

# memorandum



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**To** INCITS T10 Committee  
**From** Curtis Ballard, HP  
**Subject** Report Volume Information

**Date** ~~86 January, 2008~~ April, 2009

## Revision History

Revision 0 – Initial document

Revision 1 – Changes from May 2008 Face to Face

Revision 2 – Filled in all of the return data pages to return values as decided at the face to face meetings.

Revision 3 – Changes from September 2008 face to face

Revision 4 – Changes from January 2009 teleconference

## Related Documents

smc3r11 – SCSI Media Changer Commands - 3 revision 11

spc3r23 – SCSI Primary Commands -3 revision 23

## Background

This command is a companion to 08-066, Report Element Information. Full background is available in that proposal.

This document proposes the second half of a change to SMC-3 that creates two new media changer commands, "REPORT ELEMENT INFORMATION" and "REPORT VOLUME INFORMATION" which will provide an alternate method to retrieve all of the information currently returned by "READ ELEMENT STATUS". These new commands will provide a mechanism that allows for easier extension in the future and allows selective or all inclusive retrieval of the data. Following the standardization of these commands "READ ELEMENT STATUS" may be deprecated.

The "REPORT VOLUME INFORMATION" command specified in this proposal reports data pages containing information about a volume in a medium changer element. Using the page code mechanism to select information pages about an element allows an application client to select only the information it needs at the time and to get back only that information rather than the monolithic data block used by Read Element Status. By using this command an application client can determine information about a volume in a medium changer element.

The Read Element Status mechanism for specifying a starting element address and number of elements is leveraged for this command as well as the element type filter to allow requesting information on a single element or range of elements of a specific type or all elements of all types.

In the May 2008 meeting the working group suggested that a new command or page should be defined that will report static information about a volume type capability so this version removes characteristics that would be common for all volumes of a given type.

In the proposed changes that follow, new text appears in blue or purple, deleted text appears in ~~red~~, and editorial comments appear in green.

## Proposed Changes to SMC-3

Changes to 3.1:

**3.1.x Mounted:** mounted is a state of a volume where the volume is in a data transfer device element and the data transfer device is physically capable of processing commands that cause the media in the volume to be moved.

**3.1.x volume code:** A combination of the volume type code and the volume qualifier code (see 5.4).

Changes to 6.1:

Table 6 has the following addition (the entire table is not reproduced here):

Command	Operation Code	Type	Reference
REPORT VOLUME INFORMATION	9Eh/11h <sup>a</sup>	O	6.x

Changes to 6.2:

Table 7 has the following addition (the entire table is not reproduced here):

REPORT VOLUME INFORMATION (CDATA = 0)	Conflict	Conflict	Conflict	Allowed	Conflict	Conflict
REPORT VOLUME INFORMATION (CDATA = 1)	Allowed	Allowed	Allowed	Allowed	Allowed	Allowed

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 VOLUME INFORMATION command**

**6.x.1 REPORT VOLUME INFORMATION command introduction**

The REPORT VOLUME INFORMATION command (see table y) requests information pages that describe a volume or a set of volumes.

**Table y – REPORT VOLUME INFORMATION command**

Bit Byte	7	6	5	4	3	2	1	0
0	OPERATION CODE (9Eh)							
1	Reserved			SERVICE ACTION (11h)				
2	PAGE CODE							
3	CDATA	Reserved		VAT	Reserved	MEDIUM TYPE		
4	(MSB) REQUESTED VOLUME TYPE (LSB)							
5								
6	(MSB) FIRST VOLUME ADDRESS (LSB)							
7								
8	(MSB) NUMBER OF VOLUMES (LSB)							
9								
10	(MSB) ALLOCATION LENGTH (LSB)							
11								
12								
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 volume 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, then 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.

**Table y + 1: Volume Information Page Codes**

Page code	Definition	Reference	Support
00h	Supported volume information pages	6.x.2	Mandatory
01h	Volume static information	6.x.3	Mandatory
02h	Volume state	6.x.4	Mandatory
03h	Volume tag information	6.x.5	Optional
04h	Volume bus identifier	6.x.6	Optional
05h-7Eh	Reserved		
7Fh	Return all supported pages	6.x.6	Mandatory
80h-FFh	Vendor specific		

If the cached data (CDATA) bit is set to one, then the device server shall return the requested volume information page using cached volume information and shall not cause device motion. The device server shall support the cdata bit set to one. If the CDATA bit is set to zero, then the device server may cause device motion to validate the volume information (e.g., perform an inventory scan or other actions). The device server shall support the CDATA bit set to zero. If the CDATA bit is set to zero and

device motion is required to report a requested volume information page, but the media changer is not capable of performing the device motion, then the device server shall terminate the command with CHECK CONDITION status, with the sense key set to NOT READY, and the additional sense code shall specify the reason for NOT READY. If the CDATA bit is set to one and the device server does not have the cached volume information required to report a requested volume information page, then the device server shall terminate the command with CHECK CONDITION status, with the sense key set to NOT READY and the additional sense code shall specify the reason for NOT READY.

If the volume address type (VAT) bit is set to one, then the FIRST VOLUME ADDRESS field contains a volume index (see 6.x.x). If the VAT bit is set to zero, then the FIRST VOLUME ADDRESS field contains an element address.

The MEDIUM TYPE field specifies the type(s) of medium selected for reporting by this command. The medium type codes are defined in table 26. If the medium type selected is type 0h, (i.e., Unspecified), then all medium types are selected for reporting by this command.

Comment: Do we need to modify the definition of medium type code 0h in table 26 which currently states: "Unspecified. The media changer does not support this field, cannot determine the medium type, or the element is empty"?

The REQUESTED VOLUME TYPE field specifies the volume code (see 3.1.X) selected for reporting by this command.

The FIRST VOLUME ADDRESS field specifies the address of the first volume to report using the address type specified in the VAT field. Only volumes with a medium type code selected by the MEDIUM TYPE CODE field, a volume code selected by the REQUESTED VOLUME TYPE field, and a volume address numerically greater than or equal to the value specified in the FIRST VOLUME ADDRESS field shall be reported. 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 VOLUMES field specifies the maximum number of volumes to be reported. Pages shall only be reported for defined volume addresses. Undefined volume addresses shall not be reported and shall not be counted in the number of volumes reported. If the PAGE CODE field is set to 00h (i.e., Supported Element Information Pages), then the NUMBER OF VOLUMES field shall be ignored.

Volumes selected by the STARTING VOLUME field and the NUMBER OF VOLUMES field shall be reported once per volume in ascending order by volume address.

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

See SAM-3 for a description of the CONTROL byte.

### **6.x.2 Supported volume information pages**

The Supported volume information pages volume information page (see table y + 2) returns the list of volume information pages supported by the device server for the volumes with the volume type code specified by the REQUESTED VOLUME TYPE field in the REPORT VOLUME INFORMATION command. If all volume types are specified, then the device server shall return one supported pages descriptor for each volume type.

**Table y + 2: Supported volume information pages**

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

The PAGE CODE field shall be set to the value shown in table y + 2.

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

One supported pages descriptor shall be returned for each selected volume type. Supported pages descriptors shall be returned in ascending order by VOLUME TYPE CODE. If all volume types support the same set of pages, a single descriptor with the volume code set to 00h (all types) may be returned.

Comment: It may not make sense to return a list of supported pages by volume type since this command doesn't have a lot of optional pages that may vary by volume type but it will depend on what we decide to do with the volume type concept and if we want to future proof to allow the possibility of mixed media libraries with very different volume types (maybe mixed optical and tape media) and some potential new pages defined in the future that may describe characteristics unique to a particular volume type.

Comment 2: It has been recommended that this be a list of supported optional pages. That would be more efficient but I'm not aware of precedence for a supported pages page that doesn't list all supported pages.

**Table y + 3: Supported pages descriptor**

Bit Byte	7	6	5	4	3	2	1	0
0	VOLUME TYPE CODE							
1	Reserved							
2	(MSB)	PAGE CODE LIST LENGTH (n-3)						(LSB)
3								
4	Supported volume information page code list							
n								

The VOLUME TYPE CODE field shall contain the volume type code (see 5.4) for the volume type that supports the following list of pages. All volumes with the same volume type code shall support the same set of volume information pages.

The value in the PAGE CODE LIST LENGTH field is the length in bytes of the supported volume information page code list. If the descriptor is truncated because of the allocation length, then the PAGE CODE LIST LENGTH field shall not be affected.

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

**6.x.3 Volume static information**

The volume static information volume information page (see table y + 4) returns a set of volume characteristics that are defined as static and were established:

- a) when the media was manufactured;
- b) when the media was formatted; or
- c) by vendor specific means.

**Table y + 4: Volume static information page**

Bit Byte	7	6	5	4	3	2	1	0
0	PAGE CODE (01h)							
1	Reserved							
2	(MSB)	DESCRIPTOR LENGTH						(LSB)
3								
4	Reserved							
5								
6	(MSB)	PAGE LENGTH (n-9)						(LSB)
9								
Volume static information descriptors								
10	First volume static information descriptor (see table y + 5)							
	⋮							
n	Last volume static information descriptor (see table y + 5)							

The PAGE CODE field shall be set to the value shown in table y + 4.

The DESCRIPTOR LENGTH field shall contain the length of each volume static information descriptor. The DESCRIPTOR LENGTH shall be a multiple of 4. The volume static information descriptors shall be zero padded.

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

One volume static information descriptor shall be returned for each selected volume. Volume static information descriptors shall be returned in ascending order by element address.

**Table y + 5: volume static information descriptor**

Bit Byte	7	6	5	4	3	2	1	0
0	(MSB) VOLUME IDENTIFIER							
1	(LSB)							
2	Reserved	SIGU	VSLBE		VSMAMA	MEDIUM TYPE		
3	Reserved				CAE	VS NV	BCV	
4	REPORTED VOLUME TYPE							
5	Reserved							
6	Reserved							
15	Reserved							
16	BARCODE							
47	Reserved							
48	VOLUME SERIAL NUMBER							
79	Reserved							

If the volume address type (VAT) bit in the CDB is set to one, then the VOLUME IDENTIFIER field contains a volume index (see 6.x.x). If the VAT bit is set to zero, then the VOLUME IDENTIFIER field contains an element address.

A serial number is globally unique (SIGU) bit set to one indicates that the value reported in the VOLUME SERIAL NUMBER field is globally unique. A SIGU bit set to zero indicates that the value reported in the VOLUME SERIAL NUMBER field is not known to be globally unique.

The volume supports logical block encryption (VSLBE) field reports the logical block encryption support for the volume being reported. See table y + 6 for the VSLBE field values

**Table y + 6: VSLBE field values**

MOUNTED	Description
00b	Unknown
01b	The volume supports encrypting and decrypting the data within logical blocks (see SSC-3)
10b	The volume does not support encrypting and decrypting the data within logical blocks (see SSC-3)
11b	Reserved

Comment: can we reference SSC-3 for logical blocks or do we need to pull that definition into here since the DTD may not be a tape device?

A volume supports medium auxiliary memory attributes (VSMAMA) bit set to one indicates that the volume supports medium auxiliary memory attributes (see SPC-3). A VSMAMA bit set to zero indicates that the volume does not support medium auxiliary memory attributes. If a volume supports medium auxiliary attributes, then an application client may access the medium auxiliary attributes when the volume is in a data transfer device that supports the READ ATTRIBUTE command (see SPC-3) and the WRITE ATTRIBUTE command (see SPC-3).

See 6.x.1 for the definition of the MEDIUM TYPE field.

The configured to allow encryption (CAE) field indicates whether the volume is configured to allow encrypting and decrypting of the data within logical blocks. See table y+12 for the CAE field values.

A volume serial number valid (VS NV) bit set to one indicates that the value in the VOLUME SERIAL NUMBER field is valid. A VS NV bit set to zero indicates that the value in the VOLUME SERIAL NUMBER field is not valid.

A barcode valid (BCV) bit set to one indicates that the value in the BARCODE field is valid. A BCV bit set to zero indicates that the value in the BARCODE field is not valid.

The REPORTED VOLUME TYPE field indicates the volume code (see 3.1.X) of the volume being reported.

The BARCODE field contains 32 bytes of left-aligned ASCII data (see SPC-3) identifying the value from the barcode on the volume. If the barcode value is not known, then the device server shall return ASCII spaces (20h) in this field. This field is valid only if the BCV bit is set to one.

The VOLUME SERIAL NUMBER field contains 32 bytes of left-aligned ASCII data (see SPC-3) identifying the serial number of the volume. If the volume serial number value is not known, then the device server shall return ASCII spaces (20h) in this field. This field is valid only if the MSNV bit is set to one.

**6.x.4 Volume state**

The volume state information page (see table y + 7) returns the current state of a set of volume characteristics that are not defined as static and may change.

**Table y + 7: Volume state page**

Bit Byte	7	6	5	4	3	2	1	0
0	PAGE CODE (02h)							
1	Reserved							
2	(MSB)	DESCRIPTOR LENGTH						(LSB)
3								
4	Reserved							
5								
6	(MSB)	PAGE LENGTH (n-9)						(LSB)
9								
Volume state descriptors								
10	First volume state descriptor (see table y + 8)							
	⋮							
n	Last volume state descriptor (see table y + 8)							

The PAGE CODE field shall be set to the value shown in table y + 7.

The DESCRIPTOR LENGTH field shall contain the length of each volume state information descriptor. The DESCRIPTOR LENGTH shall be a multiple of 4. The volume state information descriptors shall be zero padded.

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

One volume state information descriptor shall be returned for each selected volume. Volume state information descriptors shall be returned in ascending order by element address volume identifier.



**Table y + 8: volume state information descriptor**

Bit Byte	7	6	5	4	3	2	1	0
0	(MSB) _____ ELEMENT ADDRESS _____ (LSB)							
1								
2	<del>WRITE PROTECT</del> Reserved	<del>MOUNTED</del> WRITE-PROTECT	<del>CEP</del> MOUNTED		<del>CEA</del> CAE			
3	Reserved		INVERT	SEAV	ECV	NCR	MBE	
4	(MSB) _____ SOURCE STORAGE ELEMENT ADDRESS _____ (LSB)							
5								
6	Reserved							
7								

The ELEMENT ADDRESS field indicates the element address of the media changer element that contains the volume being reported.

The WRITE PROTECT field indicates whether the volume is write protected. See table y+9 for the WRITE PROTECT field values.

**Table y + 9: WRITE PROTECT field values**

WRITE PROTECT	Description
00b	Unknown
01b	The device server has detected that the last data transfer device reported that the volume was write protected. If the write protection was temporary, then the volume may not be write protected when it is loaded into another data transfer device.
10b	The device server has detected that the last data transfer device reported that the volume was not write protected.
11b	Reserved

The MOUNTED field indicates whether the volume is mounted (see 3.1.X). See table y+10 for the MOUNTED field values.

**Table y + 10: MOUNTED field values**

MOUNTED	Description
00b	Unknown
01b	The volume is mounted.
10b	The volume is not mounted
11b	Reserved

The contains encrypted data (CED) field indicates whether the volume contains at least one encrypted logical block (see SSC-3). See table y+11 for the CED field values.

**Table y + 11: CED field values**

CED	Description
00b	Unknown
01b	The volume contains at least one encrypted logical block.
10b	The volume does not contain any encrypted logical blocks.
11b	Reserved

The configured to allow encryption (CAE) field indicates whether the volume is configured to allow encrypting and decrypting of the data within logical blocks. See table y+12 for the CAE field values.

**Table y + 12: CAE field values**

<b>CAE</b>	<b>Description</b>
00b	Unknown
01b	The volume does not support encrypting and decrypting of the data within logical blocks.
10b	The volume is configured to allow encrypting and decrypting of the data within logical blocks.
11b	The volume is configured to prohibit encrypting and decrypting of the data within logical blocks.

An INVERT bit set to one indicates that the volume has been inverted by MOVE MEDIUM or EXCHANGE MEDIUM operations since it was last in the SOURCE STORAGE ELEMENT ADDRESS. An INVERT bit set to zero indicates that the volume has not been inverted by MOVE MEDIUM or EXCHANGE MEDIUM operations since it was last in the SOURCE STORAGE ELEMENT ADDRESS.

A source element address valid (SEAV) bit set to one indicates that the SOURCE STORAGE ELEMENT ADDRESS field is valid. A SEAV bit set to zero indicates that the SOURCE STORAGE ELEMENT ADDRESS field is not valid.

An expired cleaning volume (ECV) bit set to one indicates that the device server has detected that the volume is an expired cleaning volume. An ECV bit set to zero indicates that the device server has not detected that the volume is an expired cleaning volume or that the device server does not support detection of expired cleaning volumes. How the device server detects that the volume is an expired cleaning volume is beyond the scope of this standard.

A no capacity remaining (NCR) bit set to one indicates that the device server has detected that the volume has passed a device server determined capacity threshold (e.g., the data transfer device includes an SSC-3 compliant device server and the logical position has passed the early warning position). A no capacity remaining (NCR) bit set to zero indicates that the device server has not detected that the volume has passed a device server determined capacity threshold or that the device server does not support capacity detection.

A may be exported (MBE) bit set to one indicates that the volume may be exported (i.e., moved to an import/export element). A MBE bit set to zero indicates that the volume may not be exported.

The SOURCE STORAGE ELEMENT ADDRESS field provides the address of the last storage element this unit of media occupied. This field is valid only if the SEAV bit is set to one.

**6.x.5 Volume tag information page**

Table y + 13 shows the format of the Volume tag information page.

**Table y +13: Volume tag information page**

Bit Byte	7	6	5	4	3	2	1	0
0	PAGE CODE (03h)							
1	Reserved							
2	(MSB)	DESCRIPTOR LENGTH						(LSB)
3								
4	Reserved							
5								
6	(MSB)	PAGE LENGTH (n-9)						(LSB)
9								
Volume tag information descriptors								
10	First volume tag information descriptor (see table y + 15)							
	⋮							
n	Last volume tag information descriptor (see table y + 15)							

The PAGE CODE field shall be set to the value shown in table y + 14.

The DESCRIPTOR LENGTH field shall contain the length of each volume tag information descriptor. The DESCRIPTOR LENGTH shall be a multiple of 4. The volume tag information descriptors shall be zero padded.

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

One volume tag information descriptor shall be returned for each selected volume. Volume tag information descriptors shall be returned in ascending order by element address.

**Table y + 15: volume tag information descriptor**

Bit Byte	7	6	5	4	3	2	1	0
0	Reserved							
1	Reserved						EAV	IVALID
3	(MSB)	VOLUME INDEX						(LSB)
4								
5	(MSB)	ELEMENT ADDRESS						(LSB)
6								
7	Reserved							
8								
16	PRIMARY VOLUME TAG INFORMATION							
51								
52	ALTERNATE VOLUME TAG INFORMATION							
87								

An element address valid (EAV) bit set to one indicates that the value reported in the ELEMENT ADDRESS field is valid. An EAV bit set to zero indicates that the value reported in the ELEMENT ADDRESS field is not valid.

See 6.x.5 for the definition of the IVALID bit and the VOLUME INDEX field.

The ELEMENT ADDRESS field indicates the address of the element that contains the volume being reported. The ELEMENT ADDRESS field is not part of the static information and is used to provide a way to identify the volume being reported in libraries that do not support the VOLUME INDEX field. This field is only valid if the EAV bit is set to one.

The PRIMARY VOLUME TAG INFORMATION field and the ALTERNATE VOLUME TAG INFORMATION field provide identifying information for this volume (see 5.3).

**6.x.6 Volume bus address**

Table y + 14 shows the format of the Volume Bus Address page.

**Table y + 14: Volume bus address page**

Bit	7	6	5	4	3	2	1	0	
Byte									
0	PAGE CODE (02h)								
1									
÷	Reserved								
5									
6	(MSB)	PAGE LENGTH (n-9)							
9									
	Volume bus address descriptors								
10	First volume bus address descriptor (see table y + 9)								
	⋮								
	⋮								
n	Last volume bus address descriptor (see table y + 9)								

The PAGE CODE field shall be set to the value shown in table y + 14.

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

Comment: This page can include information to help the application find where the volume is mounted. It would probably include information like the WWID of the DTD where the volume is mounted and may contain information about whether that DTD device believe it is connected to a transport and maybe information on the transport type if that is useful. It may make more sense to have this page with the element information for the element that contains this volume if this page is useful at all.

Comment 2: A suggestion has been made that this page be dropped. Is "on bus" useful and if so where would it go? It isn't strictly "volume" information since it is really about the data transfer device but that doesn't really fit in "element" information either. It was put here because it is "this volume is mounted at..." information.

**6.x.6 Return all supported pages**

If the Return all supported pages information page code is requested, then the device server shall return all of the pages supported by the volumes selected by the MEDIUM TYPE field in the CDB, the STARTING VOLUME field in the CDB and the REQUESTED VOLUME TYPE field in the CDB in ascending order by page code (i.e. return all page code 01h pages followed by all page code 02h pages, etc).