

ACS-2

Extended Power Conditions (EPC)

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Revision 7e

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Document Status

| Revision History (part 1 of 1) | | |
|---------------------------------------|---------------|--|
| Rev | Date | Description |
| 0 | June 10, 2008 | 1) Initial Revision |
| 1 | June 16, 2008 | 1) Initial revision posted was the wrong version. This is the 'real' initial revision |
| 2 | July 15, 2008 | 1) Address review comments from June 2008 T13 plenary 2) Added interactions with APM, IDLE IMMEDIATE with unload feature, IDLE command, NV Cache Power Management feature, background operations; 3) Minor formatting changes to tables; 4) Added editors notes to record open issues; 5) Changed 'recovery time' resolution to '1 msec' from '100 msec'; 6) Added more details about the power conditions log |
| 3 | Sept. 3, 2008 | 1) Address review comments from Aug. 2008 T13 plenary 2) Clarify the interaction with 'background activities' to only host-initiated activities, as defined by ATA8-ACS 3) Specify new DCO RESTORE behaviour |
| 4 | Nov. 13, 2008 | 1) Included Standby as an EPC power condition in all EPC subcommands 2) Added 'shall' and 'may' in appropriate places. 3) Removed mention of 'Intialized at time of manufacture' 4) Removed duplicate specifications of what log fields get changed by which command. 5) Added specification for reporting a Recovery time that is larger 65535 msec. 6) Changes for consistency and clarification. |
| 5 | Dec. 4, 2008 | 1) Allow non-zero value at poweron for the Standby timer 2) Minor grammar, spelling and clarification corrections. 3) Specify Power Conditions log contents if EPC feature is not supported. |
| 6 | Feb. 13, 2009 | 1) Synch with T10/09-054 a. Rename 'Idle1' to 'Idle_A', 'idle2' to 'Idle_B', 'Idle3' to 'Idle_C' 2) Clarify reset processing 3) Automatically enable non-zero timers after power-on reset and DCO RESTORE 4) Redesign of all of the subcommands to mat SAT translation easier 5) Minor typographical corrections 6) Removed power condition id from all log entries 7) Changed Standby units to milliseconds, and added reporting in legacy Standby timer units to the log. |

| | | |
|---|---------------|--|
| 7 | March 1, 2009 | <ol style="list-style-type: none"> 1) Made the Power Conditions log not supported if EPC is not supported 2) Moved the Supported, Saveable and Enabled flags in the log 3) Clarified the requirements for starting and stopping the timers. 4) Corrected the handling of hardware and software resets to not change the current power condition. 5) Decided to handle any mapping of the SCSI 'standby_y' state in the SAT-3 standard, and not in this document. 6) Created a new requirement that at time of manufacture, that the Saved and Default settings shall match. This removes any need to handle situations where the Saved settings are not valid. 7) Stated the requirement that if the SET POWER CONDITION TIMER subcommand fails, that no settings shall change. 8) Updated the requirements for DCO 9) Removed the new Normal Returns, in favor of using "Generic Extended Normal Output" instead |
|---|---------------|--|

1 Introduction

This proposal is an attempt to standardize fine grained power management controls. The industry currently has some vendor specific methods.

2 Scope

This is intended for incorporation into ACS-2.

References to sections, tables, etc are to ATA8-ACS revision 6a.

3 Overview

This adds substates (power conditions) to the PM1:Idle power management state, and methods to use and configure their use.

4 Changes to ACS-2

4.1 Changes to clause 2

(No changes)

4.2 Changes to clause 3

(No changes)

4.3 Changes to clause 4

4.3.1 Overview - Changes to the Feature Set Summary Table

Add: Extended Power Conditions (EPC) to the table as Optional for ATA and Prohibited for ATAPI

4.3.2 Security Mode feature set - Changes to the Security Mode Command Actions Table

(No changes)

4.3.3 Long Logical Sector feature set - Block Size By Command Table

(No changes)

4.3.4 (new) Extended Power Conditions (EPC) feature set

The Extended Power Conditions feature set provides a host with additional methods to control the power condition of a device. These methods include:

- a) defining power conditions within the PM1:Idle power management state: Idle_A, Idle_B and Idle_C.
- b) specifying that the device transition to a power condition without delay;
- c) enabling and initializing any of the power condition timers to specify that the device wait for a period of inactivity before transitioning to a specified power condition; and
- d) allowing the host to determine the power condition settings of the device.

The following command-related device properties are mandatory if this feature set is supported:

- a) the SET FEATURES 'Extended Power Conditions' subcommand
- b) the Power Conditions log
- c) additional status values returned by the CHECK POWER MODE command
- d) IDENTIFY DEVICE fields
- e) DCO controls

4.3.4.1 Power conditions

The Idle_A, Idle_B and Idle_C power conditions are within the PM1:Idle power management state. The power conditions shall be ordered from highest power consumption (and shortest recovery time) to lowest power consumption (and longest recovery time) as follows:

Idle_A power >= Idle_B power >= Idle_C power >= PM2:Standby power

Standby is also included as an EPC power condition. The traditional Standby timer may be manipulated using either the EPC subcommands or the IDLE and STANDBY commands. The EPC feature set also defines a default Standby timer value, which may be enabled, disabled, queried, etc. in the same manner as the other EPC power conditions.

Each of these power conditions has a set of current, saved and default settings (See [editors note: Power Conditions log]). Default settings are not modifiable. Default and saved settings shall persist across power-on resets. The current settings shall not persist across power-on resets. At the time of manufacture, the default, saved and current settings in the Power Conditions log shall match.

4.3.4.2 Power condition timers

The device shall have manufacturer specified power-on default settings for the power condition timers. Power condition timers are changeable with the SET FEATURES “Extended Power Conditions” subcommand (see [editors note: set features subcommand]). Configured settings for the timers shall be readable in the Power Conditions log (see [editors note: power conditions log]).

A power condition timer set to zero indicates that the associated power condition is disabled.

The IDENTIFY DEVICE command indicates when this feature set is supported, and when there are power condition timers enabled.

The value of each timer specifies the time after command completion that the device shall wait before transitioning to the power condition if the power condition is enabled. All enabled power condition timers run concurrently.

All power condition timers shall be stopped on acceptance of any command, except for the following commands:

1. CHECK POWER MODES; and
2. EPC Go To Power Condition.

On command completion the enabled timers shall be reinitialized with the current values and started

If a device processes a command while in a power condition, the device may change to a new power condition.

When an enabled timer expires, the device shall transition to the power condition associated with that timer. Timer expirations shall only cause the device to transition from higher power conditions to lower power conditions (e.g., if the standby timer is set to a smaller interval than the Idle_B timer, the device shall remain in the standby condition when the Idle_B timer expires). If the timer expiration qualifies the device to transition to more than one enabled power condition, then the device shall transition to the power condition with the least power consumption.

4.3.4.3 Interaction with resets, commands and other features

On successful processing of a power-on reset, the device shall:

1. stop all EPC timers;
2. copy the Saved Enabled field to the Current Enabled field, for all supported power conditions;
3. copy the Saved Timer field to the Current Timer field, for all supported power conditions; and
4. reinitialize and restart all enabled EPC timers with Current values.

On successful processing of a hardware reset, then the device shall:

1. stop all EPC timers;
2. remain in the current power condition; and
3. reinitialize and restart all enabled EPC timers with Current values.

On successful processing of a software reset or a DEVICE RESET command, the device shall:

1. stop all EPC timers;
2. remain in the current power condition; and
3. reinitialize and restart all enabled EPC timers with Current values.

On successful processing of the IDLE command and if the EPC feature set is supported:

1. in the Standby section of the Power Conditions log, the device shall:
 - a. save the specified Standby timer value as the Current Standby timer; and
 - b. set the Current Enabled field to one;

2. if the device contains cache memory, then the device shall write all cached data to the medium for the device (e.g., as a device does in response to a flush command) prior to entering into any power condition that prevents accessing the media (e.g., before a hard drive stops its spindle motor during transition to the standby power condition);
3. the device shall enter the PM1:Idle state and then:
 - a. if the Idle_A timer is enabled, the device shall immediately enter the Idle_A power condition;
 - b. if the Idle_A timer is disabled and the Idle_B timer is enabled, the device shall immediately enter the Idle_B power condition; or
 - c. if the Idle_A timer is disabled and the Idle_B timer is disabled and the Idle_C timer is enabled, the device shall immediately enter the Idle_C power condition;
 - i. and
4. on completion of the IDLE command, all enabled EPC timers shall be initialized and started.

On successful processing of the IDLE IMMEDIATE command and if the EPC feature set is supported:

1. if the unload feature was selected, the device shall protect itself (see 7.19.2.2). The device shall retain data in the write cache and resume writing the cached data onto the media after receiving a Software Reset, a Hardware Reset, or any new command except IDLE IMMEDIATE with unload feature;
2. if the unload feature was not selected and the device contains cache memory, the device shall write all cached data to the medium for the device (e.g., as a device does in response to a flush command) prior to entering into any power condition that prevents accessing the media (e.g., before a hard drive stops its spindle motor during transition to the standby power condition).
3. the device shall enter the PM1:Idle state and then
 - i. if the Idle_A timer is enabled, the device shall immediately enter the Idle_A power condition;
 - ii. if the Idle_A timer is disabled and the Idle_B timer is enabled, the device shall immediately enter the Idle_B power condition; or
 - iii. if the Idle_A timer is disabled and the Idle_B timer is disabled and the Idle_C timer is enabled, the device shall immediately enter the Idle_C power condition;
 and
4. on completion of the IDLE IMMEDIATE command, all enabled EPC timers shall be initialized and started.

On successful processing of the STANDBY command and if the EPC feature set is supported:

1. in the Standby section of the Power Conditions log, the device shall:
 - a) save the specified Standby timer value as the Current Standby timer; and
 - b) set the Current Enabled value to one;
2. if the device contains cache memory, the device shall write all cached data to the medium for the device (e.g., as a device does in response to a flush command) prior to entering into any power condition that prevents accessing the media (e.g., before a hard drive stops its spindle motor during transition to the standby power condition); and
3. the device shall enter the PM2:Standby state.

On successful processing of the STANDBY IMMEDIATE command and if the EPC feature set is supported:

1. the Standby section of the Power Conditions log shall not be changed;
2. if the device contains cache memory, the device shall write all cached data to the medium for the device (e.g., as a device does in response to a flush command) prior to entering into any power condition that prevents accessing the media (e.g., before a hard drive stops its spindle motor during transition to the standby power condition); and
3. the device shall enter the PM2:Standby state.

The Extended Power Conditions and the Advanced Power Management features are mutually exclusive of each other. All EPC subcommands shall return command aborted if APM is enabled. The SET FEATURES Enable/Disable APM subcommands shall abort if IDENTIFY DEVICE word TBDIDB bit TBD1 is set to one.

If the NV Cache Power Management feature is enabled, the expiration of an EPC timer shall not cause the device to transition to a lower power state until the NV Cache power mode timer expires.

During background activities, all EPC timers shall be paused. On completion of the activity, the EPC timers shall be continued from where they were paused.

5 Changes to clause 5

(No changes)

6 Changes to clause 6

(No changes)

7 Changes to clause 7

7.1.1 SET FEATURES - EFh, Non-Data

7.1.1.1 Feature Set

7.1.1.2 Description

Table 53 - SET FEATURES Feature field definitions (part X of 3)

| Value | Description |
|-------|---|
| TBDSF | Extended Power conditions (See 7.1.1.3) |

7.1.1.3 Extended Power Conditions (EPC)

Subcommand code TBDSF enables, disables, and configures the use of the Extended Power Conditions feature set (see 4.3.4). If the EPC feature is not supported, then the device shall return command aborted.

7.1.1.4 Inputs for SET FEATURES - Extended Power Conditions

| Name | Description |
|--------------|--------------------------------------|
| Feature | TBDSF (set features subcommand code) |
| Count | EPC subcommand dependent |
| LBA | Bit Description |
| | 23:4 EPC subcommand dependent |
| | 3:0 EPC subcommand (See Table 1) |
| Device | Bit Description |
| | 7 Obsolete |
| | 6 Shall be set to one |
| | 5 Obsolete |
| | 4 Transport Dependent - See |
| 3:0 Reserved | |
| Command | 7:0 EFh |

Table 1 - Extended Power Conditions Subcommands

| EPC Subcommand | EPC Subcommand |
|-----------------------|----------------------------------|
| 0h | Restore Power Condition Settings |
| 1h | Go to Power Condition |
| 2h | Set Power Condition Timer |
| 3h | Set Power Condition State |
| 4h .. Fh | Reserved |

Table 2 - Power Condition IDs

| Power Condition ID | Power Condition Name | Description |
|---------------------------|-----------------------------|----------------------------------|
| 00h | Standby | PM2:Standby state |
| 01h..80h | | Reserved |
| 81h | Idle_A | A substate of the PM1:Idle state |
| 82h | Idle_B | A substate of the PM1:Idle state |
| 83h | Idle_C | A substate of the PM1:Idle state |
| 84h .. FEh | | Reserved |
| FFh | All | All EPC power conditions |

7.48.new.1 Restore Power Condition Settings subcommand

On successful completion of this EPC subcommand, the device shall update the Power Conditions log (see [Editors note: section head in Annex A for TBDLOG]) for the selected Power Condition ID(s) as follows:

1. if Default is set to one, then
 - a. copy the Default Timer field to the Current Timer; and
 - b. copy the Default Enabled value to the Current Enabled value;
2. if Default is cleared to zero, then
 - a. copy the Saved Timer field to the Current Timer; and
 - b. copy the Saved Enabled value to the Current Enabled value;

and
3. if Save is set to one and the power condition is saveable, then
 - a. copy the Current Timer field to the Saved Timer; and
 - b. copy the Current enable value to the Saved enable value.

Table 3 - Inputs for Restore Power Condition Settings subcommand

| Name | Description | |
|---------|---|---|
| Feature | TBDSF (set features subcommand code) | |
| Count | Power Condition (see Table 2) | |
| LBA | Bit Description | |
| | 23:7 | Reserved |
| | 6 | Default 1 = Restore from Default settings 0 = Restore from Saved settings |
| | 5 | Reserved |
| | 4 | Save 1 = Save settings on completion 0 = Do not save settings on completion |
| | 3:0 | Subcommand 0h = Restore power condition settings |
| Device | Bit Description 7 Obsolete 6 Shall be set to one 5 Obsolete 4 Transport Dependent - See 6.2.12 3:0 Reserved | |
| Command | 7:0 EFh | |

Normal Outputs

See [Editors note: “Generic Extended Normal Output” in ACS-2]

Error Outputs

If the selected Power Condition is not supported or if Save is set to one and the power condition is not

saveable, then the device shall return command aborted. See [Editors note table 122].

7.48.new.2 Go To Power Condition subcommand

On successful completion of this EPC subcommand, the device shall:

- 1) stop all enabled EPC timers;
- 2) enter the selected EPC power condition after command completion of the SET FEATURES command without having to wait for any timers to expire; and
- 3) the device shall remain in the selected power condition until the device processes the next command or reset.

Table 4 - Inputs for Go To Power Condition subcommand

| Name | Description |
|---------|--|
| Feature | TBDSF (set features subcommand code) |
| Count | Power Condition ID (see Table 2) |
| LBA | Bit Description |
| | 23:4 Reserved |
| | 3:0 Subcommand 1h = Go To Power Condition |
| Device | Bit Description 7 Obsolete 6 Shall be set to one 5 Obsolete 4 Transport Dependent - See 6.2.12 3:0 Reserved |
| Command | 7:0 EFh |

Normal Outputs

See [Editors note "Generic Extended Normal Output" in ACS-2].

Error Outputs

If the Power condition ID is FFh, a reserved value or is not supported, then the device shall return command aborted. See [Editors note: Table 122].

7.48.new.3 Set Power Condition Timer subcommand

On successful completion of this EPC subcommand, the device shall update the Power Conditions log for the selected Power Condition as follows:

1. copy the Timer field to the Current Timer field;
2. if Enable is set to one and the Timer field is non-zero, then enable the Current Timer;
3. if Enable is set to one and the Timer field is zero, then disable the Current Timer;
4. if Enable is cleared to zero, then disable the Current Timer; and
5. if Save is set to one and the Power Condition settings are saveable, then
 - a. copy the Current Timer field to the Saved Timer field; and
 - b. copy the Current Enabled field to the Saved Enabled field..

Table 5 - Inputs for Set Power Condition Timer subcommand

| Name | Description |
|---------|---|
| Feature | TBDSF (set features subcommand code) |
| Count | Power Condition ID (see Table 2) |
| LBA | Bit Description |
| | 23:8 Timer (15:0) |
| | 7:6 Reserved |
| | 5 Enable 1 = Enable the selected power condition 0 = Disable the selected power condition |
| | 4 Save 1 = Save settings on completion 0 = Do not save settings on completion |
| | 3:0 Subcommand 2h = Set Power Condition Timer |
| Device | Bit Description 7 Obsolete 6 Shall be set to one 5 Obsolete 4 Transport Dependent – See 6.2.12 3:0 Reserved |
| Command | 7:0 Efh |

Timer Value

The Timer (15:0) shall be specified in units of 100 milliseconds.

Normal Outputs

See [Editors note “Generic Extended Normal Output” in ACS-2].

Error Outputs

If the Power Condition is invalid or not supported then the device shall return command aborted. If Save is set to one and the selected power condition is not saveable, then the device shall return command aborted. If the

new timer value is not supported, the device shall either set the timer with a modified value or return command aborted. If command aborted is returned, then the device shall make no modifications to the power condition settings. See [Editors note Table 122].

7.48.new.4 Set Power Condition State subcommand

On successful completion of this EPC subcommand, the device shall update the Power Conditions log for the Power Condition(s) as follows:

1. If Enable is set to one, then enable the Current Timer; otherwise disable the Current Timer; and
2. If Save is set to one, then copy the Current Enabled value to the Saved Enabled value.

Table 6 - Inputs for Set Power Condition State subcommand

| Name | Description |
|---------|--|
| Feature | TBDSF (set features subcommand code) |
| Count | Power Condition (see Table 2) |
| LBA | Bit Description |
| | 23:6 Reserved |
| | 5 Enable 1 = Enable the selected power condition 0 = Disable the selected power condition |
| | 4 Save 1 = Save settings on completion 0 = Do not save settings on completion |
| | 3:0 Subcommand 3h = Set Power Condition State |
| Device | Bit Description 7 Obsolete 6 Shall be set to one 5 Obsolete 4 Transport Dependent – See 6.2.12 3:0 Reserved |
| Command | 7:0 Efh |

Normal Outputs

See [Editors note: “Generic Extended Normal Output” in ACS-2].

Error Outputs

If the Power Condition is not valid or not supported, then the device shall return command aborted. If Save is set to one and the selected Power Condition is not saveable, then the device shall return command aborted. See [Editors note Table 122].

7.1.2 Changes to DCO IDENTIFY

| Word | Content |
|--------|---|
| TBDDCO | Command set/feature set supported TBD1 1 = Reporting support for Extended Power Conditions is changeable |

If bit TBD1 of word TBDDCO is set to one, then support for the Extended Power Conditions feature set is changeable.

7.1.3 Changes to DCO SET

| Word | Content |
|--------|--|
| TBDDCO | Command set/feature set supported TBD1 1 = Reporting support for Extended Power Conditions is allowed |

If bit TBD1 of word TBDDCO is cleared to zero, the device shall

- a) disable support for the Extended Power Conditions feature;
- b) change the Log Directory to indicate that the Power Conditions log is not supported;
- c) clear bit TBD1 of word TBDIDA in the IDENTIFY DEVICE data to zero;
- d) clear bit TBD1 of word TBDIDB in the IDENTIFY DEVICE data to zero.

7.1.4 Changes to DCO RESTORE

(add this new paragraph to the Description section of DCO RESTORE)

If a DEVICE CONFIGURATION RESTORE command changes reporting of support for the EPC feature set from not supported to supported then the device shall

- a) set IDENTIFY DEVICE data word TBDIDA bit TBD1 to one;
- b) clear IDENTIFY DEVICE data word TBDIDB bit TBD1 to zero;
- c) change the Log Directory to indicate that the Power Conditions log is supported; and
- d) initialize the Power Conditions log such that the Default, Saved and Current settings match for all power conditions.

7.1.5 Changes to IDENTIFY DEVICE data

If the proposal adds a feature set or command, there should be an addition to the IDENTIFY DEVICE data to indicate both supported and enabled descriptions. Fill in the description in the table and place a description of each bit or word underneath the table.

| Word | O M | S P | F V | Description |
|--|--------|--------|--------|---|
| TBDIDA | M | | F | Supported Settings TBD1 1 = Extended Power Conditions feature set is supported |
| TBDIDB | M | | V | Enabled Settings TBD1 1 = At least one Extended Power Conditions Idle timer is enabled |
| Key: O/M Mandatory/optional requirement. M Support of the word is mandatory. O Support of the word is optional. F/V Fixed/variable content F The content of the field is fixed and does not change. The DCO command may change the value of a fixed field. For removable media devices, these values may change when media is removed or changed. V The contents of the field is variable and may change depending on the state of the device or the commands executed by the device. X The content of the field may be fixed or variable S/P Content applies to Serial or Parallel transport S Serial Transport P Parallel Transport B Both Serial and Parallel Transports N Belongs to a transport other than Serial or Parallel | | | | |

Word TBDIDA, bit TBD 1 shall be set to one if the Extended Power Conditions feature is supported. (See 7.1.1.3)

Word TBDIDB, bit TBD 1 shall be set to one if the Idle_A Timer, Idle_B Timer or Idle_C timers are enabled. If none of these EPC timers are enabled or if the Extended Power Conditions feature is not supported, then word TBDIDB bit TBD1 shall be cleared to zero. (See 7.1.1.3)

7.2 Changes to Normal and Error Outputs

7.2.1 Changes to Normal Outputs

Table 103 - Check Power Mode Normal Output

| Name | Description | | | | | | | | | | | | | | | | | | |
|--------|---|---|-------------|-----|-------------------------------------|-----|--|-----|---|-----|---|-----|---|-----|---|-----|---|-----|--|
| Error | N/A | | | | | | | | | | | | | | | | | | |
| Count | <table border="1"> <thead> <tr> <th data-bbox="376 577 500 604">Value</th> <th data-bbox="500 577 1377 604">Description</th> </tr> </thead> <tbody> <tr> <td data-bbox="376 604 500 640">00h</td> <td data-bbox="500 604 1377 640">Device is in the PM2:Standby state.</td> </tr> <tr> <td data-bbox="376 640 500 701">40h</td> <td data-bbox="500 640 1377 701">Device is in the PM0:Active state, and the NV Cache power mode is enabled and the spindle is spun down or spinning down.</td> </tr> <tr> <td data-bbox="376 701 500 762">41h</td> <td data-bbox="500 701 1377 762">Device is in the PM0:Active state and the NV Cache power mode is enabled and the spindle is spun up or spinning up.</td> </tr> <tr> <td data-bbox="376 762 500 823">80h</td> <td data-bbox="500 762 1377 823">Device is in the PM1:Idle state and Extended Power Conditions feature set is not supported or not enabled</td> </tr> <tr> <td data-bbox="376 823 500 884">81h</td> <td data-bbox="500 823 1377 884">Device is in the PM1:Idle State, and Extended Power Conditions feature set is supported and enabled, and the device is in the Idle_A power condition.</td> </tr> <tr> <td data-bbox="376 884 500 945">82h</td> <td data-bbox="500 884 1377 945">Device is in the PM1:Idle State, and Extended Power Conditions feature set is supported and enabled, and the device is in the Idle_B power condition.</td> </tr> <tr> <td data-bbox="376 945 500 1005">83h</td> <td data-bbox="500 945 1377 1005">Device is in the PM1:Idle State, and Extended Power Conditions feature set is supported and enabled, and the device is in the Idle_C power condition.</td> </tr> <tr> <td data-bbox="376 1005 500 1066">FFh</td> <td data-bbox="500 1005 1377 1066">Device is in the PM0:Active state or PM1:Idle State.</td> </tr> </tbody> </table> | Value | Description | 00h | Device is in the PM2:Standby state. | 40h | Device is in the PM0:Active state, and the NV Cache power mode is enabled and the spindle is spun down or spinning down. | 41h | Device is in the PM0:Active state and the NV Cache power mode is enabled and the spindle is spun up or spinning up. | 80h | Device is in the PM1:Idle state and Extended Power Conditions feature set is not supported or not enabled | 81h | Device is in the PM1:Idle State, and Extended Power Conditions feature set is supported and enabled, and the device is in the Idle_A power condition. | 82h | Device is in the PM1:Idle State, and Extended Power Conditions feature set is supported and enabled, and the device is in the Idle_B power condition. | 83h | Device is in the PM1:Idle State, and Extended Power Conditions feature set is supported and enabled, and the device is in the Idle_C power condition. | FFh | Device is in the PM0:Active state or PM1:Idle State. |
| | Value | Description | | | | | | | | | | | | | | | | | |
| | 00h | Device is in the PM2:Standby state. | | | | | | | | | | | | | | | | | |
| | 40h | Device is in the PM0:Active state, and the NV Cache power mode is enabled and the spindle is spun down or spinning down. | | | | | | | | | | | | | | | | | |
| | 41h | Device is in the PM0:Active state and the NV Cache power mode is enabled and the spindle is spun up or spinning up. | | | | | | | | | | | | | | | | | |
| | 80h | Device is in the PM1:Idle state and Extended Power Conditions feature set is not supported or not enabled | | | | | | | | | | | | | | | | | |
| | 81h | Device is in the PM1:Idle State, and Extended Power Conditions feature set is supported and enabled, and the device is in the Idle_A power condition. | | | | | | | | | | | | | | | | | |
| | 82h | Device is in the PM1:Idle State, and Extended Power Conditions feature set is supported and enabled, and the device is in the Idle_B power condition. | | | | | | | | | | | | | | | | | |
| | 83h | Device is in the PM1:Idle State, and Extended Power Conditions feature set is supported and enabled, and the device is in the Idle_C power condition. | | | | | | | | | | | | | | | | | |
| FFh | Device is in the PM0:Active state or PM1:Idle State. | | | | | | | | | | | | | | | | | | |
| LBA | N/A | | | | | | | | | | | | | | | | | | |
| Device | <p>Bit Description</p> <ul style="list-style-type: none"> 15 Obsolete 14 N/A 13 Obsolete 12 Transport Dependent - See 11:8 Reserved | | | | | | | | | | | | | | | | | | |
| Status | <ul style="list-style-type: none"> 7:6 Transport Dependent - See . 5 Device Fault - See 4 N/A 3 Transport Dependent - See . 2:1 N/A 0 Error - See | | | | | | | | | | | | | | | | | | |

7.2.2 Changes to Error Outputs

None.

Changes to Annex A – Log Definitions

Changes to Table A.2

Add new row:

| Log Number | Log Name | Feature set | R/W | Access |
|------------|------------------|---------------------------|-----|--------|
| TBDLOG | Power Conditions | Extended Power Conditions | RO | GPL |

7.2.3 (new log) Power Conditions Log (TBDLOG)

If the Extended Power Conditions feature set is supported, then this non-volatile log shall be supported. If the Extended Power Conditions feature set is not supported, then this log shall not be supported.

Table 7 - Power Conditions Log

| Word Offset | Data Type | Description |
|-------------|-----------|--|
| 00h | word | <p>Nominal Recovery time from Idle_A to PM0:Active</p> <p>This is the nominal time required to transition from Idle_A to PM0:Active. This time does not include processing time for the command that caused this transition to occur . A value of zero indicates that the nominal recovery time is not specified. A value of FFFFh indicates that the recovery time is greater than or equal to 65535 milliseconds.</p> <p>Measurement Units: 1 millisecond</p> <p>This value shall be preserved over all resets</p> |

| Word Offset | Data Type | Description |
|-------------|-----------|---|
| 01h | word | General Idle_A Power Condition Flags |
| | | Bits Description |
| | | 15 Supported 1= Idle_A power condition is supported 0= Idle_A power condition is not supported |
| | | 14 Saveable 1= Idle_A power condition is saveable 0= Idle_A power condition is not saveable |
| | | 13:0 Reserved |
| 02h | word | Default Idle_A Power Condition Flags |
| | | Bits Description |
| | | 15 Enabled 1= Default Idle_A power condition is enabled 0= Default Idle_A power condition is disabled |
| | | 14:0 Reserved |
| 03h | word | <p>Default Idle_A Timer setting</p> <p>This is the minimum time that the device shall wait after command completion before entering the Idle_A power condition of the PM1:Idle power management state. A value of zero indicates that this power condition is disabled.</p> <p>Measurement Units: 100 milliseconds.</p> |
| 04h | word | Saved Idle_A Power Condition Flags |
| | | Bits Description |
| | | 15 Enabled 1= Saved Idle_A power condition is enabled 0= Saved Idle_A power condition is disabled |
| | | 14:0 Reserved |
| 05h | word | <p>Saved Idle_A Timer setting</p> <p>This is the minimum time that the device shall wait after command completion before entering the Idle_A power condition of the PM1:Idle power management state. A value of zero indicates that this power condition is disabled.</p> <p>Measurement Units: 100 milliseconds</p> |
| 06h | word | Current Idle_A Power Condition Flags |
| | | Bits Description |
| | | 15 Enabled 1= Current Idle_A power condition is enabled 0= Current Idle_A power condition is disabled |
| | | 14:0 Reserved |
| 07h | word | <p>Current Idle_A Timer setting</p> <p>This is the minimum time that the device shall wait after command completion before entering the Idle_A power condition of the PM1:Idle power management state. A value of zero indicates that this power condition is disabled.</p> <p>Measurement Units: 100 milliseconds</p> |
| 08h..0Fh | | Reserved |

| Word Offset | Data Type | Description |
|-------------|-----------|--|
| 10h | word | <p>Nominal Recovery time from Idle_B to PM0:Active</p> <p>This is the nominal time required to transition from Idle_B to PM0:Active. This time does not include processing time for the command that caused this transition to occur . A value of zero indicates that the nominal recovery time is not specified. A value of FFFFh indicates that the recovery time is greater than or equal to 65535 milliseconds.</p> <p>Measurement Units: 1 millisecond</p> <p>This value shall be preserved over all resets</p> |
| 11h | word | General Idle_B Power Condition Flags |
| | | Bits Bits |
| | | 15 Supported 1= Idle_B power condition is supported 0= Idle_B power condition is not supported |
| | | 14 Saveable 1= Idle_B power condition is saveable 0= Idle_B power condition is not saveable |
| | | 13:0 Reserved |
| 12h | word | Default Idle_B Power Condition Flags |
| | | Bits Description |
| | | 15 Enabled 1= Default Idle_B power condition is enabled 0= Default Idle_B power condition is disabled |
| | | 14:0 Reserved |
| 13h | word | <p>Default Idle_B Timer setting</p> <p>This is the minimum time that the device shall wait after command completion before entering the Idle_B power condition of the PM1:Idle power management state. A value of zero indicates that this power condition is disabled.</p> <p>Measurement Units: 100 milliseconds.</p> |
| 14h | word | Saved Idle_B Power Condition Flags |
| | | Bits Description |
| | | 15 Enabled 1= Saved Idle_B power condition is enabled 0= Saved Idle_B power condition is disabled |
| | | 14:0 Reserved |
| 15h | word | <p>Saved Idle_B Timer setting</p> <p>This is the minimum time that the device shall wait after command completion before entering the Idle_B power condition of the PM1:Idle power management state. A value of zero indicates that this power condition is disabled.</p> <p>Measurement Units: 100 milliseconds</p> |

| Word Offset | Data Type | Description |
|-------------|-----------|--|
| 16h | word | Current Idle_B Power Condition Flags |
| | | Bits Description |
| | | 15 Enabled 1= Current Idle_B power condition is enabled 0= Current Idle_B power condition is disabled |
| | | 14:0 Reserved |
| 17h | word | Current Idle_B Timer setting |
| | | This is the minimum time that the device shall wait after command completion before entering the Idle_B power condition of the PM1:Idle power management state. A value of zero indicates that this power condition is disabled. Measurement Units: 100 milliseconds |
| 18h..1Fh | | Reserved |
| 20h | word | Nominal Recovery time from Idle_C to PM0:Active |
| | | This is the nominal time required to transition from Idle_C to PM0:Active. This time does not include processing time for the command that caused this transition to occur . A value of zero indicates that the nominal recovery time is not specified. A value of FFFFh indicates that the recovery time is greater than or equal to 65535 milliseconds. Measurement Units: 1 millisecond This value shall be preserved over all resets |
| 21h | word | General Idle_C Power Condition Flags |
| | | Bits Description |
| | | 15 Supported 1= Idle_C power condition is supported 0= Idle_C power condition is not supported |
| | | 14 Saveable 1= Idle_C power condition is saveable 0= Idle_C power condition is not saveable |
| | | 13:0 Reserved |
| 22h | word | Default Idle_C Power Condition Flags |
| | | Bits Description |
| | | 15 Enabled 1= Default Idle_C power condition is enabled 0= Default Idle_C power condition is disabled |
| | | 14:0 Reserved |
| 23h | word | Default Idle_C Timer setting |
| | | This is the minimum time that the device shall wait after command completion before entering the Idle_C power condition of the PM1:Idle power management state. A value of zero indicates that this power condition is disabled. Measurement Units: 100 milliseconds. |

| Word Offset | Data Type | Description |
|-------------|-----------|---|
| 24h | word | Saved Idle_C Power Condition Flags |
| | | Bits Description |
| | | 15 Enabled 1= Saved Idle_C power condition is enabled 0= Saved Idle_C power condition is disabled |
| | | 14:0 Reserved |
| 25h | word | Saved Idle_C Timer setting |
| | | This is the minimum time that the device shall wait after command completion before entering the Idle_C power condition of the PM1:Idle power management state. A value of zero indicates that this power condition is disabled. Measurement Units: 100 milliseconds |
| 26h | word | Current Idle_C Power Condition Flags |
| | | Bits Description |
| | | 15 Enabled 1= Current Idle_C power condition is enabled 0= Current Idle_C power condition is disabled |
| | | 14:0 Reserved |
| 27h | word | Current Idle_C Timer setting |
| | | This is the minimum time that the device shall wait after command completion before entering the Idle_C power condition of the PM1:Idle power management state. A value of zero indicates that this power condition is disabled. Measurement Units: 100 milliseconds |
| 28h..2Fh | | Reserved |
| 30h | word | Nominal Recovery time from Standby to PM0:Active |
| | | This is the nominal time required to transition from Standby to PM0:Active. This time does not include processing time for the command that caused this transition to occur . A value of zero indicates that the nominal recovery time is not specified. A value of FFFFh indicates that the recovery time is greater than or equal to 65535 milliseconds. Measurement Units: 1 millisecond This value shall be preserved over all resets |

| Word Offset | Data Type | Description | |
|-------------|-----------|---|--|
| 31h | word | General Standby Power Condition Flags | |
| | | Bits | Bits |
| | | 15 | Supported 1= Standby power condition is supported 0= Standby power condition is not supported |
| | | 14 | Saveable 1= Standby power condition is saveable 0= Standby power condition is not saveable |
| | | 13:0 | Reserved |
| 32h | word | Default Standby Power Condition Flags | |
| | | Bits | Description |
| | | 15 | Enabled 1= Default Standby power condition is enabled 0= Default Standby power condition is disabled |
| | | 14:8 | Reserved |
| | | 7:0 | Default standby timer setting in units specified in Table [Editors note: "Standby Timer Periods" in ACS-2] |
| 33h | word | <p>Default Standby Timer setting</p> <p>This is the minimum time that the device shall wait after command completion before entering the PM2:Standby power management state. A value of zero indicates that this power condition is disabled.</p> <p>Measurement Units: 100 milliseconds.</p> | |
| 34h | word | Saved Standby Power Condition Flags | |
| | | Bits | Description |
| | | 15 | Enabled 1= Saved Standby power condition is enabled 0= Saved Standby power condition is disabled |
| | | 14:8 | Reserved |
| | | 7:0 | Saved standby timer setting in units specified in Table [Editors note: "Standby Timer Periods" in ACS-2] |
| 35h | word | <p>Saved Standby Timer setting</p> <p>This is the minimum time that the device shall wait after command completion before entering the PM2:Standby power management state. A value of zero indicates that this power condition is disabled.</p> <p>Measurement Units: 100 milliseconds</p> | |

| Word Offset | Data Type | Description |
|-------------|-----------|--|
| 36h | word | Current Standby Power Condition Flags |
| | | Bits Description |
| | | 15 Enabled 1= Current Standby power condition is enabled 0= Current Standby power condition is disabled |
| | | 14:8 Reserved |
| | | 7:0 Current standby timer setting in units specified in Table [Editors note: "Standby Timer Periods" in ACS-2] |
| 37h | word | <p>Current Standby Timer setting</p> <p>This is the minimum time that the device shall wait after command completion before entering the PM2:Standby power management state. A value of zero indicates that this power condition is disabled.</p> <p>Measurement Units: 100 milliseconds</p> |
| 39h..3Fh | | Reserved |
| | | |
| 40h..FFh | | Reserved |

7.3 Changes to Annex B - Command Set Summary

7.3.1 Changes to the Command Matrix Table

None.

7.3.2 Changes to the Command Codes Table

None.

7.3.3 Changes to the Historical Command Assignments Table

(suggested change to column labeling/formatting only)

| Op Code | Command | ATA/ATAPI- | | | | | | | ATA8 - ACS | ACS - 2 |
|---------|-------------------|------------|---|---|---|---|---|---|------------|---------|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | | |
| TBD | Your Command Name | C | C | C | C | C | C | C | C | |
| TBD | Your Command Name | R | R | R | R | R | R | R | R | |

Key:

| | |
|---|--|
| <p>C = a defined command. E = a retired command. O = Obsolete. R = Reserved, undefined in current specifications. V = Vendor specific commands.</p> | <p>A = Reserved for assignment by the CompactFlash Association F = If the device does not implement the CFA feature set, this command code is Vendor specific. M = Reserved for the Media Card Pass Through Command feature set. S = Reserved for Serial ATA *Indicates this definition is new to ATA8</p> |
|---|--|

7.3.4 Changes to the Historical Set Feature Code Assignments Table

(suggested change to column labeling/formatting, plus adding EPC feature)

| Feature Code | Description | ATA/ATAPI- | | | | | | | ATA8 - ACS | ACS - 2 |
|--------------|---------------------------|------------|---|---|---|---|---|---|------------|---------|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | | |
| TBDSF | Extended Power Conditions | R | R | R | R | R | R | R | R | C |

Key:

| | |
|---|---|
| <p>C = a defined command. E = a retired command. O = Obsolete. R = Reserved, undefined in current specifications. V = Vendor specific commands.</p> | <p>A = Reserved for assignment by the CompactFlash? Association. F = If the device does not implement the CFA feature set, this command code is Vendor specific. M = Reserved for the Media Card Pass Through Command feature set. S = Reserved for Serial ATA. T = Reserved for Technical Report T13/DT1696 (Time-Limited Commands).</p> |
|---|---|