

memorandum



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To
INCITS T10 Committee

From
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Subject
Report Element Information

Date
23 April, 2007

Revision History

Revision 0 – Initial document. split off from 06-046r1

Revision 1 – Changes from September 2006 T10

Changed to 16 Byte CDB to reuse number of elements concept from RES and removed "SINGLE" bit

Updated to SMC3r04

Completed element characteristics page

Added element state page

Revision 2 – Moved Page Code field in CDB

Corrected Opcode in CDB table and command table

Removed complete descriptors requirement and added note about difference from RES

Added requirement that element address be ignored if the supported pages list is requested

Renamed Element Characteristics page to Element Static Information page

Added requirement for supported pages order in return data

Added length fields to pages with fixed length descriptors

Removed "Offline" concept and all bits – disabled with UA's will be used instead

Added Import and Operator Intervention bits to element state

Change Exception Cause field to ASC/ASCQ as in RES

Added support column to page code list

Revision 3 – Changes requested in Feb. 2007 T10 meeting

Moved "see SPC-3" for allocation and control field to the correct location.

Changed ELEMENT TYPE CODE field to reference 6.10.1 directly

Moved truncated descriptors not an error statement to normative text in allocation length description

Wording corrections on supported element information pages description

Moved location of single supported pages descriptor for each element type requirement

Changed return data to allow grouping of elements by starting address and number of elements

Changed location length descriptor to 4 bytes and location parameter length to 4 bytes

Removed list of proposed location types

Corrected location of PARAMETERS LENGTH in element location descriptor.

Changed supported volume types list to supported volume types parameters

Added ability to report a supported volume type as read only when in the described data transfer element

Added a volume index to the state information.

Related Documents

smc3r04 – SCSI Media Changer Commands - 3 revision 04

spc3r23 – SCSI Primary Commands -3 revision 23

Background

The Read Element Status command is used by applications to describe which elements of a media changer device are full and empty. Some information about the element compatibility has been added to the Read Element Status command in SMC and other information is provided using various vendor unique methods. Some of the characteristics that are currently reported in vendor unique methods are medium type, and element location which are frequently returned in a vendor specific section at



New sub-clause 6.x:

(Note: existing sub-clauses 6.x and above shift to become 6.x+1 and above with the addition of this new sub-clause)

6.x REPORT ELEMENT INFORMATION command

6.x.1 REPORT ELEMENT INFORMATION command introduction

The REPORT ELEMENT INFORMATION command (see table y) requests information pages that describe an element or a set of elements.

Table y – REPORT ELEMENT INFORMATION command

Bit Byte	7	6	5	4	3	2	1	0
0	OPERATION CODE (9Eh)							
1	Reserved			SERVICE ACTION (10h)				
2	PAGE CODE							
3	Reserved				ELEMENT TYPE CODE			
4	(MSB)	STARTING ELEMENT ADDRESS						(LSB)
5								
6	(MSB)	NUMBER OF ELEMENTS						(LSB)
7								
8	Reserved							
9	Reserved							
10	(MSB)							(LSB)
11								
12	ALLOCATION LENGTH							
13								
14	Reserved							
15	CONTROL							

See SPC-3 for the definition of the OPERATION CODE field and the SERVICE ACTION field. The OPERATION CODE and SERVICE ACTION fields shall be set to the values shown in table y.

The PAGE CODE field specifies the element information page requested (see table y+1) by the application client. If the device server detects a PAGE CODE field set to an unsupported value, it shall terminate the command with CHECK CONDITION status, with the sense key set to ILLEGAL REQUEST, and the additional sense code set to INVALID FIELD IN CDB.

See 6.10.1 for the definition of the ELEMENT TYPE CODE field

The STARTING ELEMENT ADDRESS field specifies the lowest element address to report. Only elements with an element type code selected by the ELEMENT TYPE CODE field, and an element address greater than or equal to the value specified in the STARTING ELEMENT ADDRESS field shall be reported. The device server shall not report element information descriptors for undefined element addresses. If the PAGE CODE field is set to 00h (i.e., Supported Element Information Pages), then the STARTING ELEMENT ADDRESS field shall be ignored.

The NUMBER OF ELEMENTS field specifies the maximum number of elements to be reported. The value specified by this field is not the range of element addresses to be considered for reporting but rather the number of defined elements to report. If the PAGE CODE field is set to 00h (i.e., Supported Element Information Pages), then the NUMBER OF ELEMENTS field shall be ignored.

See SPC-3 for the definition of the ALLOCATION LENGTH field. If the descriptors are truncated because of the allocation length this shall not be considered an error.

See SPC-3 for the definition of the CONTROL field.



Table y+1: Element Information Page Codes

PAGE CODE	Definition	Reference	Support
00h	Supported Element Information Pages	6.x.2	Mandatory
01h	Supported Volume Types	6.x.3	Optional
02h	Element Location	6.x.4	Optional
03h	Element Static Information Page	6.x.5	Optional
04h	Element State	6.x.6	Mandatory
05h-7Eh	Reserved		
7Fh	Return All Supported Pages	6.x.7	Optional
80h-FFh	Vendor Specific		

6.x.2 Supported Element Information Pages

The Supported Element Information Pages information page (see Table y+2) returns the list of element information pages supported by the device server for the element type specified in the REPORT ELEMENT INFORMATION command.

Table y+2: Supported Element Information Pages format

Bit Byte	7	6	5	4	3	2	1	0	
0	PAGE CODE (00h)								
1	Reserved								
2	(MSB)	PAGE LENGTH (n-3)							
3	(LSB)								
Supported pages descriptors									
4	First supported pages descriptor (see table y+3)								
⋮									
n	Last supported pages descriptor (see table y+3)								

The PAGE CODE field contains the number of the element information page that is being transferred.

The value in the PAGE LENGTH field is the length in bytes of the supported pages descriptors that follow. If the descriptors are truncated because of the allocation length, the PAGE LENGTH field shall not be affected.

One supported pages descriptor shall be returned for each selected element type. Supported pages descriptors shall be returned in ascending order by element type code and supported page code.



Table y+3: Supported Pages Descriptor

Bit	7	6	5	4	3	2	1	0
Byte								
0	Reserved				ELEMENT TYPE CODE			
1	Reserved							
2	(MSB)	DESCRIPTOR LENGTH (n-3)						
3							(LSB)	
4	Supported element information page code list							
n								

The ELEMENT TYPE CODE field shall contain the element type code for the element type that supports the following list of pages.

The value in the DESCRIPTOR LENGTH field is the length in bytes of the data that follows. If the descriptor is truncated because of the allocation length, the DESCRIPTOR LENGTH field shall not be affected.

The supported element information page code list contains a list of element information page codes (see table y+1) implemented by the logical unit for the specified element type code in ascending order beginning with page code 00h.

6.x.3 Supported Volume Types

Table y+4 shows the format of the Supported Volume Types information page.

Table y+4: Supported Volume Types page format

Bit	7	6	5	4	3	2	1	0
Byte								
0	PAGE CODE (01h)							
1	Reserved							
2	(MSB)	PAGE LENGTH (n-3)						
3							(LSB)	
	Supported volume types descriptors							
4	First supported volume types descriptor (see table y+5)							
	⋮							
n	Last supported volume types descriptor (see table y+5)							

The PAGE CODE field contains the number of the element information page that is being transferred.

The value in the PAGE LENGTH field is the length in bytes of the supported volume types descriptors that follow. If the descriptors are truncated because of the allocation length, the PAGE LENGTH field shall not be affected.



Table y+5: Supported Volume Types Descriptor

Bit Byte	7	6	5	4	3	2	1	0
0	(MSB) _____ STARTING ELEMENT ADDRESS _____ (LSB)							
1								
2	(MSB) _____ NUMBER OF ELEMENTS _____ (LSB)							
3								
4	Reserved				ELEMENT TYPE CODE			
5	Reserved							
6	(MSB) _____ PARAMETERS LENGTH (n-7) _____ (LSB)							
7								
Supported volume types parameters								
8	First supported volume type parameter (See table y+6) : : : Last supported volume type parameter (See table y+6)							
11								
n-1								
n								

The STARTING ELEMENT ADDRESS field indicates the lowest element address being reported.

The NUMBER OF ELEMENTS field indicates the number of contiguous elements with element addresses greater than or equal to the value specified in the STARTING ELEMENT ADDRESS field, and with the same set of supported volume type parameters.

The ELEMENT TYPE CODE field shall contain the element type code for the element being described.

The PARAMETERS LENGTH field is the length in bytes of the parameter data to follow. If the data is truncated because of the allocation length, the PARAMETERS LENGTH field shall not be affected.

The supported volume types parameters indicate the volume types that may be moved to or from the specified element. Table y+6 shows the supported volume type parameter format.

Table y+6: Supported volume type parameter format

Bit Byte	7	6	5	4	3	2	1	0
0	VOLUME TYPE							
1	VOLUME QUALIFIER							
2	Reserved							RO
3	Reserved							

See 5.4 for the definition of the VOLUME TYPE field and the VOLUME QUALIFIER field.

If the ELEMENT TYPE CODE field is set to set to 4h (e.g. Data transfer element) an RO bit set to one indicates that this volume type is read only when moved to the specified data transfer element. If the ELEMENT TYPE CODE field is set to set to 4h an RO bit set to zero indicates that this volume type is not read only when moved to the specified data transfer element. The RO bit shall be set to zero for all other element types.

If the device server is unable to determine the volume types supported by the specified element, the unknown volume type shall be returned. If all volume types supported by the device may be moved to or from the element described, the device server may return all types. If all volume qualifiers for a volume type supported by the device may be moved to or from the element described, the device server may return the all qualifiers qualifier for that volume type.



6.x.4 Element Location

Table y+7 shows the format of the Element Location page.

Table y+7: Element Location page format

Bit Byte	7	6	5	4	3	2	1	0
0	PAGE CODE (02h)							
1	Reserved							
2	(MSB)	PAGE LENGTH (n-3)						(LSB)
3								
Element location descriptors								
4	First element location descriptor (see table y+8)							
	⋮							
n	Last element location descriptor (see table y+8)							

The PAGE CODE field contains the number of the element information page that is being transferred.

The value in the PAGE LENGTH field is the length in bytes of the element location descriptors that follow. If the descriptors are truncated because of the allocation length, the PAGE LENGTH field shall not be affected.

Table y+8: Element Location Descriptor format

Bit Byte	7	6	5	4	3	2	1	0
0	(MSB)	STARTING ELEMENT ADDRESS						(LSB)
1								
2	(MSB)	NUMBER OF ELEMENTS						(LSB)
3								
4	Reserved				ELEMENT TYPE CODE			
5	Reserved							
6	(MSB)	PARAMETERS LENGTH (n-9)						(LSB)
9								
Location parameters								
10	First element location parameter (see table y+9)							
	⋮							
n	Last element location parameter (see table y+9)							

The STARTING ELEMENT ADDRESS field indicates the lowest element address being reported.

The NUMBER OF ELEMENTS field indicates the number of contiguous elements with element addresses greater than or equal to the value specified in the STARTING ELEMENT ADDRESS field and with the same set of location parameters.

The ELEMENT TYPE CODE field shall contain the element type code for the element being described.

The PARAMETERS LIST LENGTH field is the length in bytes of the data to follow. If the data is truncated because of the allocation length, the PARAMETERS LIST LENGTH field shall not be affected.



The LOCATION PARAMETERS COUNT field shall contain a count of the location parameters to follow.

The location parameters list contains a list of location parameters for the specified element.

Table y+9 shows the element location parameter format.

Table y+9: Element location parameter format

Bit	7	6	5	4	3	2	1	0	
Byte									
0	(MSB)	ELEMENT LOCATION LENGTH (w-3)							(LSB)
3									
4	Reserved				CODE SET				
5	LOCATION TYPE CODE								
w bytes	LOCATION								

The ELEMENT LOCATION LENGTH field indicates the length in bytes of the element location data to follow.

The CODE SET field indicates the code set used for the LOCATION field in the element location descriptor. The CODE SET is described in table y+9. This field is intended to be an aid to software that displays the LOCATION field.

Table y+10 – CODE SET field

Code	Description
0h	Reserved
1h	The LOCATION field shall contain binary values.
2h	The LOCATION field contains ASCII printable characters (i.e., code values 20h through 7Eh)
3h	The LOCATION field contains UTF-8 codes (see SPC-3)
4h-Eh	Reserved
Fh	The LOCATION field contains an ASCII representation of a decimal value (i.e., code values 30h through 39h, 2Dh through 2Eh)

Comment: Code Fh allows for returning a decimal value in ASCII format so no special handling is required for decimal points or positive/negative. The decimal point and negative sign are allowed characters. Code Fh was used so that SPC can assign meaning to values 4h-Eh before this table conflicts.

The LOCATION TYPE CODE field indicates which type of location value the device server returns in the LOCATION field. Table y+11 defines the location type codes.

Table y+11 – LOCATION TYPE CODE values

LOCATION TYPE CODE	Description
00-EFh	Reserved
F0h-FFh	Vendor specific

Comment: We could define values for some common locations such as magazine, module, cabinet, row, column, panel, drawer.

The LOCATION field reports a vendor specified location value of the type specified in the LOCATION TYPE CODE field using the CODE SET specified in the Element Location Identifier header.

6.x.5 Element Static Information Page

Comment: this page is intended to be used for reporting static characteristics about an element that can be described in a True/False manner or in a few bits.

Table y+12 shows the format of the Element Static Information page.



Table y+12: Element Static Information page format

Bit	7	6	5	4	3	2	1	0
Byte								
0	PAGE CODE (03h)							
1	Reserved							
2	(MSB)	DESCRIPTOR LENGTH						(LSB)
3								
4	Reserved							
5	Reserved							
6	(MSB)	PAGE LENGTH (n-7)						(LSB)
7								
Element static data descriptors								
4	First element static data descriptor (see table y+13)							
	⋮							
n	Last element static data descriptor (see table y+13)							

The PAGE CODE field contains the number of the element information page that is being transferred.

The value in the PAGE LENGTH field is the length in bytes of the element static data descriptors that follow. If the descriptors are truncated because of the allocation length, the PAGE LENGTH field shall not be affected.

The DESCRIPTORS LENGTH field shall contain the length of each element static data descriptor. The DESCRIPTORS LENGTH shall be a multiple of 4. The element static data descriptors shall be zero padded.

Table y+13: Element Static Data Descriptor format

Bit	7	6	5	4	3	2	1	0
Byte								
0	(MSB)	STARTING ELEMENT ADDRESS						(LSB)
1								
2	(MSB)	NUMBER OF ELEMENTS						(LSB)
3								
4	Reserved				ELEMENT TYPE CODE			
5	Reserved	RMV	VRT	MDO	ECBD	IESTOR	EXP	
6	Reserved							
n	Reserved							

The STARTING ELEMENT ADDRESS field indicates the lowest element address being reported.

The NUMBER OF ELEMENTS field indicates the number of contiguous elements with element addresses greater than or equal to the value specified in the STARTING ELEMENT ADDRESS field and with the same ELEMENT TYPE CODE field, RMV field, VRT field, MDO field, EDBD field, IESTOR field, and EXP field values.

The ELEMENT TYPE CODE field shall contain the element type code for the element being described.

A removable (RMV) bit set to one indicates that the specified element is end user removable and may not always be installed. An RMV bit set to zero indicates that the specified is not end user removable.

A virtual (VRT) bit set to one indicates that the specified element is a virtualized element that is being emulated by a device outside the scope of this standard. A VRT bit set to zero indicates that the specified element is not a virtualized element.



A moves during operation (MDO) bit set to one indicates that the physical position of the specified element is not fixed and the element moves during normal operation. A MDO bit set to zero indicates that the physical position of the specified element is fixed and the element does not move during normal operation.

An element could be disabled (ECBD) bit set to one indicates that the specified element is capable of being disabled and may not always be accessible. An ECBD bit set to zero indicates that the specified element is not capable of being disabled.

An import/export or storage (IESTOR) bit set to one indicates that the specified element is configurable as either an import/export element or as a storage element. An IESTOR bit set to zero indicates that the specified element is not configurable as an import/export element or as a storage element. If the IESTOR bit is set to one the ECBD bit shall be set to one.

An expansion (EXP) bit set to one indicates that the specified element is in an expansion module that has not yet been purchased or licensed and the element is not accessible. An EXP bit set to zero indicates that the specified element is not in an expansion module that has not yet been purchased or licensed and the element may be accessible. If the EXP bit is set to one the ECBD bit shall be set to one.

6.x.6 Element State

Comment: this page is intended to be used for reporting the current state of an element

Table y+14 shows the format of the Element State page.

Table y+14: Element State page format

Bit Byte	7	6	5	4	3	2	1	0
0	PAGE CODE (04h)							
1	Reserved							
2	(MSB) _____		DESCRIPTOR LENGTH				_____ (LSB)	
3								
4	Reserved							
5	Reserved							
6	(MSB) _____		PAGE LENGTH (n-7)				_____ (LSB)	
7								
Element state descriptors								
8	_____		First element state descriptor (see table y+15)				_____	
	⋮							
n	_____		Last element state descriptor (see table y+15)				_____	

The PAGE CODE field contains the number of the element information page that is being transferred.

The value in the PAGE LENGTH field is the length in bytes of the element state descriptors that follow. If the descriptors are truncated because of the allocation length, the PAGE LENGTH field shall not be affected.

The DESCRIPTORS LENGTH field shall contain the length of each element state descriptor. The DESCRIPTORS LENGTH shall be a multiple of 4. The element state descriptors shall be zero padded.



Table y+15: Element State Descriptor format

Bit	7	6	5	4	3	2	1	0
Byte								
0	(MSB) STARTING ELEMENT ADDRESS (LSB)							
1								
2	(MSB) NUMBER OF ELEMENTS (LSB)							
3								
4	Reserved				ELEMENT TYPE CODE			
5	IVALID	IMP	OIR	FULL	ED	RMVD	EXCPT	ACCESS
6	ADDITIONAL SENSE CODE							
7	ADDITIONAL SENSE CODE QUALIFIER							
8	(MSB) VOLUME INDEX (LSB)							
9								
10	Reserved							
n								

The STARTING ELEMENT ADDRESS field indicates the lowest element address being reported.

The NUMBER OF ELEMENTS field indicates the number of contiguous elements with element addresses greater than or equal to the value specified in the STARTING ELEMENT ADDRESS field and with the same ELEMENT TYPE CODE field, IMP field, OIR field, FULL field, ED field, RMVD field, EXCPT field, ACCESS field, ADDITIONAL SENSE CODE field, and ADDITIONAL SENSE CODE QUALIFIER field values.

The ELEMENT TYPE CODE field shall contain the element type code for the element being described.

An index valid (IVALID) bit set to one indicates that the volume index field is valid. An IVALID bit set to zero indicates that the volume index field is not valid.

An IMP bit set to one indicates that the medium in this element was not present during the previous scan and was not moved to this element by the medium changer (e.g. a user bulk load or medium inserted into import/export element). An IMP bit set to zero indicates that the medium in this element was present during the previous scan, was moved to this element by the medium changer, or the previous scan results are not known .

An operator intervention required (OIR) bit set to one indicates that operator intervention is required to make the element accessible (e.g. a mailslot or access panel must be closed). An OIR bit set to zero indicates that operator intervention is not required. If the OIR bit is set to one the ED bit shall be set to one and the ACCESS bit shall be set to zero.

A FULL bit set to one indicates that the specified element contains a volume. A FULL bit set to zero indicates that the specified element does not contain a volume.

An element disabled (ED) bit set to one indicates that the specified element is disabled and is not accessible. An ED bit set to zero indicates that the specified element is not disabled and may be accessible. Support of the ED bit set to one is required for device servers that have elements which may be disabled. If the ED bit is set to one the ACCESS bit shall be set to zero.

A removed (RMVD) bit set to one indicates that the specified element has been removed and is not accessible. A RMVD bit set to zero indicates that the specified element is present and may be accessible. If the RMVD bit is set to one the ED bit shall be set to one and the ACCESS bit shall be set to zero.

An exception (EXCPT) bit set to one indicates that an exception has occurred at the specified element. An EXCPT bit set to zero indicates that no exception has occurred at the specified element or any previous exception has been cleared. If the EXCPT bit is set to one the ACCESS bit shall be set to one if the element is still accessible and shall be set to zero if the element is not accessible. If the EXCPT bit is set to one the additional sense code and additional sense code qualifier fields shall contain additional information about the exception.

An accessible (ACCESS) bit set to one indicates that access to the specified element by a medium transport element is allowed. An ACCESS bit set to zero indicates that access to the specified element by a medium transport element is not allowed. Support for the ACCESS bit set to one is mandatory.



The ADDITIONAL SENSE CODE field may provide additional information about the specified element. The values in this field are as defined for the ADDITIONAL SENSE CODE field of REQUEST SENSE command response data (see SPC-3). This field shall be set to 00h if there is no additional sense information available.

The ADDITIONAL SENSE CODE QUALIFIER field may provide more detailed additional information about the specified element. The values in this field are as defined for the ADDITIONAL SENSE CODE QUALIFIER field of REQUEST SENSE command response data (see SPC-3). This field shall be set to 00h if there is no additional sense code qualifier information available.

If the specified element contains a volume, the VOLUME INDEX field may contain a device server assigned index value which may be used with the REPORT VOLUME INFORMATION command to retrieve information about the volume in the specified element. The device server shall report the same volume index value for the volume in the specified element when that volume is in any element. If the INVALID bit is zero the VOLUME INDEX field shall be ignored. If any event occurs which causes the volume index values to change (e.g. a bulk load door is opened), the device server shall establish a unit attention (see SAM-4) condition for every I_T nexus with the additional sense code set to VOLUME INDEX VALUES CHANGED.

Comment: An additional sense code value for VOLUME INDEX VALUES CHANGED does not yet exist.

Comment: The above paragraph should just refer to the REPORT VOLUME INFORMATION command for the definition of the volume index value but that command does not yet exist.

Comment:

The following characteristics can or previously could be reported in READ ELEMENT STATUS but are not represented here.

- Primary Voltag – media information
- Secondary Voltag – media information
- Source Valid – media information
- Source Address – media information
- Invert – media information
- Medium Type – media information
- VPD Identifier – could be here but covered by “REPORT DTD ELEMENT INQUIRY”
- Import Enable – believed obsolete
- Export Enable – believed obsolete
- On Bus – Could be good information but needs different format from SCSI-2 RES command
- Address – Similar to on bus – would need updated format
-

6.x.7 Return All Supported Pages

If the Return All Supported Pages information page code is requested the device server shall return all of the pages supported by the elements selected by the STARTING ELEMENT ADDRESS field and the ELEMENT TYPE CODE field in ascending order by page code (i.e. all page code 01h pages will be returned before any page code 02h pages).