

ACS-2

Extended Power Conditions (EPC)

March 19, 2009

Revision 8

Technical Editor:

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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 Current, 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
8	March 19, 2009	<ol style="list-style-type: none"> 1) Restored the 'changeable' property that was accidentally removed. 2) Removed requirement to not stop the timers when the EPC Goto power condition command is accepted. 3) Handled IDLE and STANDBY commands when the specified timer value is zero.

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 [parameters-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) [extensions-additional status values returned by](#) ~~to~~ 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 ~~do~~ [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 ~~may~~ 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 ~~EPC~~ power condition ~~idle~~ timers enabled.

The value of each timer specifies the ~~inactivity~~ 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 ~~are~~ active and run concurrently.

~~If a device processes a command while in a power condition, the device may change to a new power management state. If any power condition timer has been enabled, then they~~ All power condition timers shall be stopped on ~~receipt~~ acceptance of ~~the~~ any command, except for CHECK POWER MODES.

~~On command completion for all commands, except for EPC Go To Power Condition, the enabled timers shall be reinitialized with the saved values and started.~~ 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.

~~A power condition timer expires when the time specified by the value in the timer field has elapsed since the last activity completed.~~

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.~~ 1. stop all EPC timers;
- ~~1.2.~~ 2. copy ~~the all saved~~ Saved Enabled field to the Current Enabled field, for all supported power conditions; ~~EPC properties to current properties; and~~
3. copy the Saved Timer field to the Current Timer field, for all supported power conditions; and
- ~~2.4.~~ 4. reinitialize and restart all enabled EPC timers with ~~current~~ Current values.

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

- ~~1.) if Software Settings Preservation is enabled, then the device shall~~
- ~~1.)~~ 1. stop all EPC timers; and
2. remain in the current power condition; and
- ~~2.3.~~ 3. reinitialize and restart all enabled EPC timers with ~~current~~ Current values.

- ~~1. if Software Settings Preservation is disabled, then the device shall~~
- ~~a.~~ stop all EPC timers; ~~and~~
- ~~b.~~ copy all saved EPC properties to current properties; and

~~c. 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~~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-set~~ the specified Standby timer value as the Current Standby timer; ~~and~~
 - b. if the specified Standby timer value is non-zero, then the device shall
 - i. set the Current Enabled ~~value~~field to one; ~~and~~
 - c. if the specified Standby timer value is zero, then the device shall
 - i. clear the Current Enabled field to zero;
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 ~~immediately~~ 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 ~~immediately~~ 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-set~~ the specified Standby timer value as the Current Standby timer; ~~and~~
 - b) if the specified Standby timer value is non-zero, then the device shall
 - i. set the Current Enabled field to one; and
 - c) if the specified Standby timer value is zero, then the device shall
 - i. clear the Current Enabled field to zero;

~~b)set the Current Enabled bit to one;~~

~~2.when the timer value specified by the STANDBY command expires then:~~

- ~~ii.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](#)

~~4. the device shall enter the PM2:Standby state;~~

~~5. and~~

3. ~~on completion of the STANDBY command, all enabled EPC timers shall be initialized and started.~~

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; and~~

~~4.3. on completion of the STANDBY IMMEDIATE command, all enabled EPC timers shall be initialized and started.~~

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

and
3. if ~~the~~ Save ~~bit~~ is set to one and the power condition is saveable, then
 - a. copy the Current ~~timer~~Timer ~~value~~field to the Saved ~~timer~~Timer; and
 - b. copy the Current enable ~~bit~~value to the Saved enable ~~bit~~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 7:45 Obsolete 6:44 Shall be set to one 5:43 Obsolete 4:42 Transport Dependent - See 6.2.12 3:0 4:8 Reserved
Command	7:0 EFh

Normal Outputs

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

Error Outputs

If ~~the any~~ selected Power Condition is not supported or is not changeable or if Save is set to one and any selected 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
	7:5 Obsolete
	6:4 Shall be set to one
	5:3 Obsolete
	4:2 Transport Dependent - See 6.2.12
3:0 14:8 Reserved	
Command	7:0 EFh

Normal Outputs

See [Editors note [“Generic Extended Normal Output” in ACS-2 Table 8 in this proposal](#)].

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(s) as follows:

1. ~~c~~Copy the Timer field to the Current ~~timer~~Timer valuefield;
2. ~~if the~~Enable bit is set to one and the Timer field is non-zero, then enable the Current ~~timer~~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 ~~;~~~~otherwise~~ disable the Current ~~timer~~Timer; and
5. ~~if the~~Save bit is set to one and the Power Condition settings are saveable, then
 - a. copy the Current Timer valuefield ~~and enabled bit~~ to the Saved Tsettingsimer 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 7:5 Obsolete 6:4 Shall be set to one 5:3 Obsolete 4:2 Transport Dependent – See 6.2.12 3:0 1:8 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 Table 9 in this proposal](#)].

Error Outputs

If the Power Condition is invalid, not changeable 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 ~~the~~ Enable ~~bit~~ is set to one, then enable the Current ~~timer~~ Timer; otherwise disable the Current ~~timer~~ Timer; and
- ~~3.~~ If ~~the~~ Save ~~bit~~ is set to one, then copy the Current ~~E~~enabled ~~bit~~value to the Saved ~~E~~enabled ~~bit~~value.
- 2.

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 7:5 Obsolete 6:4 Shall be set to one 5:3 Obsolete 4:2 Transport Dependent – See 6.2.12 3:0 1:8 Reserved
Command	7:0 Efh

Normal Outputs

See [Editors note: [“Generic Extended Normal Output” in ACS-2 Table 7 in this proposal](#)].

Error Outputs

If the Power Condition is not valid, [not changeable](#) 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) ~~clear the Idle_A, Idle_B and Idle_C sections of the Power Conditions log to all zeroes~~ [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.](#)
 - ~~a. copy the EPC Default timer value to the EPC Saved timer for all supported EPC power conditions;~~
 - ~~b. copy the EPC Default enabled bit to the EPC Saved enabled bit for all supported EPC power conditions;~~
 - ~~c. copy the EPC Default timer value to the EPC Current timer for all supported EPC power conditions; and~~
 - ~~d. copy the EPC Default enabled bit to the EPC Current enabled bit for all supported EPC 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~~Timer, Idle_B ~~timer~~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 1385 604">Description</th> </tr> </thead> <tbody> <tr> <td data-bbox="376 604 500 640">00h</td> <td data-bbox="500 604 1385 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 1385 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 1385 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 1385 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="376 823 500 926">81h</td> <td data-bbox="500 823 1385 926">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="376 926 500 1029">82h</td> <td data-bbox="500 926 1385 1029">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 1029 500 1131">83h</td> <td data-bbox="500 1029 1385 1131">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 1131 500 1190">FFh</td> <td data-bbox="500 1131 1385 1190">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 																		

Table 7 – Normal outputs for SET FEATURES EPC – General

Name	Description
Error	Description
Count	Reserved
LBA	Bit Description
	23:4 Reserved
	3:0 Extended Power Conditions subcommand (See Table 1)
Device	<p>Bit Description</p> <p>15 Obsolete</p> <p>14 N/A</p> <p>13 Obsolete</p> <p>12 Transport Dependent – See</p> <p>11:8 Reserved</p>
Status	<p>7:6 Transport Dependent – See</p> <p>5 Device Fault – See</p> <p>4 N/A</p> <p>3 Transport Dependent – See</p> <p>2:1 N/A</p> <p>0 Error – See</p>

Table 8 – Normal outputs for SET FEATURES EPC – Go To Power Condition

Name	Description
Error	Description
Count	Power condition ID (see Table 2)
LBA	Bit Description
	23:4 Reserved
	3:0 Extended Power Conditions subcommand (See Table 1)
Device	<p>Bit Description</p> <p>15 Obsolete</p> <p>14 N/A</p> <p>13 Obsolete</p> <p>12 Transport Dependent – See</p> <p>11:8 Reserved</p>
Status	<p>7:6 Transport Dependent – See</p> <p>5 Device Fault – See</p> <p>4 N/A</p> <p>3 Transport Dependent – See</p> <p>2:1 N/A</p> <p>0 Error – See</p>

Table 9 – Normal outputs for SET FEATURES Extended EPC – Set Power Condition Timer

Name	Description
Error	Description
Count	Power condition ID (see Table 2)
LBA	Bit Description
	23:8 Timer (see [editors note: 7.48.new.4])
	7:6 Reserved
	5 Enable — 0 = Disable the selected power condition — 1 = Enable the selected power condition
	4 Save — 0 = Do not save settings on completion — 1 = Save settings on completion
	3:0 Subcommand — 2h = Set Power Condition Timer
Device	Bit Description 15 Obsolete 14 N/A 13 Obsolete 12 Transport Dependent – See – 11:8 Reserved
Status	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.](#) ~~This log may be supported if the Extended Power Conditions feature set is not supported. If this log is supported and the Extended Power Conditions feature set is not supported, then the Idle_A, Idle_B and Idle_C sections shall be cleared to zero.~~

Table 7 - ~~Extended~~ 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 Changeable 1= Idle_A power condition is changeable 0= Idle_A power condition is not changeable
		12:0 Reserved
02h	word	Default Idle_A Flags 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	Default Idle_A timer Timer setting 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. Measurement Units: 100 milliseconds.
04h	word	Saved Idle_A Flags 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	Saved Idle_A timer Timer setting 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. Measurement Units: 100 milliseconds
06h	word	Current Idle_A Flags 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	Current Idle_A timer Timer setting 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. Measurement Units: 100 milliseconds
08h..0Fh		Reserved for Idle_A parameters

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 Flags 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 Changeable 1= Idle_B power condition is changeable 0= Idle_B power condition is not changeable
12:0	Reserved	
12h	word	Default Idle_B Flags 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
13h	word	<p>Default Idle_B timerTimer 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 Flags 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
15h	word	<p>Saved Idle_B timerTimer 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 Flags 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 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 for Idle_B parameters
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 Flags 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 Changeable 1= Idle_C power condition is changeable 0= Idle_C power condition is not changeable
12:0 Reserved		
22h	word	Default Idle_C Flags 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 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 timer 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	<p>Saved Idle_C timer Timer setting</p> <p>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.</p> <p>Measurement Units: 100 milliseconds</p>
26h	word	Current Idle_C timer 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	<p>Current Idle_C timer Timer setting</p> <p>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.</p> <p>Measurement Units: 100 milliseconds</p>
28h..2Fh		Reserved for Idle_C parameters
30h	word	<p>Nominal Recovery time from Standby to PM0:Active</p> <p>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.</p> <p>Measurement Units: 1 millisecond</p> <p>This value shall be preserved over all resets</p>

Word Offset	Data Type	Description	
31h	word	General Standby Flags 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	Changeable 1= Standby power condition is changeable 0= Standby power condition is not changeable
		12:0 Reserved	
32h	word	Default Standby Flags 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 timerTimer 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 Flags 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 timerTimer 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 Flags 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	Current Standby timer Timer setting 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. Measurement Units: 100 milliseconds
39h..3Fh		Reserved for Standby parameters
40h..FFh		Reserved (to the end of page 00h)

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:

- C = a defined command.
- E = a retired command.
- O = Obsolete.
- R = Reserved, undefined in current specifications.
- V = Vendor specific commands.
- 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

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:

- C = a defined command.
- E = a retired command.
- O = Obsolete.
- R = Reserved, undefined in current specifications.
- V = Vendor specific commands.
- 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).