



To: T10 Technical Committee  
 From: Gary Lestage, Kyle Walczak and Kevin Marks - Dell, Inc.  
 Date: February 27, 2007  
 Subject: T10/06-395r3 - SMC-3: Diagnostic log pages for SMC

### **Revision History**

Revision 0 (8/30/06) – Initial proposal  
 Revision 1 (10/2/06) – changes based on review and reverting back to SPC-3 log structure.  
 Revision 2 (1/09/07) – changes based on the November SMC-3 WG meeting  
 Revision 3 (2/27/07) – changes based on the January SMC-3 WG meeting

### **Related Documents**

SCSI Media Changer Commands - 3 (T10/1730-D - SMC-3r04)

[New text to be added to SMC-3](#)

~~Text to be deleted from SMC-3~~

*Editorial text*

### **Overview**

As part of the ISV feedback resolution and that Dell sees a need to standardize log pages that will allow for the collection of information required during field analysis and troubleshooting of media changer devices. This proposal is beneficial to those applications that report diagnostic information back via diagnostic software. Special code will no longer need to be written specific to the media changer device being used. This proposal defines a media changer diagnostics data log page that contains a collection of sense and diagnostics data used in field analysis and troubleshooting of media changer devices.

### **Suggested Changes to SMC-3:**

*<< Add new row to Table 37 - Log page codes >>*

**Table 37 — Log page codes**

PAGE CODE	DESCRIPTION	REFERENCE
....	....	....
<a href="#">ZZh</a>	<a href="#">Media Changer Diagnostic Data log page</a>	<a href="#">7.2.z</a>
....	....	....

*<< Where ZZh is the assigned log pages. >>*

### **7.2.z Media changer Diagnostic Data log page**

[The Media Changer Diagnostic Data log page \(see table z\) provides for a number of error-event records using the list parameter format. An error-event record contains diagnostic information for an error type encountered by the media changer device including data counters associated with the error event, sense data, operation code/service action, pick, place, barcode reader statistics and initial and target element addresses of move type operations etc. The Media Changer Diagnostic Data log page may be used to aid in field analysis and repair.](#)

The Media Changer Diagnostic Data log page shall only include parameter entries for commands that terminated with a CHECK CONDITION status having the sense key set to NOT READY, HARDWARE ERROR, or ABORTED COMMAND.

<<Editor Note:

*I was asked by the WG to look at including RECOVERED ERROR when the PER bit was set to one in Mode Page 1h, but Mode Page 1h does not apply to MC devices.*

*I was asked by the WG to look at removing NOT READY, but cannot remember why? >>*

The parameter code value associated with an error-event indicates the relative time at which a command terminated with a CHECK CONDITION status. A lower parameter code indicates that the command terminated with a CHECK CONDITION status at a more recent time. The parameter code values returned shall be numbered consecutively from 0000h (i.e., the most recent) up to  $n$ , where  $n$  is the number of current parameter entries. The number of supported parameter entries,  $n$ , is vendor specific.

In each parameter entry (see table z+1) if the REPEAT bit is set to zero, then the parameter entry represents only a single event. If the REPEAT bit is set to one, then the parameter entry represents more than one consecutive events that had the identical values for the DESTINATION ADDRESS field, SENSE KEY field, ADDITIONAL SENSE CODE field and ADDITIONAL SENSE CODE QUALIFIER field in the parameter entry. If the REPEAT bit is set to one in the parameter entry, then other fields in the parameter entry shall be set to the values when the first of the consecutive events that had the identical values for the DESTINATION ADDRESS field, SENSE KEY field, ADDITIONAL SENSE CODE field and ADDITIONAL SENSE CODE QUALIFIER field occurred.

All parameter entries shall be persistent across I T nexus losses, logical unit resets, and power-on. The parameter entries shall not be set to zero or changed with the use of a LOG SELECT command.

**Table z - Media Changer Diagnostic Data log page**

BYTE/BIT	7	6	5	4	3	2	1	0
<u>0</u>	Reserved		PAGE CODE (ZZh)					
<u>1</u>	Reserved							
<u>2</u>	<u>(MSB)</u>		PAGE LENGTH (n-3)					<u>(LSB)</u>
<u>3</u>								
	<u>Media changer diagnostic data log parameters</u>							
<u>4</u>	First media changer diagnostic data log parameter (see table z+1)							
	⋮							
<u>n</u>	Last media changer diagnostic data log parameter (see table z+1)							

See SPC-3 for a description of the PAGE CODE field and PAGE LENGTH field.

The media changer diagnostic data log parameter format is shown in table z+1.

**Table z+1 – Media changer diagnostic data log parameter entry format**

<u>BYTE\BIT</u>	<u>7</u>	<u>6</u>	<u>5</u>	<u>4</u>	<u>3</u>	<u>2</u>	<u>1</u>	<u>0</u>
<u>0</u>	<u>(MSB)</u>							
<u>1</u>	<u>PARAMETER CODE</u>							<u>(LSB)</u>
<u>2</u>	<u>DU (0b)</u>	<u>DS</u>	<u>TSD (0b)</u>	<u>ETC (0b)</u>	<u>TMC (00b)</u>	<u>LBIN(1b)</u>	<u>LP(1b)</u>	
<u>3</u>	<u>PARAMETER LENGTH (n-3)</u>							
<u>4</u>	<u>Reserved</u>							
<u>5</u>	<u>REPEAT</u>	<u>Reserved</u>			<u>SENSE KEY</u>			
<u>6</u>	<u>ADDITIONAL SENSE CODE</u>							
<u>7</u>	<u>ADDITIONAL SENSE CODE QUALIFIER</u>							
<u>8</u>	<u>(MSB)</u>							
<u>11</u>	<u>VENDOR SPECIFIC CODE QUALIFIER</u>							<u>(LSB)</u>
<u>12</u>	<u>(MSB)</u>							
<u>15</u>	<u>PRODUCT REVISION LEVEL</u>							
<u>16</u>	<u>(MSB)</u>							
<u>19</u>	<u>NUMBER OF MOVES</u>							
<u>20</u>	<u>(MSB)</u>							
<u>23</u>	<u>NUMBER OF PICKS</u>							
<u>24</u>	<u>(MSB)</u>							
<u>27</u>	<u>NUMBER OF PICK RETRIES</u>							
<u>28</u>	<u>(MSB)</u>							
<u>31</u>	<u>NUMBER OF PLACES</u>							
<u>32</u>	<u>(MSB)</u>							
<u>35</u>	<u>NUMBER OF PLACE RETRIES</u>							
<u>36</u>	<u>(MSB)</u>							
<u>39</u>	<u>NUMBER OF DETERMINED VOLUME IDENTIFIERS</u>							
<u>40</u>	<u>(MSB)</u>							
<u>43</u>	<u>NUMBER OF UNREADABLE VOLUME IDENTIFIERS</u>							
<u>44</u>	<u>OPERATION CODE</u>							
<u>45</u>	<u>Reserved</u>				<u>SERVICE ACTION</u>			
<u>46</u>	<u>Reserved</u>			<u>MTPE</u>	<u>PKE</u>	<u>PLE</u>	<u>IE</u>	<u>IEE</u>
<u>47</u>	<u>Reserved</u>				<u>MTAV</u>	<u>IAV</u>	<u>LSAV</u>	<u>DAV</u>
<u>48</u>	<u>(MSB)</u>							
<u>49</u>	<u>MEDIUM TRANSPORT ADDRESS</u>							<u>(LSB)</u>
<u>50</u>	<u>(MSB)</u>							
<u>51</u>	<u>INITIAL ADDRESS</u>							
<u>52</u>	<u>(MSB)</u>							
<u>53</u>	<u>LAST SUCCESSFUL ADDRESS</u>							
<u>54</u>	<u>(MSB)</u>							
<u>55</u>	<u>DESTINATION ADDRESS</u>							
<u>56</u>	<u>(MSB)</u>							
<u>:</u>	<u>VOLUME TAG INFORMATION</u>							
<u>:</u>	<u>VOLUME TAG INFORMATION</u>							
<u>91</u>	<u>(LSB)</u>							
<u>92</u>	<u>Reserved</u>				<u>TIMESTAMP ORIGIN</u>			
<u>93</u>	<u>Reserved</u>							
<u>94</u>	<u>Reserved</u>							
<u>99</u>	<u>TIMESTAMP</u>							
<u>100</u>	<u>Vendor specific</u>							
<u>n</u>	<u>Vendor specific</u>							

See SPC-3 for a description of the PARAMETER CODE field.

See SPC-3 for descriptions of the DU bit, DS bit, TSD bit, ETC bit, TMC field, LBIN bit and LP bit. The DU bit, TSD bit, ETC bit, TMC field, LBIN bit and LP bit shall be set to the values shown in table z+1.

The PARAMETER LENGTH field indicates the number of bytes in the media changer diagnostic data log parameter data that follows.

The REPEAT bit set to one indicates this parameter represents more than one consecutive events that had identical values for the DESTINATION ADDRESS field, SENSE KEY field, ADDITIONAL SENSE CODE field, and ADDITIONAL SENSE CODE QUALIFIER field. The REPEAT bit set to zero indicates this parameter represents a single event.

See SPC-3 for descriptions of the SENSE KEY field, ADDITIONAL SENSE CODE field, and ADDITIONAL SENSE CODE QUALIFIER field. The SENSE KEY field, ADDITIONAL SENSE CODE field, and ADDITIONAL SENSE CODE QUALIFIER field shall contain the sense key and additional sense code values of the command that terminated with the CHECK CONDITION status.

The VENDOR SPECIFIC CODE QUALIFIER field is vendor specific. The VENDOR SPECIFIC CODE QUALIFIER may provide additional diagnostics information related to the command that terminated with the CHECK CONDITION status.

See SPC-3 for the descriptions of the PRODUCT REVISION LEVEL field. The PRODUCT REVISION LEVEL field shall contain the product revision level at the time the command terminated with the CHECK CONDITION status.

The NUMBER OF MOVES field contains the number of moves from all elements at the time the command terminated with the CHECK CONDITION status. The NUMBER OF MOVES field is equivalent to the value contained in the Media Changer Statistics log page (7.2.2) with a parameter code of 0000h at the time the command terminated with the CHECK CONDITION status.

The NUMBER OF PICKS field contains the number of picks from all elements at the time the command terminated with the CHECK CONDITION status. The NUMBER OF PICKS field is equivalent to the value contained in the Media Changer Statistics log page (see 7.2.2) with a parameter code of 0001h at the time the command terminated with the CHECK CONDITION status.

The NUMBER OF PICK RETRIES field contains the number of pick retries from all elements at the time the command terminated with the CHECK CONDITION status. The NUMBER OF PICK RETRIES field is equivalent to the value contained in the Media Changer Statistics log page (see 7.2.2) with a parameter code of 0002h at the time the command terminated with the CHECK CONDITION status.

The NUMBER OF PLACES field contains the number of places to all elements at the time the command terminated with the CHECK CONDITION status. The NUMBER OF PLACES field is equivalent to the value contained in the Media Changer Statistics log page (see 7.2.2) with a parameter code of 0003h at the time the command terminated with the CHECK CONDITION status.

The NUMBER OF PLACE RETRIES field contains the number of place retries to all elements at the time the command terminated with the CHECK CONDITION status. The NUMBER OF PLACE RETRIES field is equivalent to the value contained in the Media Changer Statistics log page (see 7.2.2) with a parameter code of 0004h at the time the command terminated with the CHECK CONDITION status.

The NUMBER OF DETERMINED VOLUME IDENTIFIERS field contains the number times the VIQ field (see 5.3.4) in the volume tag information was set to 00h for all element addresses at the time the command terminated with the CHECK CONDITION status. The NUMBER OF DETERMINED VOLUME IDENTIFIERS field is equivalent to the value contained in the Media Changer Statistics log page (see

7.2.2) with a parameter code of 0005h at the time the command terminated with the CHECK CONDITION status.

The NUMBER OF UNREADABLE VOLUME IDENTIFIERS field contains the number times the VIQ field (see 5.3.4) in the volume tag information was set to 02h for all element addresses at the time the command terminated with the CHECK CONDITION status. The NUMBER OF UNREADABLE VOLUME IDENTIFIERS field is equivalent to the value contained in the Media Changer Statistics log page (see 7.2.2) with a parameter code of 0006h at the time the command terminated with the CHECK CONDITION status.

See SPC-3 for descriptions of the OPERATION CODE field and SERVICE ACTION field. The OPERATION CODE field and SERVICE ACTION field if applicable contain the operation code and service action of the command that terminated with the CHECK CONDITION status.

A medium transport positioning error (MTPE) bit set to one indicates that the command terminated with a CHECK CONDITION status because an error occurred during a positioning operation of a medium transport (e.g., an error occurred position the medium transport prior to a pick or place operation). A medium transport positioning error (MTPE) bit set to zero indicates that the command did not terminate with the CHECK CONDITION status because of an error occurring during positioning of a medium transport.

A pick error (PKE) bit set to one indicates that the command terminated with a CHECK CONDITION status because an error occurred during a pick operation by a medium transport. A pick error (PKE) bit set to zero indicates that no error occurred during a pick operation by a medium transport or no pick operation occurred.

A place error (PLE) bit set to one indicates that the command terminated with a CHECK CONDITION status because an error occurred during a place operation by a medium transport. A place error (PLE) bit set to zero indicates that no error occurred during a place operation by a medium transport or no place operation occurred.

An invert error (IE) bit set to one indicates that the command terminated with a CHECK CONDITION status because an error occurred during an invert operation (e.g., volume rotation) by a medium transport. An invert error (IE) bit set to zero indicates that no error occurred during an invert operation by a medium transport or no invert operation occurred.

An import/export error (IEE) bit set to one indicates that the command terminated with a CHECK CONDITION status because an error occurred during an open/close operation of an import/export element. An import/export error (IEE) bit set to zero indicates that no error occurred during an open/close operation of an import/export element or no open/close operation of an import/export element occurred.

For each parameter entry, at most one of the medium transport positioning error (MTPE) bit, pick error (PKE) bit, place error (PLE) bit, invert error (IE) bit, or import/export error (IEE) bit shall be set to one.

A medium transport address valid (MTAV) bit set to one indicates that the MEDIUM TRANSPORT ADDRESS field information in the parameter entry is valid. A medium transport address valid (MTAV) bit set to zero indicates that the MEDIUM TRANSPORT ADDRESS field information in the parameter entry is not valid.

An initial address valid (IAV) bit set to one indicates that the INITIAL ADDRESS field information in the parameter entry is valid. An initial address valid (IAV) bit set to zero indicates that the INITIAL ADDRESS field information in the parameter entry is not valid.

A last successful address valid (LSAV) bit set to one indicates that the LAST SUCCESSFUL ADDRESS field information in the parameter entry is valid. A last successful address valid (LSAV) bit set to zero indicates that the LAST SUCCESSFUL ADDRESS field information in the parameter entry is not valid.

A destination address valid (DAV) bit set to one indicates that the DESTINATION ADDRESS field information in the parameter entry is valid. A destination address valid (DAV) bit set to zero indicates that the DESTINATION ADDRESS field information in the parameter entry is not valid.

If the command that terminated with the CHECK CONDITION status did not require motion by a medium transport element (e.g., not a positioning, pick, place, or invert operation), then the medium transport address valid (MTAV) bit, initial address valid (IAV) bit, last successful address valid (LSAV) bit and destination address valid (DAV) bit shall be set to zero.

Table z+2 describes the contents of the MEDIUM TRANSPORT ADDRESS field and medium transport address valid (MTAV) bit, when the medium transport positioning error (MTPE) bit, pick error (PKE) bit, place error (PLE) bit, invert error (IE) bit, or import/export error (IEE) bit is set to one.

**Table z+2 – MEDIUM TRANSPORT ADDRESS field**

<u>Error</u>	<u>MTAV bit</u>	<u>Field contents</u>
<u>MTPE bit = 1</u>	<u>1</u>	<u>The element address of the medium transport involved in the positioning operation.</u>
<u>PKE bit = 1</u>	<u>1</u>	<u>The element address of the medium transport involved with the pick operation error.</u>
<u>PLE bit=1</u>	<u>1</u>	<u>The element address of the medium transport involved with the place operation error.</u>
<u>IE bit = 1</u>	<u>1</u>	<u>The element address of the medium transport involved with the invert operation error.</u>
<u>IEE bit = 1</u>	<u>0</u>	<u>Field is not valid</u>

Table z+3 describes the contents of the INITIAL ADDRESS field and initial address valid (IAV) bit, when the medium transport positioning error (MTPE) bit, pick error (PKE) bit, place error (PLE) bit, invert error (IE) bit, or import/export error (IEE) bit is set to one.

**Table z+3 – INITIAL ADDRESS field**

<u>Error bit</u>	<u>IAV bit</u>	<u>INITIAL ADDRESS field contents</u>
<u>MTPE bit = 1</u>	<u>0 or 1</u>	<p>The element address which the medium transport was located at, at the time the task entered the enabled task state (see SAM-3) (i.e., the position of the robotics prior to moving to an element address required by the command.)</p> <p>If the medium transport was not at a defined element address and media changer supports the ability to determine the element address closest to the initial location at the time the task entered the enabled task state, then the field should contain that element address. If the element address is not known, then the initial address valid (IAV) bit shall be set to zero.</p>
<u>PKE bit =1</u>	<u>0</u>	Field is not valid
<u>PLE bit=1</u>	<u>0</u>	Field is not valid
<u>IE bit = 1</u>	<u>0</u>	Field is not valid
<u>IEE bit = 1</u>	<u>0</u>	Field is not valid

Table z+4 describes the contents of the LAST SUCCESSFUL ADDRESS field and last successful address valid (LSAV) bit, when the medium transport positioning error (MTPE) bit, pick error (PKE) bit, place error (PLE) bit, invert error (IE) bit, or import/export error (IEE) bit is set to one.

**Table z+4 – LAST SUCCESSFUL ADDRESS field**

<u>Error bit</u>	<u>LSAV bit</u>	<u>LAST SUCCESSFUL ADDRESS field contents</u>
<u>MTPE bit = 1</u>	<u>0 or 1</u>	<p>If the medium transport successfully positioned to an element address as required by the command, then the LAST SUCCESSFUL ADDRESS field contains the last element address that the medium transport successfully positioned to and the last successful address valid (LSAV) bit shall be set to one.</p> <p>If the medium transport did not successfully positioned to an element address from the starting initial address, then the last successful address valid (LSAV) bit shall be set to zero.</p>
<u>PKE bit =1</u>	<u>0</u>	Field is not valid
<u>PLE bit=1</u>	<u>0</u>	Field is not valid
<u>IE bit = 1</u>	<u>0</u>	Field is not valid
<u>IEE bit = 1</u>	<u>0</u>	Field is not valid

Table z+5 describes the contents of the DESTINATION ADDRESS field and destination address valid (DAV) bit, when the medium transport positioning error (MTPE) bit, pick error (PKE) bit, place error (PLE) bit, invert error (IE) bit, or import/export error (IEE) bit is set to one.

**Table z+5 – DESTINATION ADDRESS field**

<u>Error bit</u>	<u>DAV bit</u>	<u>LAST SUCCESSFUL ADDRESS field contents</u>
<u>MTPE bit = 1</u>	<u>1</u>	<u>The element address which the medium transport was positioning to at the time the error occurred.</u>
<u>PKE bit =1</u>	<u>1</u>	<u>The element address which the medium transport was at when the pick operation error occurred.</u>
<u>PLE bit=1</u>	<u>1</u>	<u>The element address which the medium transport was at when the place operation error occurred.</u>
<u>IE bit = 1</u>	<u>1</u>	<u>The element address which the medium transport was at when the invert operation error occurred.</u>
<u>IEE bit = 1</u>	<u>1</u>	<u>The element address of the import/export element where the import/export operation error occurred.</u>

The VOLUME TAG INFORMATION field contains the volume tag information (see 5.3.4) of the volume. If the medium transport positioning error (MTPE) bit, pick error (PKE) bit, place error (PLE) bit or invert error (IE) bit is set to one, then the VOLUME TAG INFORMATION field contains the volume tag information of the volume involved with the error (e.g., the volume that was trying to be picked when the pick operation error occurred.)

See SPC-3 for descriptions of the TIMESTAMP ORIGIN and TIMESTAMP fields. The TIMESTAMP ORIGIN field and TIMESTAMP field contain the timestamp origin and timestamp maintained by the device server at the time the command terminated with the CHECK CONDITION status. If a timestamp is not supported by the device server, the TIMESTAMP ORIGIN and TIMESTAMP fields shall be set to zero.

## 7.2.2 Media changer statistics log page

<<...>>

**Table 40 – Media changer statistics log parameter codes**

<b>PARAMETER CODE</b>	<b>DESCRIPTION</b>
...	...
0004h	Number of Place Retries
0005h	Number of <del>Volume Tags read by the Volume Tag Reader</del> <u>determined volume identifiers (i.e., number of times the volume tag information contains a VIQ field (see 5.3.4) set to 00h)</u>
0006h	Number of <del>invalid Volume Tags returned by the Volume Tag Reader</del> <u>unreadable volume identifiers (i.e., number of times the volume tag information contains a VIQ field (see 5.3.4) set to 02h)</u>
0007h	Number of Library Door Opens
...	...
8000h – FFFFh	Vendor specific
NOTE xx - The exact definition of the data counters is not part of this standard. These counters should not be used to compare products because the products may define the meaning of these counters differently.	