defined in table 67.

Table 67 – SCSI target port element for enclosure status pages

Bits Bytes	7	6	5	4	3	2	1	0
0	COMMON STATUS							
1	Reserved							
2	Reserved							REPORT
3	Reserved							ENABLED

REPORT: The REPORT bit is set to indicate the enclosure services process is using this SCSI target port as part of the path for transmitting the enclosure status page. The REPORT bit is cleared to indicate that this SCSI target port did not participate in the transmission of the enclosure status page.

ENABLED: The ENABLED bit is set to indicate the SCSI target port element is enabled. The ENABLED bit is cleared when the SCSI target port element is disabled.

7.2.21 SCSI initiator port element

The format of the CONTROL INFORMATION field for an SCSI initiator port element is defined in table 68.

Table 68 – SCSI initiator port element for enclosure control pages

Bits Bytes	7	6	5	4	3	2	1	0
0	COMMON CONTROL							
1 - 2	Reserved							
3	Reserved							ENABLE

ENABLE: The ENABLE bit is set to request the SCSI initiator port be enabled. The ENABLE bit is cleared to request that the SCSI target port be disabled.

The format of the STATUS INFORMATION field for a temperature sensor element is defined in table 69.

Table 69 – SCSI initiator port element for enclosure status pages

Bits Bytes	7	6	5	4	3	2	1	0
0	COMMON STATUS							
1	Reserved							
2	Reserved							REPORT
3	Reserved							ENABLED

REPORT: The REPORT bit is set to indicate the enclosure services process is using this SCSI initiator port as part of the path for transmitting the enclosure status page. The REPORT bit is cleared to indicate that this SCSI initiator port did not participate in the transmission of the enclosure status page.

ENABLED: The ENABLED bit is set to indicate the SCSI initiator port element is enabled. The ENABLED bit is cleared when the SCSI target port element is disabled.

7.2.22 Simple sub-enclosure element

The format of the CONTROL INFORMATION field for a simple sub-enclosure element is defined in table 70.

Table 70 – Simple sub-enclosure element for enclosure control pages

Bits Bytes	7	6	5	4	3	2	1	0
0	COMMON CONTROL							
1-3	reserved							

The format of the STATUS INFORMATION field for a simple sub-enclosure element is defined in table 71.

Table 71 – Simple sub-enclosure element for enclosure status pages

Bits Bytes	7	6	5	4	3	2	1	0
0	COMMON STATUS							
1 - 2	reserved							
3	SHORT ENCLOSURE STATUS							

SHORT ENCLOSURE STATUS: The SHORT ENCLOSURE STATUS field contains the contents of the vendor specific field of the short enclosure status page from the specified sub-enclosure. (See 6.1.12)

Annex A Sub-enclosure accessing
(normative)

An alternative method for accessing multiple enclosures attached as sub-enclosures to a subsystem is defined in this annex for those systems unable to take advantage of the hierarchical addressing model defined by SCC.

A.1 Introduction and scope

A hierarchical addressing structure is defined by SCC. That structure should be used for addressing logical units that use the SES device model in complex systems. The SCC hierarchical mechanism allows the information from each enclosure to be independently accessed with the SES command set.

For those units that do not support the hierarchical addressing model defined by SCC, the enclosure services information may instead be accessed through the enclosure services process of the primary sub-enclosure. The enclosure services information from multiple sub-enclosures is combined together into a single set of enclosure services diagnostic pages. The information from each sub-enclosure is identified in the enclosure services configuration page by its sub-enclosure identifier. The required formats for enclosure services pages using sub-enclosure accessing are described in this annex.

Figure A.1 shows an example of the addressing structure using the recommended hierarchical addressing from SCC.

Figure A.1 – Example of hierarchical addressing

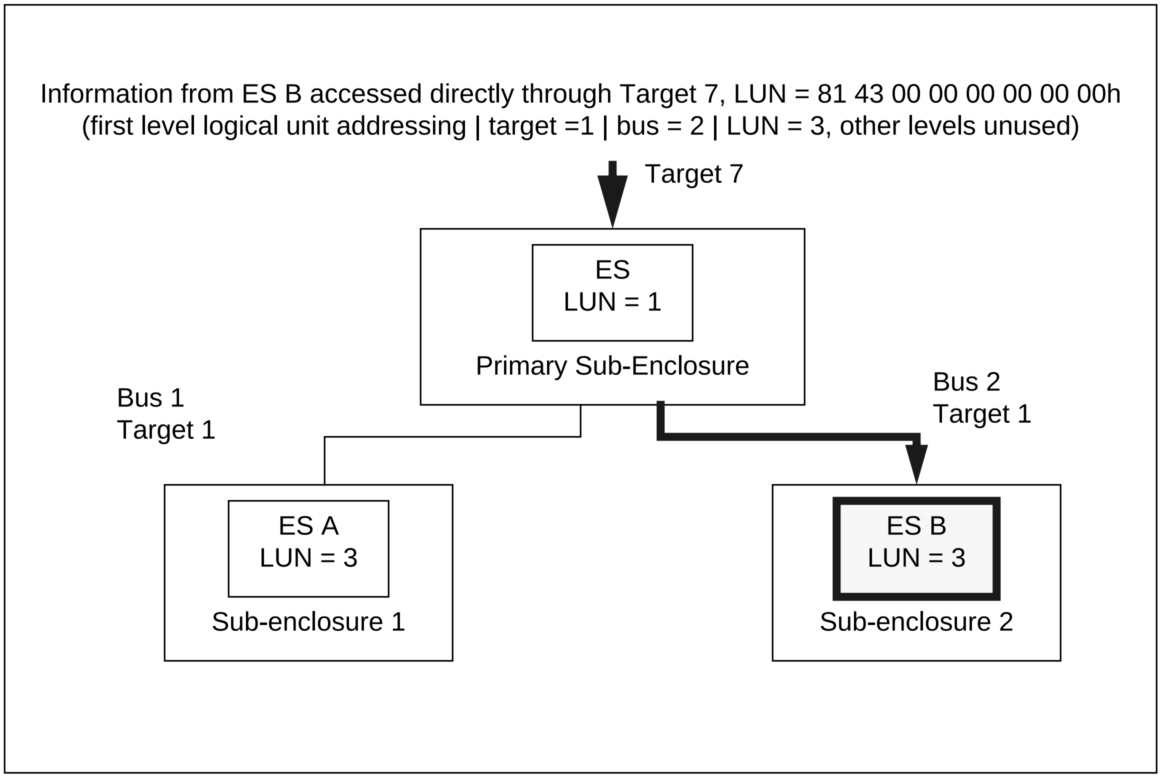
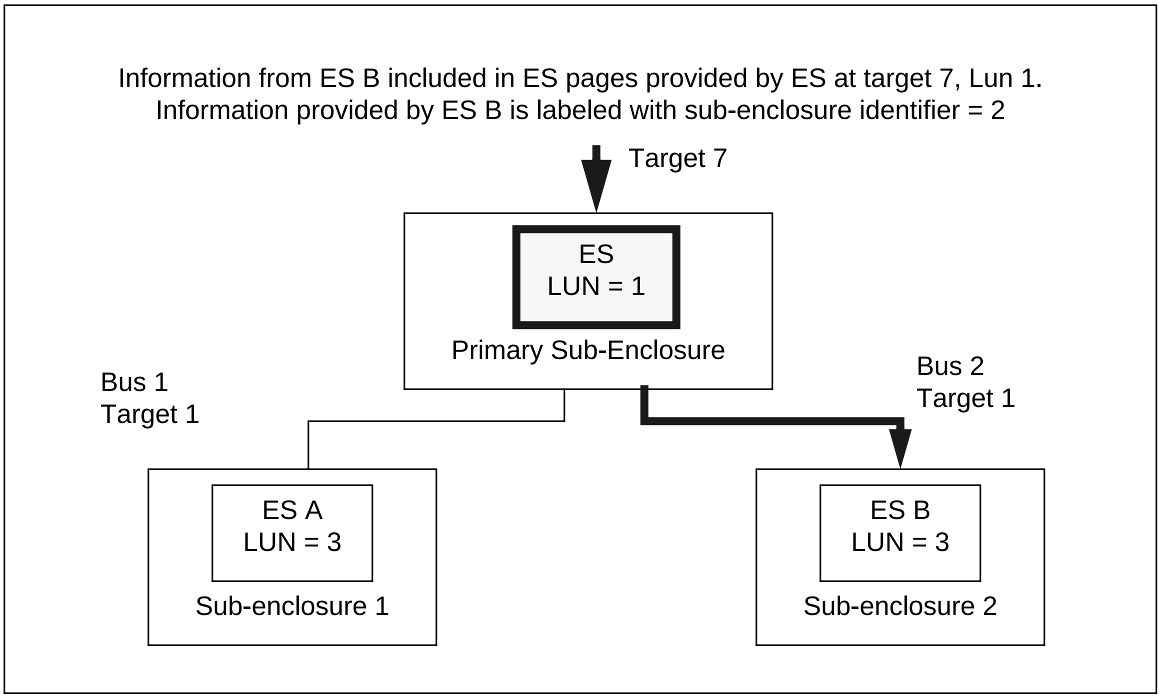

Information from ES B accessed directly through Target 7, LUN = 81 43 00 00 00 00 00 00h
(first level logical unit addressing | target =1 | bus = 2 | LUN = 3, other levels unused)
Target 7
ES
LUN = 1
Primary Sub-Enclosure
Bus 1
Target 1
Bus 2
Target 1
ES A
LUN = 3
Sub-enclosure 1
ES B
LUN = 3
Sub-enclosure 2

Figure A.2 shows an example of the addressing structure using the alternative sub-enclosure accessing described in this clause.

Figure A.2 – Example of sub-enclosure accessing


Information from ES B included in ES pages provided by ES at target 7, Lun 1.
Information provided by ES B is labeled with sub-enclosure identifier = 2
Target 7
ES
LUN = 1
Primary Sub-Enclosure
Bus 1
Target 1
Bus 2
Target 1
ES A
LUN = 3
Sub-enclosure 1
ES B
LUN = 3
Sub-enclosure 2

A.2 Definition of sub-enclosure

An enclosure may contain one or more devices, together with the associated power supplies, cooling devices, indicators, enclosure services processor, and auxiliary equipment required to support those devices. The primary sub-enclosure is the enclosure that contains the enclosure services processor responsible for transmitting the enclosure configuration page to the application client. Sub-enclosures are those zero or more enclosures that contribute to the contents of the enclosure configuration page but do not transmit it to the application client. The primary sub-enclosure selects an identifier for each sub-enclosure. That identifier is used to label the element entries and enclosure header entries associated with the sub-enclosure. The relationship between the sub-enclosure identifier and the sub-enclosure's location is vendor specific. The relationship between the sub-enclosure identifier and the sub-enclosure is fixed for a particular configuration and configuration generation. As sub-enclosures are added or removed, the configuration and configuration generation shall change. The addition or removal of a sub-enclosure also may result in a change in the relationship between a physical sub-enclosure and the corresponding sub-enclosure identifier.

The primary sub-enclosure may access enclosure service information in a sub-enclosure using standard enclosure services device commands or a vendor specific communications interface.

A.3 Configuration page using sub-enclosure identifiers

The enclosure services configuration page is accessed as described in 6.1.1.

The enclosure services configuration page returns a list of components in the primary sub-enclosure and in all the sub-enclosures communicating with the primary sub-enclosure. The configuration page contains an enclosure descriptor (see 6.1.1) for the primary sub-enclosure, an enclosure descriptor for each sub-enclosure, and the TYPE DESCRIPTOR HEADER fields from all the sub-enclosures including the primary sub-enclosure. The TYPE DESCRIPTOR HEADER fields may be in any order, except that all the device type descriptors shall be collected at the beginning of the list, regardless of sub-enclosure. Each TYPE DESCRIPTOR HEADER field is matched to a sub-enclosure by the sub-enclosure identifier.

The content of the configuration page may be constructed by the primary sub-enclosure using standard enclosure services configuration pages obtained by the primary sub-enclosure from the sub-enclosure. The primary sub-enclosure may also obtain the information required to build the configuration page using any other interface and protocol it chooses.

Table A.1 provides an overview of the components of the enclosure services configuration page using sub-enclosure identifiers.

Table A.1 – Layout of configuration page

Component name	Description	Reference
Diagnostic page header	Describes diagnostic page Indicates number of sub-enclosures	SPC
Generation Code	Generation Code	6.1.1
Enclosure descriptor header	Describes primary sub-enclosure descriptor	6.1.1
Primary Sub-Enclosure descriptor	Primary sub-enclosure identification	6.1.1
Enclosure descriptor header	Describes first sub-enclosure descriptor	6.1.1
First sub-enclosure descriptor	Contains first sub-enclosure identification	A.3
•••		
Last sub-enclosure descriptor	Contains last sub-enclosure identification	A.3
Type descriptor header list for device elements	Contains type descriptor headers for device type elements for primary sub-enclosure and all sub-enclosures.	6.1.1
Type descriptor header list for other elements	Identifies all other element types included in enclosure and sub-enclosures.	6.1.1
Type descriptor text strings	Provides optional text descriptions for element types in enclosure.	6.1.1

The references in table A.2 indicate which portions of the enclosure services configuration page are unchanged from 6.1.1 and which portions are described in this clause. The format of the configuration page using sub-enclosure identifiers is shown in table A.2.

Table A.2 – Configuration page, using sub-enclosure identifiers

Component name	Bytes	Field Name	Reference
Diagnostic page header	0	PAGE CODE (01h)	SPC
	1	NUMBER OF SUB-ENCLOSURES	A.3
	2 - 3	(MSB) PAGE LENGTH (n-3) (LSB)	SPC
	4-7	(MSB) GENERATION CODE (LSB)	A.3
Primary sub-enclosure descriptor header	8	Reserved	N/A
	9	SUB-ENCLOSURE IDENTIFIER	A.3
	10	NUMBER OF ELEMENT TYPES SUPPORTED	A.3
	11	ENCLOSURE DESCRIPTOR LENGTH (m)	6.1.1
Primary sub-enclosure descriptor (one only)	12 - 19	ENCLOSURE LOGICAL IDENTIFIER	6.1.1
	20 - 27	ENCLOSURE VENDOR IDENTIFICATION	6.1.1
	28 - 43	PRODUCT IDENTIFICATION	6.1.1
	44 - 47	PRODUCT REVISION LEVEL	6.1.1
	48 - (m+11)	VENDOR SPECIFIC ENCLOSURE INFORMATION	6.1.1
First sub-enclosure descriptor header	(1 byte)	Reserved	N/A
	(1 byte)	SUB-ENCLOSURE IDENTIFIER	A.3
	(1 byte)	NUMBER OF ELEMENT TYPES SUPPORTED	A.3
	(1 byte)	ENCLOSURE DESCRIPTOR LENGTH (p)	6.1.1
First sub-enclosure descriptor	(8 bytes)	ENCLOSURE LOGICAL IDENTIFIER	A.3
	(8 bytes)	ENCLOSURE VENDOR IDENTIFICATION	A.3
	(16 bytes)	PRODUCT IDENTIFICATION	A.3
	(8 bytes)	PRODUCT REVISION LEVEL	A.3
	(p - 40 bytes)	VENDOR SPECIFIC ENCLOSURE INFORMATION	6.1.1
•••			

Table A.2 – Configuration page, using sub-enclosure identifiers

Component name	Bytes	Field Name	Reference
Last sub-enclosure descriptor header	(1 byte)	Reserved	N/A
	(1 byte)	SUB-ENCLOSURE IDENTIFIER	A.3
	(1 byte)	NUMBER OF ELEMENT TYPES SUPPORTED	A.3
	(1 byte)	ENCLOSURE DESCRIPTOR LENGTH (p)	6.1.1
Last sub-enclosure descriptor	(8 bytes)	ENCLOSURE LOGICAL IDENTIFIER	A.3
	(8 bytes)	ENCLOSURE VENDOR IDENTIFICATION	A.3
	(16 bytes)	PRODUCT IDENTIFICATION	A.3
	(8 bytes)	PRODUCT REVISION LEVEL	A.3
	(p - 40 bytes)	VENDOR SPECIFIC ENCLOSURE INFORMATION	6.1.1
Type Descriptor Header List	(4 bytes)	TYPE DESCRIPTOR HEADER (first element type)	A.3
	•••		
	(4 bytes)	TYPE DESCRIPTOR HEADER (T^{th} element type)	A.3
Type Descriptor Text Strings	variable	TYPE DESCRIPTOR TEXT (first)	6.1.1
	•••		
	last byte = n	TYPE DESCRIPTOR TEXT (last)	6.1.1

NUMBER OF SUB-ENCLOSURES : The NUMBER OF SUB-ENCLOSURES field specifies the number of separate sub-enclosures defined by the configuration page, not including the primary sub-enclosure. That number of sub-enclosure descriptor headers and sub-enclosure descriptions shall be included immediately following the primary sub-enclosure descriptor. The sub-enclosure descriptors may follow the primary sub-enclosure descriptor in any order. If the number of sub-enclosures field specifies a value of 0, the format of the page is identical to that described in 6.1.1.

GENERATION CODE: The GENERATION CODE field is a four byte counter that is incremented by one by the primary sub-enclosure services process every time the configuration page changes. The value is not changed by status changes for elements already described by the configuration page. Changes in the configuration page may be caused by changes in the number or configuration of sub-enclosures. The methods for reporting changes in the generation code field are described in 6.1.1.

SUB-ENCLOSURE IDENTIFIER: The SUB-ENCLOSURE IDENTIFIER field for each sub-enclosure shall be assigned by the primary sub-enclosure enclosure services process in a vendor specific manner. The SUB-ENCLOSURE IDENTIFIER shall be a fixed value for each sub-enclosure for all enclosure diagnostic pages associated with a given configuration, but may change if the configuration changes.

NUMBER OF ELEMENT TYPES SUPPORTED: The NUMBER OF ELEMENT TYPES SUPPORTED field defines the number of TYPE DESCRIPTOR HEADER fields in the configuration page with this sub-enclosure identifier.

The total number of TYPE DESCRIPTOR HEADER fields is equal to the sum of the contents of the NUMBER OF ELEMENT TYPES SUPPORTED fields for the primary sub-enclosure and all of the sub-enclosures.

ENCLOSURE LOGICAL IDENTIFIER: The ENCLOSURE LOGICAL IDENTIFIER field shall contain the unique logical identifier of the sub-enclosure. The ENCLOSURE LOGICAL IDENTIFIER shall use one of the 8-byte world wide name formats defined by FC-PH.

ENCLOSURE VENDOR IDENTIFICATION: The ENCLOSURE VENDOR IDENTIFICATION field shall contain the identification string for the vendor of the sub-enclosure in the same format as specified for the vendor identification field of the INQUIRY command. (See SPC).

PRODUCT IDENTIFICATION: The PRODUCT IDENTIFICATION field shall contain the product identification string for the sub-enclosure in the same format as specified for the product identification field of the INQUIRY command. (See SPC)

PRODUCT REVISION LEVEL: The PRODUCT REVISION LEVEL field shall contain the product revision level string for the sub-enclosure in the same format as specified for the product revision level field of the INQUIRY command. (See SPC).

TYPE DESCRIPTOR HEADER: The TYPE DESCRIPTOR HEADER field indicates the element type being described, the number of such elements, the sub-enclosure where the elements are located, and the length of an optional text describing the element type. The format of the TYPE DESCRIPTOR HEADER is shown in table A.3. The elements of an enclosure shall be listed in the same order in the configuration page, the type descriptor text of the configuration page, the enclosure and array status pages, the enclosure and array control pages, and the threshold in and threshold out pages. All those elements defining SCSI devices shall be listed before elements of other types, regardless of sub-enclosure identification. The TYPE DESCRIPTOR HEADER fields for elements other than device elements may be listed in any order in the configuration page. The TYPE DESCRIPTOR TEXT fields are placed after all TYPE DESCRIPTOR HEADER fields.

Table A.3 – Type descriptor header format

Bits Bytes	7	6	5	4	3	2	1	0
0	TYPE OF ELEMENT							
1	NUMBER OF POSSIBLE ELEMENTS							
2	SUB-ENCLOSURE IDENTIFIER							
3	TYPE DESCRIPTOR TEXT LENGTH							

TYPE OF ELEMENT: See 6.1.1 for a description of this field.

NUMBER OF POSSIBLE ELEMENTS: See 6.1.1 for a description of this field.

SUB-ENCLOSURE IDENTIFIER: The SUB-ENCLOSURE IDENTIFIER field specifies a vendor specific identifier for the enclosure where the elements described by this type descriptor reside. Type descriptors describing elements in a sub-enclosure shall have the sub-enclosure identifier value contained in the enclosure descriptor for that sub-enclosure.

TYPE DESCRIPTOR TEXT LENGTH: See 6.1.1 for a description of this field.

A.4 Enclosure and Array pages using sub-enclosure identifiers

The enclosure control, enclosure status, array control, and array status page formats are not modified when sub-enclosure accessing is used. The element fields for all sub-enclosures are listed in the order matching the configuration page.

A.5 Help text page using sub-enclosure identifiers

When sub-enclosure accessing is used, the help text returned shall include all the help text from each sub-enclosure. Each individual HELP TEXT field is identified by a sub-enclosure string header.

The help text page is mandatory if any sub-enclosure help text strings are implemented. Any of the help text strings may have a length of 0000h.

The format of the help text page using sub-enclosure identifiers is shown in table A.4.

Table A.4 – Help text page, using sub-enclosure identifiers

Component name	Bytes	Field Name	Reference
Diagnostic Page Header	0	PAGE CODE (03h)	SPC
	1	NUMBER OF SUB-ENCLOSURES	A.5
	2 - 3	(MSB) PAGE LENGTH (n-3) (LSB)	SPC
Sub-enclosure help text (primary sub-enclosure)	(1 byte)	Reserved	N/A
	(1 byte)	SUB-ENCLOSURE IDENTIFIER	A.5
	(2 bytes)	(MSB) HELP TEXT LENGTH (primary sub-enclosure) (LSB)	A.5
	variable	HELP TEXT (primary sub-enclosure)	6.1.4
Sub-enclosure help text (first sub-enclosure)	(1 byte)	Reserved	N/A
	(1 byte)	SUB-ENCLOSURE IDENTIFIER	A.5
	(2 bytes)	(MSB) HELP TEXT LENGTH (first sub-enclosure) (LSB)	A.5
	variable	HELP TEXT (first sub-enclosure)	6.1.4
•••			
Sub-enclosure help text (last sub-enclosure)	(1 byte)	Reserved	N/A
	(1 byte)	SUB-ENCLOSURE IDENTIFIER	A.5
	(2 bytes)	(MSB) HELP TEXT LENGTH (last sub-enclosure) (LSB)	A.5
	variable	HELP TEXT (last sub-enclosure)	6.1.4

NUMBER OF SUB-ENCLOSURES : The NUMBER OF SUB-ENCLOSURES field specifies the number of separate sub-enclosure HELP TEXT fields that are included in the help text page, not including the HELP TEXT field for the primary sub-enclosure. The sub-enclosure HELP TEXT fields may follow the primary sub-enclosure HELP TEXT in any order. The NUMBER OF SUB-ENCLOSURES value shall be the same as the number of sub-enclosures value in the configuration page.

SUB-ENCLOSURE IDENTIFIER: The SUB-ENCLOSURE IDENTIFIER field specifies a vendor specific identifier for the help text that follows it. Each of the SUB-ENCLOSURE IDENTIFIER fields shall match one of the SUB-ENCLOSURE IDENTIFIER values found in the configuration page, or the configuration page shall report a changed configuration and incremented GENERATION CODE (see A.3).

HELP TEXT LENGTH: The HELP TEXT LENGTH field specifies the number of bytes in the HELP TEXT field following the HELP TEXT LENGTH field. If a sub-enclosure has no help text, the HELP TEXT LENGTH field shall contain zero.

A.6 String Out page using sub-enclosure identifiers

When sub-enclosure accessing is used, the string out diagnostic page transmitted to the primary sub-enclosure includes the VENDOR SPECIFIC field required for the single sub-enclosure specified by the sub-enclosure identifier.

The string out page is mandatory if any sub-enclosure implements the string-out page.

The string out page format is shown in table A.5.

Table A.5 – String out page, using sub-enclosure identifiers

Component name	Bytes	Field Name	Reference
Diagnostic Page Header	0	PAGE CODE (04h)	SPC
	1	SUB-ENCLOSURE IDENTIFIER	A.6
	2 - 3	(MSB) PAGE LENGTH (n-3) (LSB)	SPC
Data	4 - n	VENDOR SPECIFIC	6.1.5

SUB-ENCLOSURE IDENTIFIER: The SUB-ENCLOSURE IDENTIFIER field specifies a vendor specific identifier for the sub- enclosure to which the application client wants the VENDOR SPECIFIC field sent. The SUB-ENCLOSURE IDENTIFIER value shall match a SUB-ENCLOSURE IDENTIFIER value found in the configuration page, or the enclosure services process shall report an invalid field error using one of the methods described in 4.1.5.

A.7 String In page using sub-enclosure identifiers

When sub-enclosure accessing is used, the string in diagnostic page returned by the primary sub-enclosure shall include the VENDOR SPECIFIC field from each sub-enclosure and the VENDOR SPECIFIC field from the primary sub-enclosure. Each individual set of binary data is identified by a sub-enclosure string header.

The string in page is mandatory if any sub-enclosure is capable of providing a string in VENDOR SPECIFIC field. Any of the VENDOR SPECIFIC fields may have a length of 0000h.

The string in page format is shown in table A.6.

Table A.6 – String in page, using sub-enclosure identifiers

Component name	Bytes	Field Name	Reference
Diagnostic Page Header	0	PAGE CODE (04h)	SPC
	1	NUMBER OF SUB-ENCLOSURES	A.7
	2 - 3	(MSB) PAGE LENGTH (n-3) (LSB)	SPC
Sub-enclosure string in text (primary sub-enclosure)	(1 byte)	Reserved	N/A
	(1 byte)	SUB-ENCLOSURE IDENTIFIER	A.7
	(2 bytes)	(MSB) VENDOR SPECIFIC LENGTH (primary) (LSB)	A.7
	variable	VENDOR SPECIFIC	6.1.6
Sub-enclosure string in text (first sub-enclosure)	(1 byte)	Reserved	N/A
	(1 byte)	SUB-ENCLOSURE IDENTIFIER	A.7
	(2 bytes)	(MSB) VENDOR SPECIFIC LENGTH (first sub-enclosure) (LSB)	A.7
	variable	VENDOR SPECIFIC	6.1.6
•••			
Sub-enclosure string in text (last sub-enclosure)	(1 byte)	Reserved	N/A
	(1 byte)	SUB-ENCLOSURE IDENTIFIER	A.7
	(2 bytes)	(MSB) VENDOR SPECIFIC LENGTH (last sub-enclosure) (LSB)	A.7
	variable	VENDOR SPECIFIC	6.1.6

NUMBER OF SUB-ENCLOSURES : The NUMBER OF SUB-ENCLOSURES field specifies the number of separate sub-enclosure VENDOR SPECIFIC fields that are included in the string in page, not including the field for the primary sub-enclosure. That number of sub-enclosure string in text fields shall be included immediately following the primary sub-enclosure string in field. The sub-enclosure string in fields may follow the primary sub-enclosure field in any order. The NUMBER OF SUB-ENCLOSURES value shall be the same as the NUMBER OF SUB-ENCLOSURES value in the configuration page.

SUB-ENCLOSURE IDENTIFIER: The SUB-ENCLOSURE IDENTIFIER field specifies a vendor specific identifier for the string in field that follows it. The SUB-ENCLOSURE IDENTIFIER value shall match at least one of the SUB-ENCLOSURE IDENTIFIER values found in the configuration page, or the configuration page shall report a changed configuration and incremented GENERATION CODE (see A.3).

VENDOR SPECIFIC LENGTH: The VENDOR SPECIFIC LENGTH field specifies the number of bytes in the VENDOR SPECIFIC field following the length field. If a sub-enclosure has no string in field, the VENDOR SPECIFIC LENGTH field shall contain zero.

A.8 Threshold pages using sub-enclosure identifiers

The threshold out and threshold in diagnostic page formats are not modified when sub-enclosure accessing is used. The threshold fields for all sub-enclosures are listed in the order matching the configuration page (see 6.1.7 and 6.1.8).

A.9 Element descriptor page using sub-enclosure identifiers

The element descriptor diagnostic page format is not modified when sub-enclosure accessing is used. The element descriptors for all sub-enclosures are listed in the order matching the configuration page (see 6.1.11).

A.10 Short enclosure status page using sub-enclosure identifiers

Some enclosure processors report the short status page, as described in 6.1.12. Enclosures reporting the short status page shall not be primary sub-enclosures. If an enclosure providing the short status page is used as a sub-enclosure attached to a primary sub-enclosure, the enclosure shall be represented as a simple sub-enclosure element (see 7.2.22).

Annex B ASC/ASCQ for enclosure services devices
(informative)

B.1 ASC/ASCQ for enclosure services devices

The ASC/ASCQ values defined for SES are described below. The values and names are assigned in SPC.

The information in this annex was complete and accurate at the time of publication. However, the information is subject to change. Technical Committee X3T10 of Accredited Standards Committee X3 maintains an electronic copy of this information on its world wide web site (http://www.symbios.com/x3t10). In the event that the X3T10 world wide web site is no longer active, access may be possible via the X3 world wide web site (http://www.xe.org).

ENCLOSURE FAILURE: The ENCLOSURE FAILURE ASC/ASCQ is provided to indicate when a critical or an unrecoverable enclosure failure has been detected by the enclosure services process. The Sense Key is HARDWARE ERROR. Further information may be available using the RECEIVE DIAGNOSTIC RESULTS command and requesting the enclosure status page. This additional sense code should only be returned by an enclosure services type device in the sense data for a CHECK CONDITION status returned for a command other than RECEIVE DIAGNOSTIC RESULTS.

ENCLOSURE SERVICES FAILURE: The ENCLOSURE SERVICES FAILURE ASC/ASCQ is provided to indicate that the enclosure services device has failed in an unknown manner. This is provided using the Sense Key of HARDWARE ERROR. This additional sense code may be returned by any device that provides access to enclosure services.

ENCLOSURE SERVICES UNAVAILABLE: The ENCLOSURE SERVICES UNAVAILABLE ASC/ASCQ indicates that the device has been asked to invoke an enclosure services function that is temporarily busy or unavailable. This is provided using the Sense Key of NOT READY. This additional sense code may be returned by any device that provides access to enclosure services.

ENCLOSURE TRANSFER FAILURE: The ENCLOSURE TRANSFER FAILURE ASC/ASCQ indicates that the device communication with the enclosure services process has failed. This is provided using the Sense Key of HARDWARE ERROR. This additional sense code may be generated by any device that provides enclosure services access.

ENCLOSURE TRANSFER REFUSED: The ENCLOSURE TRANSFER REFUSED ASC/ASCQ indicates that the device or the enclosure services process indicated either an error or an invalid format in their communication. This is provided using the Sense Key of HARDWARE ERROR or ILLEGAL REQUEST, depending on the cause of the error. This additional sense code may be generated by any device that provides access to enclosure services.

UNSUPPORTED ENCLOSURE FUNCTION: The ENCLOSURE SERVICES FAILURE ASC/ASCQ indicates that the device has been asked to invoke an enclosure services function that does not exist. This is provided using the Sense Key of ILLEGAL REQUEST. This additional sense code may be generated by any device that provides access to enclosure services.

WARNING - ENCLOSURE DEGRADED: The WARNING - ENCLOSURE DEGRADED ASC/ASCQ is provided to indicate that an informational condition or a noncritical failure has been detected by the enclosure services process. This is provided using the Sense Key of RECOVERED ERROR and may be managed by the Informational Exceptions Control mode page. Further information may be available using the RECEIVE DIAGNOSTIC RESULTS command and requesting the enclosure status page. This additional sense code should only be returned by an enclosure services type device in the sense data for a CHECK CONDITION status returned for a command other than RECEIVE DIAGNOSTIC RESULTS.