

ACS-3 New DOWNLOAD MICROCODE Subcommands

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Revision 1

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Document Status

Revision History		
Rev	Date	Description
0	Dec. 2, 2009	1) Initial Revision
1	Feb 2, 2010	1) Merged e09157 DOWNLOAD MICROCODE Clarifications into this proposal, and the Dec. 2009 plenary comments against it. 2)

1 Introduction

During ACS-2 letter ballot comment resolution, some clarifications were requested for the DOWNLOAD MICROCODE command. Specifically, it was requested that the Download and save microcode for immediate and future use subcommand be documented.

The DOWNLOAD MICROCODE command (see ACS-2) has some restrictions that have become harder and harder to live with:

- a) when using the 'download with offsets' option, simultaneous activity is not allowed (e.g., no read or write commands are allowed between segments);
- b) since the command is not queueable, any DOWNLOAD MICROCODE command will cause all queued commands to be terminated with error;
- c) there is no standard option to 'download and save for future use';
- d) given the vendor specific manner of initializing and starting the new firmware, the Phy is sometimes disabled and then re-enabled before command completion for the command. This causes significant host interface disruption; and
- e) there is no standard expectation concerning configuration changes that may occur as a result of a firmware update.

2 Scope

This proposal defines and modifies the DOWNLOAD MICROCODE command to:

- a) require that read and write commands be processed in a normal manner between segments;
- b) define new 'download and save for future use' and 'activate saved download' modes;
- c) define allowable and expected behaviors during the process of activating downloaded microcode; and
- d) define allowable and expected configuration changes as a result of activating downloaded microcode

3 Overview

This proposal clarifies the existing DOWNLOAD MICROCODE subcommands and defines some new DOWNLOAD MICROCODE subcommands.

4 Changes to ACS-3

4.1 Changes to clause 7

Replace all of section 7.13 with the following:

4.2 (section 7.13) DOWNLOAD MICROCODE - 92h, PIO Data-Out/Non-Data

4.2.1 Feature Set

This 28-bit command is optional for ATA devices.

4.2.2 Description

This command enables the host to alter the device's microcode. The data transferred using the DOWNLOAD MICROCODE command is vendor specific.

The term 'new microcode image' means a collection of data that is necessary and sufficient for the device to update its microcode. The host transfers this data to the device using one or more DOWNLOAD MICROCODE subcommands, each transferring a piece of the complete microcode image.

There are three phases to this process:

- 1) download;
- 2) save; and
- 3) activation.

During the 'download' phase, the host transfers new microcode data to the device.

During the 'save' phase, the device saves the new microcode image to a non-volatile location.

During the 'activation' phase, the device begins using the new microcode.

The block count is the number of 512-byte data blocks that shall be transferred. The block count of a segment is specified in the Count and LBA fields (see table xxx). If the Block count is zero, then the Non-Data transfer protocol shall be used and the device response to this subcommand is vendor specific. [

Editor's Note 1: should we standardize the count=zero behaviour ?

Table 1 lists the DOWNLOAD MICROCODE subcommands.

Editor's Note 2: move this table back to inside the Inputs table

Table 1 — DOWNLOAD MICROCODE subcommands

<u>Subcommand Code</u>	<u>Down Load</u>	<u>Save</u>	<u>Activate</u>	<u>Subcommand Name</u>
00h				Reserved
01h				Obsolete
02h				Reserved
03h	1 or more segments	Yes	Yes ¹	Download with offsets and save microcode for immediate and future use (see 4.2.2.1)
04h-06h				Reserved
07h	1 segment only	Yes	Yes	Download and save microcode for immediate and future use (see 4.2.2.2)
08h-0Dh				Reserved
0Eh	1 or more segments	Yes	No	Download with offsets and save microcode for future use (see 4.2.2.3)
0Fh	No	No	Yes	Activate downloaded microcode (see 4.2.2.4)
10h-FFh				Reserved

¹ Activation occurs after the complete new microcode image has been downloaded.

4.2.2.1 Download with offsets and save microcode for immediate and future use subcommand

The Download with offsets and save microcode for immediate and future use subcommand transfers microcode in one or more DOWNLOAD MICROCODE commands. This subcommand downloads data containing a segment (e.g., part) of the complete new microcode image. During the processing of a power-on reset, a hardware reset, or a software reset prior to applying the new microcode, the device shall discard any received microcode segments.

4.2.2.1.1 Download phase

Each download segment is identified by a block count and a buffer offset.

The buffer offset of a segment is defined by the value in LBA (23:8). The buffer offset is the starting location in the data relative to the last successful DOWNLOAD MICROCODE command received by the device with a buffer offset of zero.

If the current buffer offset is not equal to the sum of the previous DOWNLOAD MICROCODE command buffer offset and the previous block count, then the device shall report command aborted for the DOWNLOAD MICROCODE command and discard all previously downloaded microcode. If the first DOWNLOAD MICROCODE command processed after a power cycle does not specify a buffer offset equal to zero, then the device shall return command aborted.

Editor's Note 3: what shall the device do if the offset is not zero ?

If the device receives a command other than DOWNLOAD MICROCODE command prior to the receipt of the last segment, then the device shall process the new command and may discard previously downloaded microcode.

4.2.2.1.2 Save phase

The device shall determine when the complete new microcode image has been downloaded.

If the complete new microcode image has been downloaded, then:

- 1) the device shall perform verification of the new microcode image;
- 2) if the validation fails, the device shall return command aborted; and
- 3) if the validation succeeds, then
 - 1) the device shall save the new microcode image to a non-volatile location;
 - 2) if the save operation fails, then the device shall return command aborted; and
 - 3) if the save operation succeeds, then the device shall begin the activation phase.

4.2.2.1.3 Activation phase

The device should:

- 1) cause the new microcode to become active; and
- 2) report command completion.

The activation of the new microcode results in the downloaded microcode image being used by the device. Activation may change device feature configuration (e.g., DCO, IDENTIFY DEVICE, SET FEATURES settings or the contents of any logs).

Editor's Note 4: ordered or unordered list ?

Editor's Note 5: during the activation phase, does the command completion come from the old or new microcode ?

4.2.2.2 Download and save microcode for immediate and future use subcommand

The Download and save microcode for immediate and future use subcommand transfers microcode in one DOWNLOAD MICROCODE command. During the processing of a power-on reset, a hardware reset, or a software reset prior to applying the new microcode, the device shall discard any received microcode segments.

4.2.2.2.1 Download phase

The entire new microcode image shall be transferred by this subcommand in a single data transfer.

4.2.2.2.2 Save phase

After the download phase is complete:

- 1) The device shall perform vendor specific validation of the new microcode image;
- 2) if the validation fails, the device shall return command aborted; and
- 3) if the validation succeeds, then:
 - 1) the device shall save the new microcode image to a non-volatile location;
 - 2) if the save operation fails, then the device shall return command aborted; and
 - 3) if the save operation succeeds, then the device shall activate the new microcode image.

4.2.2.2.3 Activation phase

The device should:

- 1) cause the new microcode to become effective; and
- 2) report command completion.

The activation of the new microcode results in the downloaded microcode image being used by the device. Activation may change device feature configuration (e.g., DCO, IDENTIFY DEVICE, SET FEATURES settings or the contents of any logs).

4.2.2.3 Download with offsets and save microcode for future use subcommand

The Download with offsets and save microcode for immediate and future use subcommand transfers microcode in one or more DOWNLOAD MICROCODE commands.

If bit TBD5 of word TBD4 (see 4.2.6.0.2) is cleared to zero, then the device shall return command aborted.

If the block count is set to zero, then the device shall return command aborted.

4.2.2.3.1 Download phase

Each segment is identified by a block count and an offset.

The buffer offset of a segment is defined by the value in the LBA (23:8). The buffer offset is the starting location in the data relative to the last successful DOWNLOAD MICROCODE command received by the device with a buffer offset of zero.

Segments may be transferred in any order. Segments shall not overlap. The device shall determine when the complete new microcode image has been downloaded.

If the device receives a command other than DOWNLOAD MICROCODE command prior to the receipt of the last segment, then:

- a) the device shall process the new command; and
- b) the device shall not discard previously downloaded microcode.

4.2.2.3.2 Save phase

If the complete new microcode image has been downloaded, then:

- 1) the device shall perform vendor specific validation of the new microcode image;
- 2) if the validation fails, the device shall return command aborted; and
- 3) if the validation succeeds, then
 - 1) the device shall save the new microcode image to a non-volatile location;
 - 2) if the save operation fails, then the device shall return command aborted; and
 - 3) if the save operation succeeds, then the device shall return command complete.

4.2.2.3.3 Activation phase

Identify Data log, page TBDxx data word TBD3 (see 4.2.6.0.1) indicates the expected time to complete the next activation of the new microcode. The new microcode should become effective within the specified time after any of these events:

- a) power on reset;
- b) for PATA devices: hardware reset;
- c) for SATA devices: COMRESET (with Software Settings Preservation disabled); or

Editor's Note 6: need liaison with SATA-IO

- d) processing a DOWNLOAD MICROCODE Activate downloaded microcode subcommand (see 4.2.2.4).

During activation, the connection between the host and the device may experience asynchronous signal loss. If signal loss occurred, the device shall initiate recovery from the condition when the activation process is complete.

After activation, device feature configuration (e.g., DCO, IDENTIFY DEVICE, SET FEATURES settings or the contents of any logs) may be affected by the DOWNLOAD MICROCODE command.

4.2.2.4 Activate downloaded microcode subcommand

This subcommand activates a microcode image that had been previously downloaded and saved by the DOWNLOAD MICROCODE Download with offsets and save microcode for future use subcommand (see 4.2.2.3).

The device shall return command aborted:

- a) If bit TBD5 of word TBD4 (see 4.2.6.0.2) is cleared to zero;
- b) if the block count is not cleared to zero;

- c) if the device has not successfully processed a DOWNLOAD MICROCODE Download with offsets and save microcode for future use subcommand since the last power cycle; or
- d) if the device has successfully processed a DOWNLOAD MICROCODE Download with offsets and save microcode for future use subcommand since the last power cycle and has not saved the new microcode image.

4.2.2.4.1 Download phase

There is no download phase.

4.2.2.4.2 Save phase

There is no save phase.

4.2.2.4.3 Activation phase

IDENTIFY DEVICE data word TBD3 (see 4.2.6.0.1) indicates the expected time to activate the new microcode. The new microcode should become effective within that time after command acceptance.

During activation, the connection between the host and the device may experience asynchronous signal loss. If signal loss occurred, the device shall initiate recovery from the condition when the activation process is complete.

The device should:

- 1) cause the new microcode to become effective; and
- 2) report command completion.

The activation of the new microcode results in the downloaded microcode image being used by the device. Activation may change device feature configuration (e.g., DCO, IDENTIFY DEVICE, SET FEATURES settings or the contents of any logs).

4.2.3 Inputs

Name	Description
Feature	Subcommand (see table 1)
	Editor's Note 7: embed the table here again
Count	Block count (7:0)
LBA	<p>Bit Description</p> <p>27:24 Reserved</p> <p>23:8 Buffer offset (only used for Feature = 03h and Feature = 0Eh, otherwise this field shall be reserved)</p> <p>7:0 Block count (15:8)</p>
Device	<p>Bit Description</p> <p>7 Obsolete</p> <p>6 N/A</p> <p>5 Obsolete</p> <p>4 Transport Dependent - See 6.2.12</p> <p>3:0 Reserved</p>
Command	7:0 92h

4.2.4 Normal Outputs

If IDENTIFY DEVICE data word 234 (see xxx) or IDENTIFY DEVICE data word 235 (see xxx) have a value other than 0000h or FFFFh, then table 2 describes the indicator returned in the Count field.

[Editor's Note 8: can we make the title of Table 2 shorter ?](#)

Table 2 — Count field output for DOWNLOAD MICROCODE requesting the offset transfer method

Value	Description
00h	No indication of download microcode status.
01h	Indicates the ATA device is expecting more download microcode commands to follow.
02h	Indicates that the ATA device has applied the new microcode.
03h-FFh	Reserved

[For additional returns see table 100.](#)

4.2.5 Error Outputs

The device shall return command aborted if the device did not accept the microcode data. The device shall return command aborted if the subcommand code is not a supported value. See table 124.

4.3 Changes to clause A.XXX (Identify Device Log)

Editor's Note 9: add the following to the Identify Device log, in page XXX

Table 3 — (A.xxx.xxx) XXXX Page

<u>Offset</u>	<u>Type</u>	<u>Content</u>
<u>TBD..</u> <u>TBD+7</u>	<u>QWord</u>	<u>Estimated DOWNLOAD MICROCODE activation time</u> <u>Bit Meaning</u> <u>63</u> <u>Shall be set to one.</u> <u>62:0</u> <u>Estimated DOWNLOAD MICROCODE activation time (seconds)</u>
<u>TBD..</u> <u>TBD+7</u>	<u>QWord</u>	<u>Supported DOWNLOAD MICROCODE subcommands</u> <u>Bit Meaning</u> <u>63</u> <u>Shall be set to one.</u> <u>62:16</u> <u>Reserved</u> <u>15</u> <u>Subcommand 0Fh is supported</u> <u>14</u> <u>Subcommand 0Eh is supported</u> <u>13:8</u> <u>Reserved</u> <u>7</u> <u>Subcommand 07h is supported</u> <u>6:4</u> <u>Reserved</u> <u>3</u> <u>Subcommand 03h is supported</u> <u>2:0</u> <u>Reserved</u>

0.0.0.1 Estimated DOWNLOAD MICROCODE activation time

The device should complete the DOWNLOAD MICROCODE activation phase within the reported number of seconds from the beginning of the activation phase.

0.0.0.2 Supported DOWNLOAD MICROCODE subcommands

If a bit is set to one, then the device shall support the associated DOWNLOAD MICROCODE subcommand.