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MMC-2 FEATURE SETS

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8.0 Feature Sets

This specification gives the suppliers of C/DVD Logical Units choices, but still reduces the number of options possible. Optional commands in many cases become mandatory due to multiple vendor needs. Thus the inclusion of options is very often not indicative of the actual capabilities the Logical Units will provide.

It is the philosophy of this document to provide only the functionality needed. This minimization of commands works for most environments, but fails when it comes to sets of higher level functionality such as Audio. It is possible for a Logical Unit to not support Audio. Thus for Logical Units to be compliant with this specification would need to make the audio commands optional. This would allow a Logical Unit to support only some of the Audio commands, when what is necessary is that either all or none of the commands for Audio need to be supported.

Thus this specification uses "Feature Sets". Each feature is in itself optional, but when a feature is implemented all the commands defined for the set shall be implemented. There are also other capabilities that shall be implemented with each feature set. These will include such items as Mode Sense/Select pages and specific options to other commands. The section describing each of the feature sets will detail the specifics of these other capabilities.

8.1 Feature sets currently defined

- Core Features support
- CD Audio support
- Embedded Changer support
- Packet SMART support
- Event Status Notification support
- Media Event Status Notification support (Persistent Prevent)
- Key Management support
- Digital Output support
- Sequential CD Recordable support
- Sequential DVD Recordable support
- Random Recordable support

8.2 Core Features

The commands in this feature set shall be implemented by all C/DVD Logical Units.

8.3 CD Audio

C/DVD Logical Units that have an analog audio output port and that can play media that contain audio tracks, shall support all of the normal C/DVD commands with the addition of the commands specified by "Table 18 - Audio Play Feature Set Commands" on page 82. In addition the Mode Pages specified in "Table 19 - Audio Play Feature Set Mode Pages" on page 82 shall be supported.

To allow a method for the Host Computer to determine if audio operations are supported, an C/DVD Logical Unit responding to a PLAY AUDIO command which has a transfer length of zero, with CHECK CONDITION status, and setting the sense key to ILLEGAL REQUEST does not support audio operations.

Table 18 - Audio Play Feature Set Commands

Command Description	Opcode
PAUSE/RESUME	4Eh
PLAY AUDIO (TU)	45h
PLAY AUDIO MSF	47h
SCAN	EAh
STOP PLAY / SCAN	4Eh

Table 19 - Audio Play Feature Set Mode Pages

Page Description	Page Code
CD Audio Control Mode Page	0Eh

8.4 Embedded Changer support

For more information on changers, see the description of the Changer Model.

Table 20 - Changer Feature Set Commands

Command Description	Opcode
LOAD/UNLOAD C/DVD	A6h

8.5 Packet SMART support

The S.M.A.R.T. (Self-Monitoring, Analysis and Reporting Technology) is a technology developed to manage the reliability of data storage Logical Units. S.M.A.R.T.-capable PC systems have the goal of enhancing system reliability by warning users of some pending Logical Unit or media failures. With sufficient warning, users may have the opportunity to back up vital data and replace suspect Logical Units prior to data loss or unscheduled down time. S.M.A.R.T. capability is a key new element in the PC architecture that will one day provide new levels of data integrity and data availability.

Peripheral data storage Logical Units are complex electromechanical Logical Units and, as such, can suffer performance degradation or failure due to a single event or a combination of events. Some events are immediate and catastrophic while others cause a gradual degradation of the Logical Unit's ability to perform. It is possible to predict a portion of the failures, but S.M.A.R.T. cannot and will not predict all future Logical Unit failures. S.M.A.R.T. should be treated as a feature to assist the computer user in preventing some but not all system down time due to Logical Unit failure.

S.M.A.R.T. capable Logical Units monitor a wealth of information internal to the Logical Unit to assess reliability and predict an impending Logical Unit or medium failure. This information is, in some cases, available through the interface and can be presented to end-users via drivers and supporting applications. This data should not be presented to or interpreted by system users or managers to predict the integrity or reliability of a S.M.A.R.T. Logical Unit. The predictive algorithms in a S.M.A.R.T. Logical Unit are designed to interpret internal conditions in order to detect impending failures and thus users or system managers should not attempt to predict impending Logical Unit failure from this internal data.

S.M.A.R.T. data are not linear predictors of the degrading reliability of a S.M.A.R.T. capable Logical Unit. It is the responsibility of a S.M.A.R.T. Logical Unit to predict an impending failure and report that failure via an Informational Exception Condition.

C/DVD Logical Units that support Self Monitoring Analysis and Reporting, shall support all of the normal C/DVD commands. In addition the Mode Pages specified in "Table 21 - SMART Feature Set Mode Pages" on page 83 shall be supported.

Table 21 - SMART Feature Set Mode Pages

Page Description	Page Code
Informational Exceptions Control Page	1Dh

8.6 Event Status Notification

As it is difficult to synchronously interrupt the host due to lack of industry support for Asynchronous Event Notification, the GET EVENT STATUS NOTIFICATION (GESN) command and Event Status Notification feature provide a method for the host to receive notification of events that are beyond host control.

A logical unit that implements Event Notification shall support the commands as specified in "Table 22 - Event Notification Feature Set Commands" on page 83.

Table 22 - Event Notification Feature Set Commands

Command Description	Opcode
GET EVENT STATUS NOTIFICATION (GESN)	4Ah

In the Polling Mode of Event Notification, the host shall repeatedly issue GESN commands with an immediate bit of 1. The logical unit shall complete these commands upon receipt, supplying the host with information on the most recent event occurrences, as described in the GESN command. If an event occurrence of the class(es) requested is not in the logical unit event queue, the Logical Unit shall complete the GESN command, and shall set the NEA bit to 1. This shall not be deemed an error.

If command queuing is supported, the host may issue a GESN command with an immediate bit of 0. The command shall not complete until an event occurrence of the class(es) requested is either in the event queue, or occurs.

The logical unit shall maintain a separate queue for each class of Event Notification(s) supported. Events that are generated shall be placed at the tail of the event queue. The depth of the queue(s) is vendor specific, although it shall be at least one. If an overflow occurs, the logical unit shall maintain the most recent Events in the queue.

Each GESN command shall report only one event. If multiple Event Classes are requested and multiple events are available, the logical unit shall report the Event in the Event Class with the lowest Notification Class ordinal.

8.7 Media Event Status Notification (MESN) support

A major shortcoming of removable media Logical Units on PC platforms is their inability to report to the host when the user attempts to eject the medium. Currently most removable media Logical Units just eject the medium when the user presses the Eject button, and potentially any data the operating system has not saved to the Logical Unit is lost. Various volume tracking and locking schemes reduce this risk, but do not eliminate it. Using this feature, Logical Units will have a means of communicating to the host that the user wants to eject the medium or has inserted a new medium.

A logical unit that implements Media Event Status Notification shall support the commands as specified in "Table 23 - Media Event Status Notification Feature Set Commands" on page 84.

Table 23 - Media Event Status Notification Feature Set Commands

Command Description	Opcode
GET EVENT STATUS NOTIFICATION	4Ah
PREVENT/ALLOW and the PERSISTENT PREVENT option of the command	1Eh

This section defines a protocol for providing this functionality for removable media Logical Units. The support is enabled using a new bit in the PREVENT / ALLOW command (Persistent Bit), and the media status is retrieved using the GET EVENT STATUS NOTIFICATION command.

When the Persistent Prevent state is entered, the media shall remain locked in the Logical Unit, until the host issues an eject request, or a power on or hard reset condition occurs. The Persistent Prevent state shall be maintained after the

eject request. New media that is inserted into the Logical Unit shall be locked in the Logical Unit after the logical unit reports the NEW MEDIA event. Prior to reporting the NEW MEDIA event, the logical unit may eject media without an explicit eject command from the host. This allows the user to remove incorrectly inserted media without having to wait for host intervention.

While in the Persistent prevent state, the logical unit shall generate Events upon receipt of a User Eject request. The logical unit shall not eject the media on receipt of these requests, if the logical unit has already reported a NEW MEDIA event for this media. When the host receives the Eject Request, and determines that it is safe to eject the medium, an eject command will be issued, at which time the logical unit shall eject the medium.

The logical unit shall only generate MSEN (EJECT REQUEST) events after reporting a MSEN (NEW MEDIA) event, and prior to reporting a MSEN (MEDIA REMOVAL) event for the given media.

8.7.1 Compatibility Considerations

To maintain compatibility with existing BIOS implementations and operating systems, the logical unit shall default to Persistent Prevent disabled. When the host enables the support using the PREVENT ALLOW command, the logical unit shall respond as described in this specification. When the host disables this feature, the logical unit must default to normal operating modes. A power on or hard reset shall cause the logical unit to the default Persistent Prevent state.

If the Logical Unit is unable to maintain media status information across a reset or power cycle, the Logical Unit shall generate a NEW MEDIA event.

Commands must be processed exactly the same as they would be if Persistent Prevent was not enabled. For compatibility reasons, UNIT ATTENTION status conditions must still be returned. However, the logical unit shall not return the UNIT ATTENTION status on a GESN command. For example, if the user inserts a new medium and the logical unit is accessed with a command, the CHECK CONDITION with UNIT ATTENTION shall be reported, but the logical unit shall also report the NEW MEDIA Event with the next available GESN (Media Status) command.

8.7.2 Changer Media Status Operation

If a changer type Logical Unit uses media status operation, it shall use the following variations. If the changer Logical Unit supports individual slot load and unload capability, the slot number(s) exhibiting the media status change shall be reported in the slot fields of the Media Status Event Data. If the changer Logical Unit uses a cartridge load mechanism, the slot fields shall be set to the start and end slot numbers present in the cartridge.

For non-immediate GESN commands, the host shall use exactly one GET EVENT STATUS NOTIFICATION request for the entire changer Logical Unit. The Logical Unit shall respond as indicated in the Asynchronous Operation section above, indicating the slot information in the Request Sense Data as described above.

8.8 Power Management support

A logical unit that implements Power Management shall support the commands as specified in "Table 24 - Power Management Feature Set Commands" on page 85.

Table 24 - Power Management Feature Set Commands

Command Description	Opcode
START/STOP UNIT and the Power Conditions field	1Eh
GET EVENT STATUS NOTIFICATION	4Ah

8.9 Digital Output support

C/DVD Logical Units that have a digital output port, shall support all of the normal C/DVD commands with the addition of the commands specified by "Table 25 - Data Play Feature Set Commands" on page 85.

Table 25 - Data Play Feature Set Commands

Command Description	Opcode
PAUSE/RESUME	4Bh
PLAY CU	ECBh
STOPPLAY/SCAN	4Bh

8.10 Key Management support

C/DVD Logical Units that support Key Management for Digital Movies, shall support all of the normal C/DVD commands with the addition of the commands specified by "Table 26 - Key Management Feature Set Commands" on page 85.

Table 26 - Key Management Feature Set Commands

Command Description	Opcode
REPORT KEY	A2h
SEND KEY	A3h
SET READ AHEAD	A7h

8.11 Sequential CD Recordable support

This capability is not fully described in this specification. See SFF8080 specification for further information.

8.12 Sequential DVD Recordable support

This capability is not yet fully described in this specification. See "Appendix A - Support for DVD-R and DVD-RAM" on page 263 for further information. This capability will be included in this specification in the future.

8.13 Random Recordable support

This capability is not yet fully described in this specification. See SFF8070i specification for further information. This capability will be included in this specification in the future.