## NVM Express Technical Errata

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| **Errata ID** | **016** |
| **Change Date** | **7/14/2011** |
| **Affected Spec Ver.** | **NVM Express 1.0b** |
| **Corrected Spec Ver.** | |

Submission info

| Name | Company | Date |
|---|---|---|
| Amber Huffman | Intel | 6/30/2011 |
| Peter Onufryk | IDT | 6/30/2011 |

This erratum clarifies that reads of the doorbell registers return vendor specific values.

This erratum adds a status value that indicates that to apply a firmware image a conventional reset is required.

The erratum also corrects several typos in the specification.

Description of the specification technical flaw

***Modify the second paragraph of section 3.1.10 as shown below:***

The host should not read the doorbell registers. If a doorbell register is read, the value returned is ~~undefined~~ vendor specific. Writing a non-existent or unallocated Submission Queue Tail Doorbell has undefined results.

***Modify the second paragraph of section 3.1.11 as shown below:***

The host should not read the doorbell registers. If a doorbell register is read, the value returned is ~~undefined~~ vendor specific. Writing a non-existent or unallocated Completion Queue Head Doorbell has undefined results.

***Modify Figure 15 as shown below:***

**Figure 15: Status Code – Status Code Type Values**

| Value | Description |
|---|---|
| 0h | **Generic Command Status:** Indicates that the command specified by the Command and Submission Queue identifiers in the completion entry has completed. These status values are generic across all command types, and include such conditions as success, opcode not supported, and invalid field. |
| 1h | **Command Specific Status ~~Errors~~:** Indicates a status value ~~an error~~ that is specific to a particular command opcode. These values may indicate additional processing is required. Status values ~~Errors~~ such as invalid firmware image or exceeded maximum number of queues is reported with this type. |
| 2h | **Media Errors:** Any media specific errors that occur in the NVM or data integrity type errors shall be of this type. |
| 3h – 6h | Reserved |
| 7h | **Vendor Specific** |

***Modify Figure 18 as shown below:***

**Figure 18: Status Code – Command Specific Status ~~Errors~~ Values**

| Value | Description | Commands Affected |
|---|---|---|
| 0h | Completion Queue Invalid | Create I/O Submission Queue |
| 1h | Invalid Queue Identifier | Create I/O Submission Queue, Create I/O Completion Queue, Delete I/O Completion Queue, Delete I/O Submission Queue |
| 2h | Maximum Queue Size Exceeded | Create I/O Submission Queue, Create I/O Completion Queue |
| 3h | Abort Command Limit Exceeded | Abort |
| 4h | Reserved | Reserved |
| 5h | Asynchronous Event Request Limit Exceeded | Asynchronous Event Request |
| 6h | Invalid Firmware Slot | Firmware Activate |
| 7h | Invalid Firmware Image | Firmware Activate |
| 8h | Invalid Interrupt Vector | Create I/O ~~Submission~~ Completion Queue |
| 9h | Invalid Log Page | Get Log Page |
| Ah | Invalid Format | Format NVM |
| Bh | Firmware Application Requires Conventional Reset | Firmware Activate |
| ~~Bh~~ Ch – 7Fh | Reserved | |
| 80h - BFh | I/O Command Set Specific | |
| C0 - FFh | Vendor Specific | |

***Modify Figure 19 as shown below:***

**Figure 19: Status Code – Command Specific Status ~~Errors~~ Values, NVM Command Set**

| Value | Description | Commands Affected |
|---|---|---|
| 80h | Conflicting Attributes | Dataset Management, Read, Write |
| 81h - BFh | Reserved | |

***Modify section 5.7.1 as shown below:***

A completion entry is posted to the Admin Completion Queue when the controller has complicated the requested action (specified in the Activate Action parameter). Firmware Activate command specific status values ~~errors~~ are defined in Figure 45.

**Figure 45: Firmware Activate – Command Specific Status ~~Errors~~ Values**

| Value | Description |
|---|---|
| 6h | **Invalid Firmware Slot:** The firmware slot indicated is invalid. This error is indicated if the firmware slot exceeds the number supported. |
| 7h | **Invalid Firmware Image:** The firmware image specified for activation is invalid and not loaded by the controller. |
| Bh | **Firmware Application Requires Conventional Reset:** The operation specified by the Activate Action field completed successfully. However, activation of the firmware image requires a conventional reset. If an FLR or controller reset occurs prior to a conventional reset, the controller shall continue operation with the currently executing firmware image. |

***Modify section 5.1.1 as shown below:***

A completion queue entry is posted to the Admin Completion Queue when the command has been completed and a corresponding completion queue entry has been posted to the appropriate Admin or I/O Completion Queue. Dword 0 of the completion queue entry indicates whether the command was aborted. If the command was successfully aborted, then bit 0 of Dword 0 is cleared to '0'. If the command was not aborted, then bit 0 of Dword 0 is set to '1'.

Command specific status values ~~errors~~ associated with Abort are defined in Figure 27.

**Figure 27: Abort – Command Specific Status ~~Errors~~ Values**

| Value | Description |
|---|---|
| 3h | **Abort Command Limit Exceeded:** The number of concurrently outstanding Abort commands has exceeded the limit indicated in the Identify Controller data structure. |

***Modify the beginning of section 5.2.1 as shown below:***

A completion queue entry is posted to the Admin Completion Queue when there is an asynchronous event to signal to the host. ~~For the Asynchronous Event Request command, there are some Command Specific Errors that are specific to this command that are defined in Figure 28.~~ Command specific status values associated with Asynchronous Event Request are defined in Figure 28.

**Figure 28: Status Code – Command Specific Status ~~Errors~~ Values**

| Value | Description |
|---|---|
| 5h | **Asynchronous Event Request Limit Exceeded:** The number of concurrently outstanding Asynchronous Event Request commands has been exceeded. |

***Modify section 5.3.1 as shown below:***

When the command is completed, the controller shall post a completion queue entry to the Admin Completion Queue indicating the status for the command.

Create I/O Completion Queue command specific status values ~~errors~~ are defined in Figure 35.

**Figure 35: Create I/O Completion Queue – Command Specific Status ~~Errors~~ Values**

| Value | Description |
|---|---|
| 1h | **Invalid Queue Identifier:** The creation of the I/O Completion Queue failed due to an invalid queue identifier specified as part of the command. |
| 2h | **Maximum Queue Size Exceeded:** Software attempted to create an I/O Completion Queue with a number of entries that exceeds the maximum supported by the controller, specified in CAP.MQES. |
| 8h | **Invalid Interrupt Vector:** The creation of the I/O Completion Queue failed due to an invalid interrupt vector specified as part of the command. |

***Modify section 5.4.1 as shown below:***

When the command is completed, the controller shall post a completion queue entry to the Admin Completion Queue indicating the status for the command.

Create I/O Submission Queue command specific status values ~~errors~~ are defined in Figure 39.

**Figure 39: Create I/O Submission Queue – Command Specific Status ~~Errors~~ Values**

| Value | Description |
|---|---|
| 0h | **Completion Queue Invalid:** The Completion Queue identifier specified in the command does not exist. |
| 1h | **Invalid Queue Identifier:** The creation of the I/O Submission Queue failed due an invalid queue identifier specified as part of the command. |
| 2h | **Maximum Queue Size Exceeded:** Software attempted to create an I/O Submission Queue with a number of entries that exceeds the maximum supported by the controller, specified in CAP.MQES. |

***Modify section 5.5.1 as shown below:***

A completion queue entry is posted to the Admin Completion Queue when the indicated I/O Completion Queue has been deleted. Delete I/O Completion Queue command specific status values ~~errors~~ are defined in Figure 41.

**Figure 41: Delete I/O Completion Queue – Command Specific Status ~~Errors~~ Values**

| Value | Description |
|---|---|
| 1h | **Invalid Queue Identifier:** The Queue Identifier specified in the command is invalid. This error is also indicated if the Admin Completion Queue identifier is specified. |

***Modify section 5.6.1 as shown below:***

After all commands issued to the indicated I/O Submission Queue are either completed or aborted, a completion queue entry is posted to the Admin Completion Queue when the queue has been deleted. The completion queue entry shall indicate if commands were aborted. Delete I/O Submission Queue command specific status values ~~errors~~ are defined in Figure 43.

**Figure 43: Delete I/O Submission Queue – Command Specific Status ~~Errors~~ Values**

| Value | Description |
|---|---|
| 1h | **Invalid Queue Identifier:** The Queue Identifier specified in the command is invalid. This error is also indicated if the Admin Submission Queue identifier is specified. |

***Modify section 5.7.1 as shown below:***

A completion queue entry is posted to the Admin Completion Queue if the controller has completed the requested action (specified in the Activate Action field). Firmware Activate command specific status values ~~errors~~ are defined in Figure 45.

**Figure 45: Firmware Activate – Command Specific Status ~~Errors~~ Values**

| Value | Description |
|---|---|
| 6h | **Invalid Firmware Slot:** The firmware slot indicated is invalid or read only. This error is indicated if the firmware slot exceeds the number supported. |
| 7h | **Invalid Firmware Image:** The firmware image specified for activation is invalid and not loaded by the controller. |

***Modify section 5.10.1 as shown below:***

A completion queue entry is posted to the Admin Completion Queue when the log has been posted to the memory buffer indicated in PRP Entry 1. Get Log Page command specific status values ~~errors~~ are defined in Figure 61.

**Figure 61: Get Log Page – Command Specific Status ~~Errors~~ Values**

| Value | Description |
|---|---|
| 9h | **Invalid Log Page:** The log page indicated is invalid. This error condition is also returned if a reserved log page is requested. |

***Modify section 5.13.1 as shown below:***

A completion queue entry is posted to the Admin Completion Queue when the NVM media format is complete. Format NVM command specific status values ~~errors~~ are defined in Figure 89.

**Figure 89: Format NVM – Command Specific Status ~~Errors~~ Values**

| Value | Description |
|---|---|
| Ah | **Invalid Format:** The format specified is invalid. This may be due to various conditions, including:<br>1) specifying an invalid LBA Format number, or<br>2) enabling protection information when there is not sufficient metadata per LBA, or<br>3) enabling metadata to be transferred as part of a separate buffer when there is no metadata supported as part of the format selected, or<br>4) invalid security state (refer to TCG SIIS), etc. |

***Modify section 6.5.1 as shown below:***

When the command is completed, the controller shall post a completion queue entry to the associated I/O Completion Queue indicating the status for the command. If there are any miscompares between the data read from the NVM media and the data buffer provided, then the command fails with a status code of Compare Failure.

Compare command specific status values ~~errors~~ are defined in Figure 108.

**Figure 108: Compare – Command Specific Status ~~Errors~~ Values**

| Value | Description |
|---|---|
| 81h | **Invalid Protection Information:** The Protection Information settings specified in the command are invalid. |

***Modify section 6.6.2 as shown below:***

When the command is completed, the controller shall post a completion queue entry to the associated I/O Completion Queue indicating the status for the command.

Dataset Management command specific status values ~~errors~~ are defined in Figure 115.

**Figure 115: Dataset Management – Command Specific Status ~~Errors~~ Values**

| Value | Description |
|---|---|
| 80h | **Conflicting Attributes:** The attributes specified in the command are conflicting. |

***Modify section 6.8.1 as shown below:***

When the command is completed with success or failure, the controller shall post a completion queue entry to the associated I/O Completion Queue indicating the status for the command.

Read command specific status values ~~errors~~ are defined in Figure 124.

**Figure 124: Read – Command Specific Status ~~Errors~~ Values**

| Value | Description |
|---|---|
| 80h | **Conflicting Attributes:** The attributes specified in the command are conflicting. |
| 81h | **Invalid Protection Information:** The Protection Information settings specified in the command are invalid. |

***Modify section 6.9.1 as shown below:***

When the command is completed with success or failure, the controller shall post a completion queue entry to the associated I/O Completion Queue indicating the status for the command.

Write command specific status values ~~errors~~ are defined in Figure 133.

**Figure 133: Write – Command Specific Status ~~Errors~~ Values**

| Value | Description |
|---|---|
| 80h | **Conflicting Attributes:** The attributes specified in the command are conflicting. |
| 81h | **Invalid Protection Information:** The Protection Information settings specified in the command are invalid. |

***Modify the Captured Slow Power Limit Scale definition in section 2.5.3 as shown below:***

| | | | |
|---|---|---|---|
| 27:26 | RO | 00b | **Captured Slot Power Limit Scale (CSPLS):** Specifies the scale used for the ~~Slow~~ Slot Power Limit Value. |

***Modify the Atomic Write Unit Normal definition in Figure 65 as shown below:***

| | | |
|---|---|---|
| 527:526 | M | **Atomic Write Unit Normal (AWUN):** This field indicates the atomic write size for the controller during normal operation. This field is specified in logical blocks and is a 0's based value. If a write is issued of this size or less, the host is guaranteed that the write is atomic to the NVM with respect to other read or write operations. A value of ~~FFh~~ FFFFh indicates all commands are atomic as this is the largest command size. It is recommended that implementations support a minimum of 128KB (appropriately scaled based on LBA size). |

Disposition log

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|---|---|
| 6/30/2011 | Erratum partial draft circulated. |
| 7/14/2011 | Updates and completion of erratum draft. |
| 8/19/2011 | Erratum ratified. |