To: T10 Technical Committee
From: Rob Elliott, HP (elliott@hp.com)
Date: 1 March 2004
Subject: 04-010r2 SPC-3 SES-2 More diagnostic pages for SES

Revision history
Revision 0 (21 November 2003) First revision, called “Diagnostic subpages”
Revision 1 (30 December 2003) Added pad field to keep this page aligned on 4 byte boundaries.
Revision 2 (1 March 2004) Changed to just grab more page codes rather than defining diagnostic subpages. No standard other than SES is actively using the page codes.

Related documents
spc3r17 - SCSI Primary Commands - 3 revision 17
ses2r06 - SCSI Enclosure Services - 2 revision 6
sff-8067 - 40-pin SCA-2 Connector w/Bidirectional ESI revision 3.2 (28 January 2004) (available from http://www.sffcommittee.org)
02-189r1 Vendor Specific diagnostic pages - incorporated into spc3r09. This added sixteen SES-related vendor-specific page codes (10h - 1Fh) to SPC-3 and SES-2, using page codes that were formerly reserved for all device types in SPC-2 and SES-1.
04-074 Report Supported SES Diagnostic Pages

Overview
SCSI enclosure services (SES) is allocated 20h (32) diagnostic pages by SPC-3, 10h (16) of which are vendor specific. Page codes up to 0Ch have been used, so the codes are nearly exhausted. More page codes are needed.

Table 1 — Diagnostic page codes

Page Code	Diagnostic Page Name
00h	Supported Diagnostic Pages
01h - 0Ch	Defined by SES-2 and currently used
0Dh - 0Fh	Defined by SES-2 and currently not used
10h - 1Fh	Defined by SES-2 and currently used
20h - 3Fh	Reserved for pages that apply to all device types
40h - 7Fh	See specific device type for definition
80h - FFh	Vendor specific

Two options were considered:

a) The simplest option is to claim more page codes from SPC-3 for SES-2. To date no diagnostic pages have been defined for all device types except for the Supported Diagnostic Pages diagnostic page 00h. Only two diagnostic pages have been defined for *any* command set other than SES - the Translate Address and Device Status pages in SBC (for direct-access, optical, and write-once block devices).
b) A more complicated but more extensible option is to add “subpages” similar to those defined for mode pages and log pages. Subpages cannot be added to most of the existing pages, because there is no room for a subpage code field in byte 1 of the page definitions. They could be added for new pages. Even if this option is not selected, new diagnostic pages should be defined keeping room for a subpage code field in byte 1.

Given the low diagnostic page usage in SCSI by command set standards other than SES, option a) is proposed.

SPC-3 includes normative text with page code assignments mentioned each page defined by SES-2. This proposal also suggests maintaining the list in the numeric order codes informational annex instead, so SPC-3 is not obligated to keep up with every SES change.

Figure 1 shows the mapping from a SCSI target port to an enclosure services processor using the SFF-8067 Enclosure Service Interface (ESI).

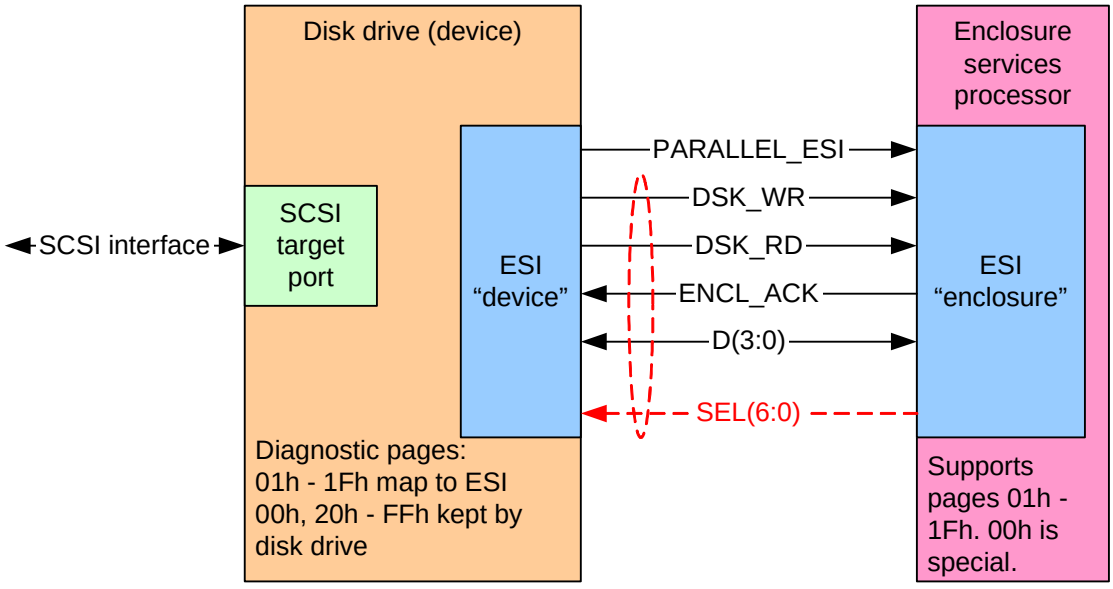

Figure 1 — ESI mapping

Suggested changes to SPC-3

7.1 Diagnostic parameters

7.1.1 Diagnostic page format and page codes for all device types

This subclause describes the diagnostic page structure and the diagnostic pages that are applicable to all SCSI devices. Diagnostic pages specific to each device type are described in the command standard (see 3.1.17) that applies to that device type.

A SEND DIAGNOSTIC command with a PF bit set to one specifies that the SEND DIAGNOSTIC parameter list consists of zero or more diagnostic pages and that the data returned by the subsequent RECEIVE DIAGNOSTIC RESULTS command shall use the diagnostic page format defined in table 170. A RECEIVE DIAGNOSTIC RESULTS command with a PCV bit set to one specifies that the device server return a diagnostic page using the format defined in table 170.

Table 2 — Diagnostic page format

Byte\Bit	7	6	5	4	3	2	1	0
0	PAGE CODE							
1	Reserved							
2	(MSB)			PAGE LENGTH (n - 3)				
3								(LSB)
4				Diagnostic parameters				
n								

Each diagnostic page defines a function or operation that the device server shall perform as a result of a SEND DIAGNOSTIC command or the information being returned as a result of a RECEIVE DIAGNOSTIC RESULTS with the PCV bit equal to one. The diagnostic page contains a page header followed by the data that is formatted according to the page code specified.

Device servers that implement diagnostic pages are only required to accept a single diagnostic page per command.

The page code field identifies which diagnostic page is being sent as a result of a SEND DIAGNOSTIC command, requested as a result of a RECEIVE DIAGNOSTIC RESULTS command with the pcv bit equal to one, or returned as a result of a RECEIVE DIAGNOSTIC RESULTS parameter data. The page codes are defined in table 171.

Table 3 — Diagnostic page codes

Page Code	Diagnostic Page Name	Reference
00h	Supported Diagnostic Pages	7.1.2
~~01h~~	~~Configuration~~	~~SES~~
~~02h~~	~~Enclosure Status/Control~~	~~SES~~
~~03h~~	~~Help Text~~	~~SES~~
~~04h~~	~~String In/Out~~	~~SES~~
~~05h~~	~~Threshold In/Out~~	~~SES~~
~~06h~~	~~Array Status/Control~~	~~SES~~
~~07h~~	~~Element Descriptor~~	~~SES~~
~~08h~~	~~Short Enclosure Status~~	~~SES~~
~~09h~~	~~Enclosure Busy~~	~~SES-2~~
~~0Ah~~	~~Device Element Status~~	~~SES-2~~
~~0Bh - 1Fh~~	~~Reserved for SES~~	~~SES-2~~
01h - 2Fh	Defined by SES-2 for: a) enclosure services devices (i.e., the PERIPHERAL DEVICE TYPE field is set to 0Dh in standard INQUIRY data); and b) any device type if the ENCSERV bit is set to one in standard INQUIRY data	SES-2
~~20h~~ 30h- 3Fh	Reserved for p~~P~~ages that apply to all device types	
40h - 7Fh	See specific device type for definition	
80h - FFh	Vendor specific	

The PAGE LENGTH field specifies the length in bytes of the diagnostic parameters that follow this field. If the application client sends a page length that results in the truncation of any parameter, the device server shall terminate the command with CHECK CONDITION status. The sense key shall be set to ILLEGAL REQUEST with the additional sense code set to INVALID FIELD IN PARAMETER LIST.

The diagnostic parameters are defined for each diagnostic page code. The diagnostic parameters within a diagnostic page may be defined differently in a SEND DIAGNOSTIC command than in a RECEIVE DIAGNOSTIC RESULTS command.

Annex C Numeric order codes

Add a new table with this information.

Table 4 — Diagnostic page codes

Page Code	Diagnostic Page Name	Device types
00h	Supported Diagnostic Pages	All except R - Simplified Direct-access Device
01h	Configuration	E - Enclosure Services Device
02h	Enclosure Status/Control	E - Enclosure Services Device
03h	Help Text	E - Enclosure Services Device
04h	String In/Out	E - Enclosure Services Device
05h	Threshold In/Out	E - Enclosure Services Device
06h	Obsolete	E - Enclosure Services Device
07h	Element Descriptor	E - Enclosure Services Device
08h	Short Enclosure Status	E - Enclosure Services Device
09h	Enclosure Busy	E - Enclosure Services Device
0Ah	Device Element Status	E - Enclosure Services Device
0Bh	Sub-enclosure Help Text	E - Enclosure Services Device
0Ch	Sub-enclosure String In/Out	E - Enclosure Services Device
0Dh	Supported SES Diagnostic Pages	E - Enclosure Services Device
0Eh - 0Fh	Reserved for SES	E - Enclosure Services Device
10h - 2Fh	Reserved for SES	E - Enclosure Services Device
40h	Translate Address In/Out	D - Direct Access Block Device O - Optical Memory Block Device W - Write-Once Block Device
41h	Device Status In/Out	
80h - FFh	Vendor specific	
All codes not shown are reserved.		

Editor's Note 1: The following command sets define no special diagnostic pages: SSC-2, SMC-2, MMC-4, OSD, RBC, ADC, SCC-2, MSC. None of the obsolete SCSI-2 era device types had any either.

Suggested changes to SES-2

6 Parameters for enclosure services devices

6.1 Diagnostic parameters

6.1.1 Diagnostic parameters overview

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 in SPC-3. All diagnostic pages have the diagnostic page header defined in SPC-3, including the PAGE CODE and PAGE LENGTH fields.

The PAGE CODE field identifies the diagnostic page being sent or requested. The page codes are defined in table 18.

Table 5 — Diagnostic page codes for enclosure service devices

Page code	Description	Control or status	Reference
00h	Supported Diagnostic Pages	Status	SPC-3
01h	Configuration diagnostic page	Status	6.1.2
02h	Enclosure Control diagnostic page	Control	6.1.3
	Enclosure Status diagnostic page	Status	6.1.4
03h	Help Text diagnostic page	Status	6.1.2
04h	String Out diagnostic page	Control	6.1.3
	String In diagnostic page	Status	6.1.4
05h	Threshold Out diagnostic page	Control	6.1.8
	Threshold In diagnostic page	Status	6.1.9
06h	Obsolete	N/A	
07h	Element Descriptor diagnostic page	Status	6.1.10
08h	Short Enclosure Status diagnostic page	Status	6.1.11
09h	Enclosure Busy diagnostic page	Status	6.1.12
0Ah	Device Element Status diagnostic page	Status	6.1.13
0Bh	Sub-enclosure Help Text diagnostic page	Status	6.1.2
0Ch	Sub-enclosure String Out diagnostic page	Control	6.1.3
	Sub-enclosure String In diagnostic page	Status	6.1.4
0Dh-0Fh	Reserved for ~~SES~~ this standard	N/A	6.1
10h-1Fh	Vendor-specific SES diagnostic pages	N/A	6.1
20h-2Fh	Reserved for this standard	N/A	6.1
~~20h~~30h-3Fh	Reserved ~~(applies to all device type pages)~~for all device types	N/A	SPC-3
40h-7Fh	See specific device type for definition; reserved for the SES device type	N/A	SPC-3
80h-FFh	Vendor-specific pages	N/A	SPC-3

Suggested changes to SFF-8067

Editor's Note 2: These changes are not to a T10 standard but are included here for reference.

7. Mapping of SCSI command to Enclosure Service Interface operation

This section provides an overview of the proper mapping between the enclosure services commands defined by the SCSI-3 Enclosure Services command set (SES) and the enclosure services interface defined by this specification. Section 7.1, describing the SCSI command definitions, is informative. Future revisions to the

SES may modify the functions and formats communicated across the SCSI interface. The ESI interface functions defined in Sections 7.2 and the mechanisms relating the ESI and SCSI interfaces defined in Sections 7.3 and 7.4 are normative. Section 7.5 describing the ASC/ASCQs for such devices is informative.

7.1 Brief review of SCSI command set (informative)

The enclosure services device model is defined SES. The device model allows commands accessing enclosure services information to be sent to any type of device. In addition, the model defines the capability of accessing the same information through a special enclosure services device type that can be run on a target and logical unit independent of any other SCSI device.

The commands used by all devices for the transmission of enclosure services information are the SEND DIAGNOSTIC and RECEIVE DIAGNOSTIC RESULTS commands. The SEND DIAGNOSTIC command transmits pages of information to the device for transfer to the enclosure across the interface defined by SFF-8067. The RECEIVE DIAGNOSTIC RESULTS command requests pages of information from the device, which the device must obtain from the enclosure across the interface defined by SFF-8067.

The SCSI commands obey all the normal rules for SCSI commands, including disconnection and tagged queuing. The CDB formats for the commands are shown in Figure 7-1 and Figure 7-2.

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FIGURE 7-1 SCSI RECEIVE DIAGNOSTIC RESULTS CDB (reference)

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FIGURE 7-2 SCSI SEND DIAGNOSTIC CDB (reference)

The PF (Page Format) bit is 1 for a SEND DIAGNOSTIC command that transmits information to an enclosure.

The SES standard defines the following page codes for transmitting information to and from an enclosure. The content of the pages is specified by SES.

TABLE 7-1 PAGE CODES DEFINED FOR ESI AND NON-ESI FUNCTIONS

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Add the following information to table 7-1 and make section 7.1 normative rather than informative. Consider dropping information from 7.1 that is already covered by SPC-3 and SES-2.

Table 6 — Page codes for ESI

SCSI diagnostic page code	Description
00h	Handled by the device
01h - 2Fh	Passed through to ESI with the same page code
30h - FFh	Handled by the device

The general format of a page as defined by the SCSI-3 Primary Command document is shown in Table 7-2.

TABLE 7-2 DIAGNOSTIC PAGE FORMAT

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The Page Length contains the count of the SES parameters that will be provided. The actual length of the page is 4 greater than the value specified by the Page Length, since the header is not counted in the Page Length.

7.2 Definition of command bytes for enclosure (normative)

If a SCSI device receives one of the SCSI diagnostic commands with a page code value between 01h and ~~0Fh~~ 2Fh, it prepares the proper information for transmission to the enclosure in a command phase. The

command phase is composed of 4 bytes, as defined in Table 7-3. The command phase is always clocked with -DSK_WR.

TABLE 7-3 ESI COMMAND PHASE INFORMATION

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The page code specifies the SES page that is to be transferred to or from the enclosure.

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7.3 Transmission of SEND DIAGNOSTIC pages to enclosure (normative)

When an SFF-8067 SCSI device receives a SEND DIAGNOSTIC command, it examines the CDB to determine the allocation length and to determine that the PF (Page Format) bit is set. If these conditions are met, it obtains at least 4 bytes of the parameters and examines the diagnostic page header. If the page code value is from 01h to ~~0Fh~~ 2Fh inclusive, the device prepares to communicate with the enclosure by executing a Discovery phase. SEND DIAGNOSTIC commands that do not involve enclosure activity are handled by the SCSI device according to the requirements of the SCSI SPC standard.

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7.4 Transmission of RECEIVE DIAGNOSTIC RESULTS from enclosure (normative)

When an SFF-8067 SCSI device receives a RECEIVE DIAGNOSTIC RESULTS command, it examines the CDB to determine the allocation length and the requested page code. If the page code is from 01h to ~~0Fh~~ 2Fh, inclusive, the device prepares to communicate with the enclosure by executing a Discovery phase.

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If the Discovery phase determines that the enclosure is an SFF-8067 compliant enclosure and responding correctly, the device begins transmission of the ESI Command phase.

TABLE 7-4 SPECIAL STATUS PAGE FORMAT FOR SFF-8045 PARALLEL ESI

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The ESI Command transmits the page code ~~extracted from~~ specifed by the SCSI CDB page code field to the enclosure. The ESI command transmits the SEND bit with a 0 value to the enclosure.

For the RECEIVE DIAGNOSTIC RESULTS command, the parameter length field shall be 0.

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