

ATA Security feature Set Clarifications

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Date: ~~March 31~~May 24, 2006

Revision History:

- 0: Initial revision
- 1: Incorporate feedback from Dec. 2005 plenary. Split the Enhancements to a separate proposal.
- 2: Incorporate feedback from March 14, 2006 ad hoc meeting.
- 3: Incorporate feedback from March 28, 2006 ad hoc meeting.
- 4: Incorporate feedback from Plenary #58 (April 2006), and ad hoc meetings (May 17, 2006 and May 24, 2006)

Introduction

The purpose of this proposal is to clarify a number of vague and unspecified issues regarding the ATA Security ~~Mode~~ feature set. This is the source of unpredictable behavior between vendors and models currently in the market. Locking down the specification of ATA Security is critical to ensuring reliable interoperability.

Proposal

I propose that the following ~~text~~ be incorporated into ATA/ATAPI-8 ACS as a full replacement for the referenced sections.

These terms are to be added to the Glossary

<u>Security Is Not Supported</u>	<u>The Security feature set is not supported. The SECURITY commands (see 1.1.5) are not supported and shall be command aborted. IDENTIFY DEVICE reports that the Security feature set is ‘not supported’.</u>
<u>Security Is Disabled</u>	<u>The Security feature set is supported, but that there is no valid User password. There is a Master password. Access to user data is not restricted by the Security feature set. The terms ‘Security Is Locked’ and ‘Security Is Unlocked’ are not applicable. (e.g. Security states SEC0, SEC1, SEC2).</u>
<u>Security Is Enabled</u>	<u>The Security feature set is supported, and a valid User password has been set. (e.g. Security states SEC3, SEC4, SEC5, SEC6).</u>
<u>Security Is Locked</u>	<u>Security is enabled. In addition, access to the device is restricted. (e.g. Security state SEC4).</u>
<u>Security Is Unlocked</u>	<u>Security is enabled. A SECURITY UNLOCK command was successful, allowing access to the device. (e.g. Security state SEC5, SEC6).</u>
<u>Security Is Frozen</u>	<u>Security may be either enabled or disabled. Changes to Security states are not allowed until after the next power-on or hardware reset. (e.g. Security states SEC2, SEC6).</u>
<u>Security Is Not Frozen</u>	<u>Security may be either enabled or disabled. Changes to Security states are allowed (e.g. Security states SEC1, SEC4, SEC5).</u>
<u>Master Password Capability</u>	<u>The Master Password Capability indicates whether or not the Master password may be used to unlock the device. This was formerly know as ‘Security Level’.</u>
<u>Security Level</u>	<u>See Master Password Capability .</u>
<u>Password Attempt Counter Exceeded</u>	<u>There were too many attempts to unlock the device with an incorrect password. Further unlock attempts are denied until a power-on or hardware reset.</u>

1.1 Security **Mode** feature set

1.1.1 Overview

The optional Security **Mode** feature set is a password system that restricts access to user data stored on a device. In addition, access to some configuration capabilities is restricted.

See also the '~~Master Password Revision Code~~Master Password Identifier' feature (1.2) and '~~Enhanced Security Mode feature set~~' (1.3) which are is an optional enhancements to the Security **Mode** feature set.

1.1.1 Security attributes

~~These are the Security attributes:~~

- ~~– Power: on or off~~
- ~~– Feature set supported: True or False~~
- ~~– Locked: True or False~~
- ~~– Security Level: High or Maximum~~
- ~~– Attempt Limit counter~~
- ~~– Frozen: True or False~~
- ~~– User password~~
- ~~– Master password~~
- ~~–~~

~~Here are some special terms used in the Security Mode feature set:~~

1.1.2 ~~Master and User~~ Passwords

The system has two types of passwords: User (~~optional~~) and Master (~~required~~), and two security levels, High and Maximum.

1.1.2.1.1 User Password

The User password is used to create a lock to block execution of some commands, including preventing access to all user data on the device. The User password may be used to unlock the device to allow access.

~~The Ssecurity system~~ is enabled by sending a user setting a User password to the device with the SECURITY SET PASSWORD command. When the security ~~system~~ is Enabled, ~~the device is automatically Locked (i.e., access to user data on the device is denied)~~ after a power ~~cycle on reset is processed~~ until the User password is sent to the device with the a SECURITY UNLOCK command completes successfully.

1.1.2.1.2 Master Password

The Master password is a password that may be used to unlock the device if the User password is lost or if an administrator requires access (e.g. to repurpose a device).

~~A device always has a Master password. A factory-installed Master password may be valid before an initial SECURITY SET (master) PASSWORD command has been successfully executed. A device may contain both a valid Master and a valid User password. The Master password may be set used in addition to the User password. The purpose of the Master password is to allow an administrator to establish a password that is kept secret from the user, and which may be used to unlock the device if the User password is lost. Setting the Master password does not enable the password Security system (i.e., does not Lock the device after the next power-on reset has been processed).~~

~~1.1.3 High and Maximum Security Level~~ **Master Password Capability**

~~A device with Security enabled has two ways of using the Master password. This capability has values of 'High' or 'Maximum'. The security level is set to High or Maximum with the SECURITY SET PASSWORD command. The security level determines device behavior when the Master password is used with the SECURITY DISABLE PASSWORD, SECURITY UNLOCK and SECURITY ERASE UNIT commands to unlock the device.~~

~~When the security level Master Password Capability is set to High, either the User or Master password may be used interchangably. ~~the device requires the SECURITY UNLOCK command and the Master password to unlock.~~ See Table 1.~~

~~When the security level Master Password Capability is set to Maximum, the Master password cannot be used with the SECURITY DISABLE PASSWORD and SECURITY UNLOCK commands. The SECURITY ERASE UNIT command, however, does accept the either the User or Master password. ~~the device requires a SECURITY ERASE PREPARE password command and a SECURITY ERASE UNIT command with the masterpassword to unlock.~~ Execution of the SECURITY ERASE UNIT command erases all user data on the device.~~

Table 1 - Interaction of ~~Security Levels~~ Master Password Capability and Passwords [Editors note: only when not frozen]

<u>Security Enabled</u>	<u>Master Password Capability</u>	<u>Passwords Defined</u>	<u>Password Supplied</u>	<u>Actions Taken by Security Commands</u>		
				<u>SECURITY DISABLE PASSWORD</u>	<u>SECURITY UNLOCK</u>	<u>Properly Prefaced SECURITY ERASE UNIT</u>
<u>No</u>	Disabled <u>N/A</u>	master only	master (correct)	N	N	E
<u>No</u>	N/A <u>disabled</u>	master only	user <u>(not valid)</u>	A	A	A
<u>Yes</u>	High	master and user	master (correct)	E	E	E
<u>Yes</u>	High	master and user	user (correct)	E	E	E
<u>Yes</u>	Maximum	master and user	master (correct)	A	A	E
<u>Yes</u>	Maximum	master and user	user (correct)	E	E	E

Key:

- N ~~NO~~OP – Do nothing, but return normal completion.
- A Return command aborted
- E Execute the command (if all other validations pass); otherwise return command aborted.

1.1.4 Frozen Mode

The SECURITY FREEZE LOCK command prevents changes to ~~passwords~~ all Security ~~attribute~~states until a following ~~power cycle~~ power-on reset or hardware reset. The purpose of the SECURITY FREEZE LOCK command is to prevent password setting attacks on the security system. [Editors note: fix the figure or fix this text]

1.1.5 Commands

A device that implements the Security ~~Mode~~ feature set shall implement the following ~~minimum~~ set of commands:

- SECURITY SET PASSWORD
- SECURITY UNLOCK _____ (requires a password)
- SECURITY ERASE PREPARE
- SECURITY ERASE UNIT _____ (requires a password)
- SECURITY FREEZE LOCK
- SECURITY DISABLE PASSWORD _____ (requires a password)

1.1.6 IDENTIFY DEVICE data

Support of the Security ~~Mode~~ feature set is indicated in IDENTIFY DEVICE and IDENTIFY PACKET DEVICE data word 82 and data word 128.

Security information in words 82, 89 and 90 is fixed until the next power-on reset and shall not change unless DEVICE CONFIGURATION OVERLAY removes support for the Security ~~Mode~~ feature set.

Security information in words ~~82~~, 85, 92 and 128 are variable and may change.

If the Security ~~Mode~~ feature set is not supported, then words 89, 90, 92 and 128 are ~~invalid N/A and shall be cleared to zero.~~

1.1.7 Security ~~mode~~ initial setting

When the device is shipped by the manufacturer, ~~the state of the Security Mode feature shall be disabled (e.g. is not Locked).~~ The initial Master password value is not defined by this standard.

~~If the Master Password Revision Code feature is supported, the Master Password Revision Code shall be set to FFFEh by the manufacturer.~~

1.1.8 ~~User password lost~~ Password Rules

This section applies to any Security command that accepts a password, ~~and for which there exists a valid password.~~ ~~This section does not apply while Security is Frozen.~~

~~If Security is disabled and there is a valid Master password, then the Master password may be used.~~

~~The SECURITY ERASE UNIT command ignores the Master Password Capability value when comparing passwords, and shall accept either a valid Master or User password.~~

If the User password sent to the device ~~with the SECURITY UNLOCK command~~ does not match the user password previously set with the SECURITY SET PASSWORD command, the device shall ~~not allow the user to access data~~ return command aborted.

If the ~~Security Level Master Password Capability~~ was set to High during the last SECURITY SET ~~(user)~~ PASSWORD command, the device shall ~~unlock if~~ accept the Master password ~~is received~~ and complete normally.

If the ~~Security Level Master Password Capability~~ was set to Maximum during the last SECURITY SET ~~(user)~~ PASSWORD command, the device shall ~~not unlock~~ return command aborted ~~for SECURITY UNLOCK or SECURITY DISABLE PASSWORD~~ if the Master password is ~~received~~ supplied. ~~The However, the SECURITY ERASE UNIT command, shall erase all user data and shall unlock the device if the Master password~~

~~matches the last Master password previously set with the SECURITY SET PASSWORD command.~~

1.1.9 ~~Password Attempt~~ Limit counter for SECURITY UNLOCK command

The device shall have an ~~attemptpassword attempt-limit~~ counter. The purpose of this counter is to defeat repeated trial attacks. The counter shall only be decremented while in state SEC4, whenever the SECURITY UNLOCK command fails because of an invalid User or Master password SECURITY UNLOCK command, the counter is decremented.

SECURITY ERASE UNIT and SECURITY DISABLE PASSWORD commands may decrement the counter for failed password comparisons [editors note: from which states ?].

Once the counter reaches zero, it shall not be decremented, and ~~When the counter value reaches zero~~ the ~~EXPIRE PasswordAttemptCounterExceeded~~ bit ((bit 4) of IDENTIFY DEVICE data word 128, bit 4) ~~is~~ shall be set to one, and the SECURITY UNLOCK and SECURITY ~~UNIT ERASE ERASE UNIT~~ commands ~~are~~ shall be command aborted until after the next the device is powered off power-on or hardware reset.

The ~~EXPIRE PasswordAttemptCounterExceeded~~ bit shall be cleared to zero [editors note “(only)” ?] after by either a power-on or hardware reset. [editors note: should hardware reset not clear the counter ?] None of the commands in the Security feature set shall clear this bit.

The counter shall be set to five (5) [editors note “(only)” ?] after a power-on or hardware reset. [editors note: should hardware reset not initialize the counter ?] None of the commands in the Security feature set shall re-initialize this counter.

1.1.10 ~~Resets~~

~~When Software Reset and Device Reset occurs between commands, the device shall not change any Security attribute of the device. When a device Hardware reset behavior may be affected by the ‘Software Settings Preservation’ (SSP) feature described in SATA IO document “Serial ATA Revision 2.5”.~~

~~Power-on Reset causes an exit from Frozen mode and preserves any Master and User passwords that have been set. The device shall enter either security state SEC1 or SEC4 depending on whether Security is disabled or enabled.~~

~~Any reset or power-down event that occurs during the execution of a Security command may result in indeterminate results.~~

4.1.441.1.10 Security mode states

See [Figure 1](#) and [Table 2](#). When the power is off, the Security characteristics are as in Table 2, but are not reportable.

Table 2 - Summary of Security States and AttributeCharacteristics

Security State	Security <u>Attribute</u> Characteristics				
	Power	Enabled (ID word 85, bit 1)	Locked (ID word 128, bit 2)	<u>Frozen</u> (ID word 128, bit 3)	<u>Expired Password Attempts Exceeded</u> (ID word 128, bit 4)
SEC0	off	0	<u>N/A</u>	<u>N/A</u>	<u>N/A</u>
SEC1	on	0	0	<u>0</u>	0
SEC2	on	0	0	<u>1</u>	<u>varies 0 or 1</u>
SEC3	off	1	<u>0</u> <u>N/A</u>	<u>N/A</u>	<u>N/A</u>
SEC4	on	1	1	<u>0</u>	<u>0 or 1</u> <u>varies</u>
SEC5	on	1	0	<u>0</u>	<u>varies 0 or 1</u>
SEC6	on	1	0	<u>1</u>	<u>varies 0 or 1</u>

Table 3—Security mode command actions

Table 4 - Security mode command actions

Command	Disabled (SEC1) <u>[Editors note: this entire column is new]</u>	Locked (SEC4)	Unlocked (SEC5)	Frozen (SEC2 or SEC6)
CFA ERASE SECTORS	Executable	Command aborted	Executable	Executable
CFA REQUEST EXTENDED ERROR CODE	Executable	Executable	Executable	Executable
CFA TRANSLATE SECTOR	Executable	Executable	Executable	Executable
CFA WRITE MULTIPLE WITHOUT ERASE	Executable	Command aborted	Executable	Executable
CFA WRITE SECTORS WITHOUT ERASE	Executable	Command aborted	Executable	Executable
CHECK MEDIA CARD TYPE	Executable	Command aborted	Executable	Executable
CHECK POWER MODE	Executable	Executable	Executable	Executable
CONFIGURE STREAM	Executable	Command aborted	Executable	Executable
DEVICE CONFIGURATION	Executable	Command aborted	Executable	Executable
DEVICE RESET	Executable	Executable	Executable	Executable
<u>DOWNLOAD MICROCODE</u>	<u>Vendor Specific</u>	<u>Vendor Specific</u>	<u>Vendor Specific</u>	<u>Vendor Specific</u>
EXECUTE DEVICE DIAGNOSTIC	Executable	Executable	Executable	Executable
FLUSH CACHE	Executable	Command aborted	Executable	Executable
FLUSH CACHE EXT	Executable	Command aborted	Executable	Executable
GET MEDIA STATUS	Executable	Command aborted	Executable	Executable
IDENTIFY DEVICE	Executable	Executable	Executable	Executable
IDENTIFY PACKET DEVICE	Executable	Executable	Executable	Executable
IDLE	Executable	Executable	Executable	Executable
IDLE IMMEDIATE	Executable	Executable	Executable	Executable
MEDIA EJECT	Executable	Command aborted	Executable	Executable
MEDIA LOCK	Executable	Command aborted	Executable	Executable
MEDIA UNLOCK	Executable	Command aborted	Executable	Executable
NOP	Executable	Executable	Executable	Executable
NV CACHE	Executable	Command aborted	Executable	Executable
PACKET	Executable	Command aborted	Executable	Executable
READ BUFFER	Executable	Executable	Executable	Executable
READ DMA	Executable	Command aborted	Executable	Executable
READ DMA EXT	Executable	Command aborted	Executable	Executable
READ DMA QUEUED	Executable	Command aborted	Executable	Executable
READ DMA QUEUED EXT	Executable	Command aborted	Executable	Executable
READ LOG EXT	Executable	Command aborted Executable	Executable	Executable
READ LOG DMA EXT	Executable	Executable	Executable	Executable
READ MULTIPLE	Executable	Command aborted	Executable	Executable
READ MULTIPLE EXT	Executable	Command aborted	Executable	Executable
READ NATIVE MAX ADDRESS	Executable	Executable	Executable	Executable
READ NATIVE MAX ADDRESS EXT	Executable	Executable	Executable	Executable
READ SECTOR(S)	Executable	Command aborted	Executable	Executable
READ SECTOR(S) EXT	Executable	Command aborted	Executable	Executable
READ STREAM DMA EXT	Executable	Command aborted	Executable	Executable
READ STREAM EXT	Executable	Command aborted	Executable	Executable
READ VERIFY SECTOR(S)	Executable	Command aborted	Executable	Executable
READ VERIFY SECTOR(S) EXT	Executable	Command aborted	Executable	Executable
<u>SCT Long Segment Access</u>	<u>Executable</u>	<u>Command aborted</u>	<u>Executable</u>	<u>Executable</u>
<u>SCT Write Same</u>	<u>Executable</u>	<u>Command aborted</u>	<u>Executable</u>	<u>Executable</u>
<u>SCT Error Recovery Control</u>	<u>Executable</u>	<u>Command aborted</u>	<u>Executable</u>	<u>Executable</u>
<u>SCT Feature Control</u>	<u>Executable</u>	<u>Command aborted</u>	<u>Executable</u>	<u>Executable</u>
<u>SCT Data Tables</u>	<u>Executable</u>	<u>Command aborted</u>	<u>Executable</u>	<u>Executable</u>
<u>SCT Read Status</u>	<u>Executable</u>	<u>Executable</u>	<u>Executable</u>	<u>Executable</u>
SECURITY DISABLE PASSWORD	Executable	Command aborted	Executable	Command aborted
SECURITY ERASE PREPARE	Executable	Executable	Executable	Command aborted
SECURITY ERASE UNIT	Executable	Executable	Executable	Command aborted

Table 4 - Security mode command actions

Command	Disabled (SEC1) [Editors note: this entire column is new]	Locked (SEC4)	Unlocked (SEC5)	Frozen (SEC2 or SEC6)
SECURITY FREEZE LOCK	Executable	Command aborted	Executable	Executable
SECURITY SET PASSWORD	Executable	Command aborted	Executable	Command aborted
SECURITY UNLOCK	Command aborted Executable	Executable	Executable	Command aborted
SERVICE	Executable	Command aborted	Executable	Executable
SET FEATURES	Executable	Executable	Executable	Executable
SET MAX ADDRESS	Executable	Command aborted	Executable	Executable
SET MAX ADDRESS EXT	Executable	Command aborted	Executable	Executable
SET MAX SET PASSWORD	Executable	Command aborted	Executable	Executable
SET MAX LOCK	Executable	Command aborted	Executable	Executable
SET MAX FREEZE LOCK	Executable	Command aborted	Executable	Executable
SET MAX UNLOCK	Executable	Command aborted	Executable	Executable
SET MULTIPLE MODE	Executable	Executable	Executable	Executable
SLEEP	Executable	Executable	Executable	Executable
SMART DISABLE OPERATIONS	Executable	Executable	Executable	Executable
SMART ENABLE/DISABLE AUTOSAVE	Executable	Executable	Executable	Executable
SMART ENABLE OPERATIONS	Executable	Executable	Executable	Executable
SMART EXECUTE OFF-LINE IMMEDIATE	Executable	Executable	Executable	Executable
SMART READ DATA	Executable	Executable	Executable	Executable
SMART READ LOG	Executable	Executable	Executable	Executable
SMART RETURN STATUS	Executable	Executable	Executable	Executable
SMART WRITE LOG ¹	Executable	Executable	Executable	Executable
STANDBY	Executable	Executable	Executable	Executable
STANDBY IMMEDIATE	Executable	Executable	Executable	Executable
TRUSTED RECEIVE	Executable	Command aborted	Executable	Executable
TRUSTED RECEIVE DMA	Executable	Command aborted	Executable	Executable
TRUSTED SEND	Executable	Command aborted	Executable	Executable
TRUSTED SEND DMA	Executable	Command aborted	Executable	Executable
WRITE BUFFER	Executable	Executable	Executable	Executable
WRITE DMA	Executable	Command aborted	Executable	Executable
WRITE DMA EXT	Executable	Command aborted	Executable	Executable
WRITE DMA FUA EXT	Executable	Command aborted	Executable	Executable
WRITE DMA QUEUED	Executable	Command aborted	Executable	Executable
WRITE DMA QUEUED EXT	Executable	Command aborted	Executable	Executable
WRITE DMA QUEUED FUA EXT	Executable	Command aborted	Executable	Executable
		Executable [Editors note: in ATA7 this was 'aborted'. This proposal would change this to Executable because SMART WRITE LOG is executable]		
WRITE LOG EXT ¹	Executable	Executable	Executable	Executable
WRITE LOG DMA EXT ¹	Executable	Executable	Executable	Executable
WRITE MULTIPLE	Executable	Command aborted	Executable	Executable
WRITE MULTIPLE EXT	Executable	Command aborted	Executable	Executable
WRITE MULTIPLE FUA EXT	Executable	Command aborted	Executable	Executable
WRITE SECTOR(S)	Executable	Command aborted	Executable	Executable
WRITE SECTOR(S) EXT	Executable	Command aborted	Executable	Executable
WRITE STREAM DMA EXT	Executable	Command aborted	Executable	Executable
WRITE STREAM EXT	Executable	Command aborted	Executable	Executable

Table 4 - Security mode command actions

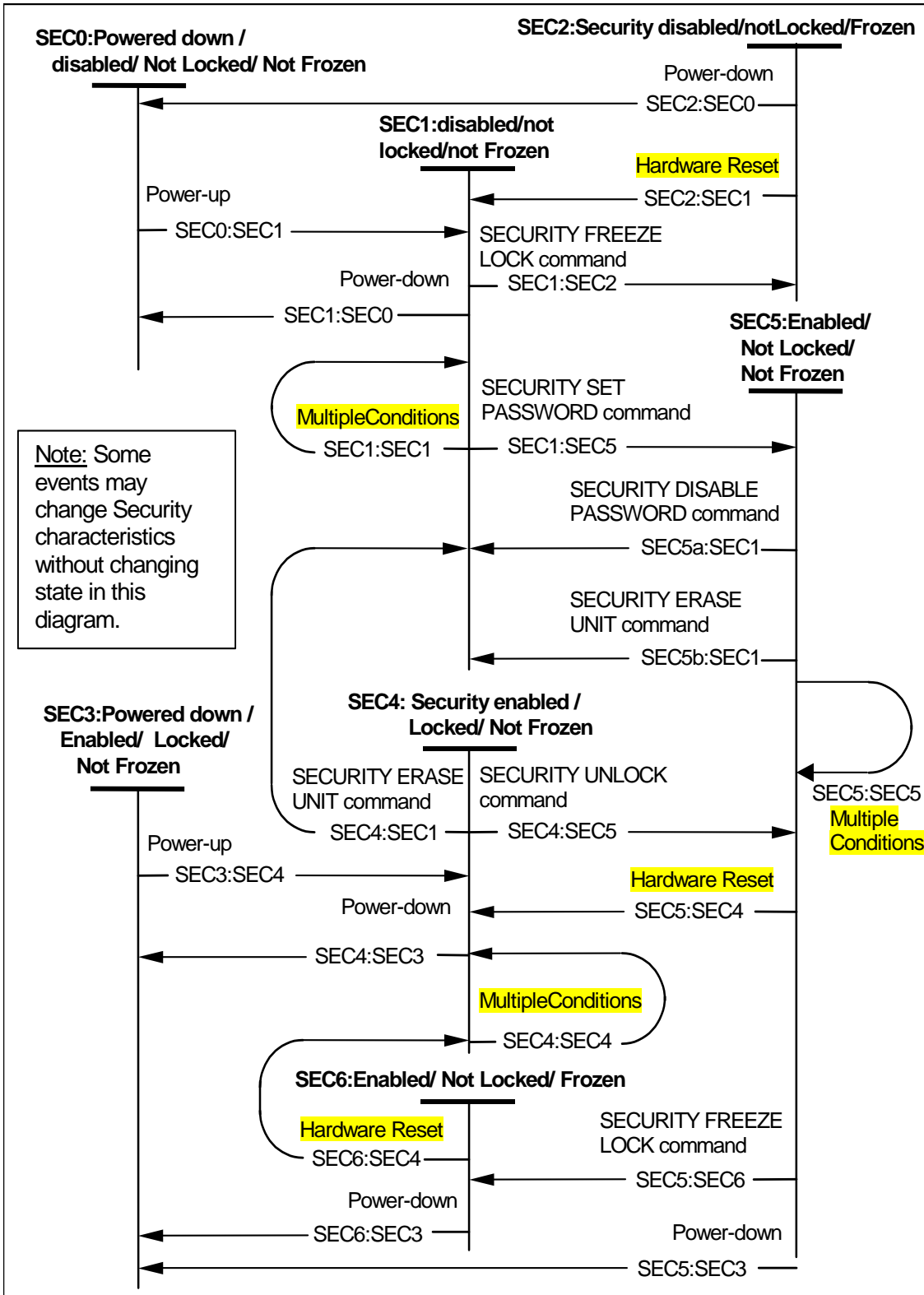
Command	Disabled (SEC1) <u>[Editors note: this entire column is new]</u>	Locked (SEC4)	Unlocked (SEC5)	Frozen (SEC2 or SEC6)
¹ Writing to SMART Log E0h or E1h (SCT) is prohibited when Security is Locked, SET MAX ADDRESS EXT Executable Command aborted Executable Executable				

(continued) |

~~Table 3 – Security mode command actions (continued)~~ |

(concluded) |

Figure 1 - Security State Mode Diagram



1.1.421.1.11 Details about each state and transition**[editors note: resume here - - - - -]**

State SEC0: Powered down/Security Disabled/Not Locked/ Not Frozen: This ~~modestate~~ shall be entered when the device is powered-down with the Security ~~Mode~~ feature set disabled.

Transition SEC0:SEC1: When the device is powered-up, the device shall make a transition to the SEC1: Security disabled/not Frozen state, ~~and initialize the IDENTIFY DEVICE or IDENTIFY PACKET DEVICE data.~~

State SEC1: Security Disabled/Not Locked/ Not Frozen: This ~~modestate~~ shall be entered when the device is powered-up or a hardware reset is received with the Security ~~Mode~~ feature set disabled or when the Security ~~Mode~~ feature set is disabled by a SECURITY DISABLE PASSWORD or SECURITY ERASE UNIT command.

In this state, the device shall respond to all commands except those indicated as Command Aborted in “Disabled” column of Table 4.

When entering this state from power-on or hardware reset, the device shall set the ~~attemptpassword attempt limitcounter~~ to five.

~~The device shall initialize IDENTIFY DEVICE or IDENTIFY PACKET DEVICE field values in accordance with-~~ While in this state, IDENTIFY DEVICE and IDENTIFY PACKET DEVICE shall report values as described in Table 5.

Table 54 - IDENTIFY settings for values reported in Security state SEC1

<u>Word</u>	<u>Bit position</u>	<u>Value</u>	<u>Description</u>
82	1	1	Security Mode feature set is supported
85	1	0	There is no active User password.
128	0	copy of word 82, bit 1	Security Mode feature set is supported
128	1	copy of word 85, bit 1	Security Mode feature set is disabled
128	2	0	device is not locked
128	3	0	device is not frozen
<u>128</u>	<u>4</u>	<u>varies</u>	<u>PasswordAttemptCounterExceeded flag. On power-on or hardware reset, clear to zero; otherwise, do not modify this value.</u>
128	8	0	security level-Master Password Capability is not ‘maximum’

Transition SEC1:SEC0: When the device is powered-down, the device shall make a transition to the SEC0:~~Powered down/Security disabled~~ state.

Transition SEC1:SEC1:

When a Hardware reset occurs the device shall remain in state SEC1.

[Editors note: do we need this loopback ? what about non-security commands ? is this list of events inclusive or exclusive ?] [only needed if something special is done in the state – so not needed]

When a hardware reset occurs, the device shall clear the PasswordAttemptLimitExceeded flag and remain in state SEC1.

[Editors note: if the loopback is kept, should it be labeled ?]

When a successful SECURITY SET (master) PASSWORD command is received, the Master password and the optional Master Password Identifier shall be saved, and the device shall remain in state SEC1. The Master Password Capability shall remain unchanged.

In this state, the device shall respond to all commands except those indicated as Command Aborted in “Disabled” column in Table 4 [global]. With the exception of the SECURITY commands, execution of these commands does not cause a transition from state SEC1.

Transition SEC1:SEC2: When a SECURITY FREEZE LOCK command is ~~received~~ successful, the device shall make a transition to the SEC2:~~Security disabled/Frozen~~ state.

Transition SEC1:SEC5: When a SECURITY SET (user) PASSWORD command is ~~received~~ successful, the device shall save the User password, update the Master Password Capability and make a transition to the SEC5:~~Unlocked/not frozen~~ state.

State SEC2: Security Disabled/ Not Locked/ Frozen: This ~~mode-state~~ shall be entered when the device receives a SECURITY FREEZE LOCK command while in the SEC1:~~Security disabled/not Frozen~~ state.

In this state, the device shall respond to all commands except those indicated as Command Aborted in “Frozen” column. Execution of these commands does not cause a transition from state SEC2.

~~In this state, the device shall respond to all commands except those indicated as Command Aborted in “Frozen” column~~

The device shall ~~initialize~~report the following IDENTIFY DEVICE or IDENTIFY PACKET DEVICE data when in this state:

word 128, bit 3 shall be set to one (frozen)

Transition SEC2:SEC0: When the device is powered-down, the device shall make a transition to the SEC0:~~Powered down/Security disabled~~ state.

Transition SEC2:SEC1: When the device receives a hardware reset, the device shall make a transition to the SEC1:~~Security disabled/not Frozen~~ state.

State SEC3: Powered down/Security Enabled/ Locked/ Not Frozen: This ~~mode~~state shall be entered when the device is powered-down with the Security ~~Mode~~ feature set enabled.

Transition SEC3:SEC4: When the device is powered-up, the device shall make a transition to the SEC4:~~Security enabled/locked~~ state.

State SEC4: Security Enabled/ Locked/ Not Frozen: This ~~mode~~state shall be entered when the device is powered-up or a hardware reset is received with the Security ~~Mode~~ feature set enabled.

In this state, the device shall respond to all commands except those indicated as Command Aborted in “Locked” column. With the exception of the SECURITY commands, execution of these commands does not cause a transition from state SEC4.

~~In this state, the device shall respond to all commands except those indicated as Command Aborted in “Locked” column.~~

When entering this state from power-on or hardware reset, the device shall set the ~~attempt~~password attempt ~~limit~~counter to five.

The device shall ~~initialize~~report IDENTIFY DEVICE or IDENTIFY PACKET DEVICE field values in accordance with Table 6 .

Table 65 - IDENTIFY settings for Security state SEC4

Word	Bit(s)	Value	Description
82	1	1	Security Mode feature set is supported

85	1	1	There is an active User password.
128	0	copy of word 82, bit 1	Security Mode feature set is supported
128	1	copy of word 85, bit 1	Security Mode feature set is enabled.
128	2	1	device is locked
128	3	0	device is not frozen
128	4	<u>varies</u>	<u>PasswordAttemptCounterExceeded flag.</u> <u>Note 1:</u> On power-on or hardware reset, clear to zero; otherwise, do not modify this value.
128	8	<u>0 varies</u>	security level is not 'maximum'

Transition SEC4:SEC1: When a SECURITY ERASE PREPARE command is successful and is followed by a successfully completing SECURITY ERASE UNIT command, the device shall make a transition to the SEC1 state.

Transition SEC4:SEC3: When the device is powered-down, the device shall make a transition to the SEC3: ~~Powered down/Security enabled~~ state.

Transition SEC4:SEC4: When the device receives a hardware reset, the device shall remain in state SEC4. ~~[Editor's note: Only transitions which change state are shown.]~~
~~[Editors note: do we need this loopback ? what about non-security commands ? is this list of events inclusive or exclusive ?]~~

When a SECURITY UNLOCK command is received with an incorrect password, the password attempt counter shall be decremented by 1, and remain in state SEC4. If password attempt counter reaches 0, the PasswordAttemptCounterExceeded bit (IDENTIFY DEVICE word 128, bit 4) shall be set to 1.

Transition SEC4:SEC5: When a ~~successful~~ SECURITY UNLOCK command is ~~received~~ successful, the device shall make a transition to the SEC5: ~~UNLOCKED/NOT FROZEN~~ state.

~~**Transition SEC4:SEC1:** When a SECURITY ERASE PREPARE command is successful received and is followed by a successfully completing SECURITY ERASE UNIT command, the device shall make a transition to the SEC1: SECURITY DISABLED/NOT FROZEN state.~~

State SEC5: Security Enabled/ Not Locked/ Not FrozenUnlocked/not Frozen: This ~~mode~~state shall be entered when ~~the device receives~~ either a SECURITY SET (user)

PASSWORD command ~~to enable the lock~~ or a SECURITY UNLOCK command is successful.

In this state, the device shall respond to all commands except those indicated as Command Aborted in “Unlocked” column. With the exception of the SECURITY commands, execution of these commands does not cause a transition from state SEC5.

The device shall ~~initialize~~report the following IDENTIFY DEVICE or IDENTIFY PACKET DEVICE data when in this state:

word 128, bit 1	shall be set to one (enabled)
word 128, bit 2	shall be cleared to zero (not locked)
word 128, bit 8	shall be set to one if the Security level <u>Master Password Capability</u>
	is ‘maximum’
<u>Password Capability</u>	shall be cleared to zero if the Security level <u>Master</u>
	is ‘high’

Transition SEC5:SEC1: When a ~~valid~~ SECURITY DISABLE PASSWORD command is successful~~received~~, the device shall make a transition to the SEC1:~~Security disabled/not Frozen~~ state.

~~Transition SEC5:SEC6: When a SECURITY FREEZE LOCK command is successful received, the device shall make a transition to the SEC6: Unlocked/Frozen state.~~

Transition SEC5:SEC3: When the device is powered-down, the device shall make a transition to the SEC3:~~Powered down/Security enabled~~ state.

Transition SEC5:SEC4: When the device receives a hardware reset, the device shall make a transition to the SEC4:~~Security enabled/Locked~~ state.

Transition SEC5:SEC5: [Editors note: do we need this loopback ? what about non-security commands ? is this list of events inclusive or exclusive ?]

When a successful SECURITY SET (master) PASSWORD command is received, the Master password and the optional Master Password Identifier shall be saved and the device shall remain in state SEC5. The Master Password Capability shall remain unchanged.

When a SECURITY SET (user) PASSWORD command is successful, the device shall save the User password, update the Master Password Capability and make a transition to the SEC5: state.

Transition SEC5:SEC6: When a SECURITY FREEZE LOCK command is successful, the device shall make a transition to the SEC6 state.

State SEC6: ~~Security Enabled/ Locked/ Frozen~~Unlocked/~~Frozen~~: This ~~modest~~state shall be entered when the device receives a SECURITY FREEZE LOCK command while SEC5:~~UNLOCKED/NOT FROZEN: Unlocked/Locked~~state.

~~In this state, the device shall respond to all commands except those indicated as Command Aborted in “Frozen” column. Execution of these commands does not cause a transition from state SEC6.~~

~~In this state, the device is capable of responding to all commands except those indicated as Command Aborted in Table 3 “Frozen” column.~~

The device shall initialize the following IDENTIFY DEVICE or IDENTIFY PACKET DEVICE data when in this state:

word 128, bit 3 shall be set to one (frozen)

Transition SEC6:SEC4: When the device receives a hardware reset, the device shall make a transition to the SEC4:~~Security enabled/Locked~~ state. ~~[Editor’s note: Frozen state is only exited after a power on reset. This is a bug that has persisted and was never discovered before.]~~

Transition SEC6:SEC3: When the device is powered-down, the device shall make a transition to the SEC3:~~Powered down/Security enabled~~ state.

1.2 Master Password ~~Revision Code~~ feature Identifier feature

This is an optional enhancement to the Security ~~Mode~~ feature set, which is a prerequisite. Support for this feature requires that the Security Mode feature set also be supported.

1.2.1 Use Case (Informative)

The intended purpose of this feature is to assist an administrator that uses several sets of Master passwords (for use in different deployments of devices). The administrator may maintain a mapping of actual Master passwords and a corresponding Identifier. When an administrator sets a Master password, the corresponding Master Password Identifier could be also set.

When the time comes to redeploy a device for which a User password had been set (and subsequently lost), the administrator needs to know which Master password is actually valid for this individual device. Since the device never reveals the Master password but does reveal the Identifier, the administrator may obtain a hint as to which Master password was previously set.

1.2.2 Requirements

The device shall maintain a 2-byte host vendor-specific data value associated with the Master Password.

The Master Password Identifier does not indicate whether a Master Password exists or is valid.

Support for this feature is reported in the IDENTIFY DEVICE or IDENTIFY PACKET DEVICE data in word 92. Valid ~~revision code~~ identifiers are 0001h through FFFEh. A value of 0000h or FFFFh indicates that the ~~Master Password Revision Code~~ this feature is not supported.

If the device supports this feature,

- A. The device shall ~~associate~~ store a non-volatile ~~revision code~~ identifier field with the stored Master password. The ~~revision code~~ identifier is maintained for the benefit of the host. The value is not modified by the device ~~device has no required use for it.~~
- B. Prior to first use, the initial ~~Master Password Revision Code~~ Master Password Identifier shall be set to FFFEh by the manufacturer.

1.3 DEVICE CONFIGURATION SET - B1h/C3h, PIO Data Out

1.3.1.1.1 Word 7: Command/features set supported part 1

Word 7 bit 3 is cleared to zero to disable support for the Security ~~feature~~ Security Mode feature set if ~~the Security Mode feature set is not enabled, is disabled,~~ and has the effect of ~~clearing bit 1 to zero in word 82 and word 85~~ of changing the IDENTIFY DEVICE or IDENTIFY PACKET DEVICE response: clear word 82 bit 1 to zero, clear word 85 bit 1 to zero, clear words 89, 90, 92 and 128 to zero. If ~~the Security-~~ **Mode feature set** is enabled, then the device shall return command aborted and make no changes.

Word 7 bit 3 is set to one to allow reporting of support for the Security **Mode** feature set and if the device does support the feature set has the effect of changing the IDENTIFY DEVICE or IDENTIFY PACKET DEVICE response: set word 82 bit 1 to one; clear word 85 bit 1 to zero; set word 128 bit 0 to one; set word 128 bit 5 to one if the enhanced security erase feature is supported; and setting words 89, 90 and 92 to a valid value. ~~These bits shall not be cleared if the Security feature set has been enabled.~~

1.4 IDENTIFY DEVICE - ECh, PIO Data-in

1.4.1.1 Words (84:82): Features/command sets supported

If bit 1 of word 82 is set to one, the Security ~~Mode~~ feature set is supported.

1.4.1.2 Words (87:85): Features/command sets enabled

If bit 1 of word 85 is set to one, the ~~n~~ Security ~~Mode feature set~~ has been enabled by setting a User password via the SECURITY SET PASSWORD command. If bit 1 of word 85 is cleared to zero, there is no valid ~~Security Mode feature set User password has been disabled via the SECURITY DISABLE PASSWORD command User password.~~ If the Security ~~Mode~~ feature set is not supported, this bit shall be cleared to zero.

1.4.1.3 Word 89: Time required for Security erase unit completion

Word 89 specifies the estimated time required for the SECURITY ERASE UNIT command to complete its normal mode erasure. Support of this word is mandatory if the Security ~~Mode~~ feature set is supported. If the Security ~~Mode~~ feature set is not supported, this word shall be cleared to zero.

Value	Time
0	Value not specified
1-254	(Value*2) minutes
255	>508 minutes

1.4.1.4 Word 90: Time required for Enhanced security erase unit completion

Word 90 specifies the estimated time required for the ~~ENHANCED~~ SECURITY ERASE UNIT command to complete its enhanced mode erasure. Support of this word is mandatory if support of the ~~Enhanced~~ Security ~~Mode~~ feature set is supported. If the Security ~~Mode~~ feature set is not supported, this word shall be cleared to zero.

Value	Time
0	Value not specified
1-254	(Value*2) minutes
255	>508 minutes

1.4.1.5 Word 92: Master Password ~~Revision Code Identifier~~

If either the Security feature set or the Master Password Identifier feature are not supported, word 92 shall contain the value 0000h or FFFFh

~~If the Security feature set and the Master Password Identifier feature are supported, w~~Word 92 contains the value of the ~~Master Password Revision Code~~ Master Password Identifier set when the Master Password was last changed. ~~Valid values are 0001h through FFFFh. A value of 0000h or FFFFh indicates that the Master Password Revision is not supported. Support of this word is mandatory if the Security Mode feature set is supported. (See 1.2). If the Security Mode feature set is not supported, this word contain the value FFFFh.~~

1.4.1.6 Word 128: Security status

Support of this word is mandatory if the Security ~~Mode~~ feature set is supported. If the Security ~~Mode~~ feature set is not supported, this word shall be cleared to zero,

Bit 8 of word 128 indicates the ~~security level~~Master Password Capability. If security~~mode~~ is enabled and the ~~security level~~Master Password Capability is high, bit 8 shall be cleared to zero. If security~~mode~~ is enabled and the ~~security level~~Master Password Capability is maximum, bit 8 shall be set to one. When security~~mode~~ is disabled, bit 8 shall be cleared to zero.

Bit 5 of word 128 set to one indicates that the ~~Enhanced security erase unit feature~~enhanced mode of the SECURITY ERASE UNIT command is~~supported. If bit 5 is set to one, the Enhanced security erase unit feature set is~~ supported.

Bit 4 of word 128 set to one indicates that the ~~security count~~password attempt limitcounter has ~~expired~~decremented to zero. This is also known as the “PasswordAttemptCounterExceeded” bit.~~If bit 4 is set to one, the security count is expired and SECURITY UNLOCK and SECURITY ERASE UNIT are command aborted until a power-on reset or hardware reset.~~

Bit 3 of word 128 set to one indicates that security is frozen. ~~If bit 3 is set to one, the security is frozen.~~

Bit 2 of word 128 set to one indicates that security is locked.~~If bit 2 is set to one, the security is locked.~~

Bit 1 of word 128 set to one indicates that security is enabled. ~~If bit 1 is set to one, the security is enabled.~~ This is a copy of word 85, bit 1.

Bit 0 of word 128 set to one indicates that the Security ~~Mode~~ feature sets~~supported. If bit 0 is set to one, security~~ is supported. This is a copy of word 82, bit 1.

1.5 IDENTIFY PACKET DEVICE - A1h, PIO Data-in

1.5.1.1 Words (84:82): Features/command sets supported

Words (84:82) shall have the content described for words (84:82) of the IDENTIFY DEVICE command except that bit 4 of word 82 shall be set to one to indicate that the PACKET Command feature set is supported.

1.5.1.2 Words (87:85): Features/command sets enabled

Words (87:85) shall have the content described for words (87:85) of the IDENTIFY DEVICE command except that bit 4 of word 85 shall be set to one to indicate that the PACKET Command feature set is supported.

1.5.1.3 Word 89: Time required for Security erase unit completion

Word 89 shall have the content described for word 89 of the IDENTIFY DEVICE command.

1.5.1.4 Word 90: Time required for Enhanced security erase unit completion

Word 90 shall have the content described for word 90 of the IDENTIFY DEVICE command.

1.5.1.5 Word (92:91): Reserved

Word 92 shall have the content described for word 92 of the IDENTIFY DEVICE command.

[Editors note: Add Words 89, 90, 92 to ID Packet Device table] |

1.5.1.6 Word 128: Security status

Word 128 shall have the content described for word 128 of the IDENTIFY DEVICE command. Support of this word is mandatory if the Security ~~feature~~ **Security Mode** feature set is supported. |

1.6 SECURITY DISABLE PASSWORD - F6h, PIO data-out

1.6.1 Feature Set

This command is mandatory for devices that implement the Security ~~Mode~~-feature set.

1.6.2 Description

The SECURITY DISABLE PASSWORD command transfers 512 bytes of data from the host. [Table 7](#) defines the content of this information.

If the password selected by word 0 matches the password previously saved by the device, the device shall disable the ~~Lock mode~~User password, and return the drive to the SEC1 state.

This command shall not change the Master password. ~~The Master password shall be reactivated when a User password is set(See 1.2).~~

~~This command shall return command aborted if the Security feature set is not supported, if Security is Locked (SEC4) or is Frozen (states SEC2 or SEC6).~~

~~When Security is Disabled: : [Editors note: is this an enhancement or clarification ?]~~

- ~~a. If the Identifier bit is set to Master, then the password supplied shall be compared with the stored Master password. [Editors note: should this case be ‘ignore the password and succeed ? or check the password always ?][erase unit ?]~~
- ~~b. If the Identifier bit is set to User, then the device shall return command aborted.~~

~~When Security is Enabled, and the Master Password Capability is ‘High’:~~

- ~~a. If the Identifier bit is set to Master, then the password supplied shall be compared with the stored Master password.~~
- ~~b. If the Identifier bit is set to User, then the password supplied shall be compared with the stored User password.~~

~~When Security is Enabled, and the Master Password Capability is ‘Maximum’~~

- ~~a. If the Identifier bit is set to Master, then the device shall return command aborted, even if the supplied Master password is valid.~~
- ~~b. If the Identifier bit is set to User, then the password supplied shall be compared with the stored User password.~~

~~If the Security Level is High, either a valid Master or User password is required.~~

~~If the Security Level is Maximum, a valid User password is required. If a Master password (even if valid) is supplied, the device shall return command aborted.~~

~~This command shall only complete successfully if the Device is in Unlocked mode.~~

Upon successful completion, these fields of IDENTIFY DEVICE or IDENTIFY PACKET DEVICE shall be updated:

word 85, bit 1 shall be cleared to zero (no active User password)

word 128, bit 1 is a copy of word 85, bit 1
 word 128, bit 8 shall be cleared to zero (security level Master Password
Capability
 is not Mmaximum)

1.6.3 Inputs

Word	Name	Description
00h	Feature	N/A
01h	Count	N/A
02h-04h	LBA	N/A
05h	Command	F6h

1.6.4 Normal outputs

See [Table 62]

1.6.5 Error outputs

The device shall return command aborted if the command is not supported, the device is in Locked mode, or the device is in Frozen mode. The device may return error status if an Interface CRC error has occurred. See [Table 76].

1.6.6 Output Data Structure (Sent by the Host)

Table 76 -- ~~Security password content~~ SECURITY DISABLE PASSWORD data

Word	Content									
0	Control word <table border="1"> <thead> <tr> <th>Bit</th> <th>Field Name</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>Bit0</td> <td>Identifier</td> <td>0=compare User password 1=compare Master password</td> </tr> <tr> <td>Bit (15:1)</td> <td>Reserved</td> <td></td> </tr> </tbody> </table>	Bit	Field Name	Description	Bit 0	Identifier	0=compare User password 1=compare Master password	Bit (15:1)	Reserved	
Bit	Field Name	Description								
Bit 0	Identifier	0=compare User password 1=compare Master password								
Bit (15:1)	Reserved									
1-16	Password (32 bytes)									
17-255	Reserved									

1.7 SECURITY ERASE PREPARE - F3h, Non-data

1.7.1 Feature Set

This command is mandatory for devices that implement the Security ~~Mode~~ feature set.

1.7.2 Description

The SECURITY ERASE PREPARE command shall be issued immediately before the SECURITY ERASE UNIT command ~~to enable device erasing and unlocking. This command prevents accidental loss of data on the device.~~

1.7.3 Inputs

Word	Name	Description
00h	Feature	N/A
01h	Count	N/A
02h-04h	LBA	N/A
05h	Command	F3h

1.7.4 Normal outputs

See [Table 62]

1.7.5 Error outputs

Abort shall be set to one if the device is in Frozen mode. See [Table 76]

1.8 SECURITY ERASE UNIT - F4h, PIO data-out

1.8.1 Feature Set

This command is mandatory for devices that implement the Security ~~Mode~~ feature set.

1.8.2 Description

This command transfers 512 bytes of data from the host. [Table 8](#) defines the content of this information.

If the password does not match the password previously saved by the device, the device shall ~~reject the command with~~ return command aborted.

The SECURITY ERASE PREPARE command shall be completed immediately prior to the SECURITY ERASE UNIT command. If the device receives a SECURITY ERASE UNIT command ~~and the previous command was not without an immediately prior a successful~~ SECURITY ERASE PREPARE command, the device shall return command aborted for the SECURITY ERASE UNIT command.

If the ~~attempt~~password attempt limit counter has already decremented to zero, then the device shall return command aborted even if a correct password has been supplied.

[editors note: resume here -----]

When Security is Disabled: [Editors note: is this an enhancement or clarification ?][the interpretation that closes the hole should prevail ?]

- a. If the Identifier bit is set to Master, then the password supplied shall be compared with the stored Master password.
- b. If the Identifier bit is set to User, then the device shall return command aborted.

When Security is Enabled, and the Master Password Capability is 'High':

- a. If the Identifier bit is set to Master, then the password supplied shall be compared with the stored Master password.
- b. If the Identifier bit is set to User, then the password supplied shall be compared with the stored User password.

When Security is Enabled, and the Master Password Capability is 'Maximum':

- a. If the Identifier bit is set to Master, then the password supplied shall be compared with the stored Master password.
- c. If the Identifier bit is set to User, then the password supplied shall be compared with the stored User password.

~~If the the Security mode is Disabled (e.g. there is no active user password), a valid Master password is required.~~

~~If the Security Level is High or Maximum, either a valid Master or User password is required.~~

When Normal Erase mode is specified, the SECURITY ERASE UNIT command shall write binary zeroes to all user data areas (as determined by READ NATIVE MAX or

READ NATIVE MAX EXT). IDENTIFY DEVICE or IDENTIFY PACKET DEVICE word 89 gives an estimate of the time required to complete the erasure.

The Enhanced Erase mode is optional. IDENTIFY DEVICE or IDENTIFY PACKET DEVICE word 128, bit 5 indicates whether it is supported. When Enhanced Erase mode is specified, the device shall write predetermined data patterns to all user data areas. In Enhanced Erase mode, all previously written user data shall be overwritten, including sectors that are no longer in use due to reallocation. IDENTIFY DEVICE or IDENTIFY PACKET DEVICE word 90 gives an estimate of the time required to complete the erasure.

On successful completion, ~~t~~This command shall disable ~~the device Lock mode Security~~ (e.g. returns the device to Security state SEC1), and ~~deactivate-invalidate~~ any existing User password. ~~., however, the Masterpassword shall still be stored internally within the device and may be reactivated later when a new User password is set. Any previously valid Master password remains valid and active.~~

~~This command shall be immediately preceded by a SECURITY ERASE PREPARE command.~~

Upon successful completion, these fields of IDENTIFY DEVICE or IDENTIFY PACKET DEVICE shall be updated:

word 85, bit 1	shall be cleared to zero (no active user password)
word 128, bit 1	shall be cleared to zero (no active user password)
word 128, bit 8	shall be cleared to zero (security level Master Password

Capability

is not Mmaximum)

1.8.3 Inputs

Word	Name	Description
00h	Feature	N/A
01h	Count	N/A
02h-04h	LBA	N/A
05h	Command	F4h

1.8.4 Normal outputs

See [Table 62]

1.8.5 Error outputs

~~Abort shall be set to one~~The device shall return command aborted if the ~~device is in Frozen mode~~, not immediately preceded by a SECURITY ERASE PREPARE command, or if Enhanced mode was requested but the device does not support it, or of an

invalid password was specified, or if the data area is not successfully overwritten. The device may return error status if an Interface CRC error has occurred. See [Table 76].

1.8.6 Output Data Structure (Sent by the Host)

Table 87 - SECURITY ERASE UNIT passworddata

Word	Content		
0	Control word		
	<u>Bit</u>	<u>Field Name</u>	<u>Description</u>
	Bit 0	Identifier	0=Compare User password 1=Compare Master password
	1	Erase mode	0=Normal Erase <u>mode</u> 1=Enhanced Erase <u>mode</u>
	Bit (15:2)	Reserved	
1-16	Password (32 bytes)		
17-255	Reserved		

1.9 SECURITY FREEZE LOCK - F5h, Non-data

1.9.1 Feature Set

This command is mandatory for devices that implement Security **Mode** feature set.

1.9.2 Description

The SECURITY FREEZE LOCK command shall set the device to Frozen mode. After command completion any other commands that update the device Lock mode shall be command aborted. Frozen mode shall be disabled by power-off or hardware reset. If SECURITY FREEZE LOCK ~~shall be~~ is issued when the device is in Frozen mode, the command executes and the device shall remain in Frozen mode.

See [Table 4](#) for a list of commands disabled by SECURITY FREEZE LOCK.

~~Commands disabled by SECURITY FREEZE LOCK are:~~

- ~~- SECURITY SET PASSWORD~~
- ~~- SECURITY UNLOCK~~
- ~~- SECURITY DISABLE PASSWORD~~
- ~~- SECURITY ERASE PREPARE~~
- ~~- SECURITY ERASE UNIT~~

Upon successful completion, these fields of IDENTIFY DEVICE or IDENTIFY PACKET DEVICE shall be updated:

word 128, bit 3 shall be set to one (frozen)

1.9.3 Inputs

Word	Name	Description
00h	Feature	N/A
01h	Count	N/A
02h-04h	LBA	N/A
05h	Command	F5h

1.9.4 Normal outputs

See [Table 62].

1.9.5 Error outputs

Abort shall be set to one if the device is in Frozen mode. See [Table 76].

1.10 SECURITY SET PASSWORD - F1h, PIO data-out

1.10.1 Feature Set

This command is mandatory for devices that implement the Security ~~Mode~~ feature set.

1.10.2 Description

This command transfers 512 bytes of data from the host. Table 9 defines the content of this information. ~~The data transferred controls the function of this command. defines the interaction of the identifier and security level bits. The command sets only one password at a time.~~

1.10.2.1 Setting the Master Password

If a Master password is specified, the device shall save the supplied Master password in a non-volatile location. ~~The Master Password Capability shall remain unchanged. This does not cause any -changes to IDENTIFY DEVICE or IDENTIFY PACKET DEVICE words 85 or 128.~~

~~In addition, if the device supports the Master Password Revision Code~~Master Password Identifier feature and a valid ~~revision code~~identifier is supplied (see 1.2), the device shall save the ~~revision code~~identifier in a non-volatile location. ~~This new value shall be returned, and return it~~ in word 92 of IDENTIFY DEVICE or IDENTIFY PACKET DEVICE result data. ~~If the host attempts to set the identifier to an invalid value (0000h or FFFFh), the device shall preserve the existing identifier and return command aborted.~~

If the device does not support the ~~Master Password Revision Code~~Master Password Identifier feature, the device shall not ~~change word 92~~.validate the identifier field, and shall not change word 92 of IDENTIFY DEVICE or IDENTIFY PACKET DEVICE. This shall not be cause to return command aborted.

~~1.10.2.2 The revision code field shall be returned in the IDENTIFY DEVICE data word 92. The valid revision codes are 0001h through FFFEh. A value of 0000h or FFFFh indicates that the Master Password Revision Code is not supported.~~Setting the User Password

If a User password is specified, the device shall save the User password in a non-volatile location and, update the Security Level. ~~The Master Password Identifier shall not be changed. These and these~~ fields of IDENTIFY DEVICE or IDENTIFY PACKET DEVICE shall be updated:

word 85, bit 1	shall be set to one (Security enabled)
word 128, bit 1	shall be set to one (Security enabled)
<u>word 128, bit 8</u>	<u>shall indicate the Security Level</u>

1.12.31.10.3 Inputs

Word	Name	Description
00h	Feature	N/A
01h	Count	N/A
02h-04h	LBA	N/A
05h	Command	F1h

1.10.3.1 Output data structure (Sent by the Host)**Table 9 – SECURITY SET PASSWORD data**

<u>Word</u>	<u>Content</u>															
<u>0</u>	<u>Control word</u>															
	<table border="1"> <thead> <tr> <th><u>Bit</u></th> <th><u>Field Name</u></th> <th><u>Description</u></th> </tr> </thead> <tbody> <tr> <td><u>0</u></td> <td><u>Identifier</u></td> <td><u>0=set User password</u> <u>1=set Master password</u></td> </tr> <tr> <td><u>(7:1)</u></td> <td><u>Reserved</u></td> <td></td> </tr> <tr> <td><u>8</u></td> <td><u>Security Level</u></td> <td><u>0=High</u> <u>1=Maximum</u></td> </tr> <tr> <td><u>(15:9)</u></td> <td><u>Reserved</u></td> <td></td> </tr> </tbody> </table>	<u>Bit</u>	<u>Field Name</u>	<u>Description</u>	<u>0</u>	<u>Identifier</u>	<u>0=set User password</u> <u>1=set Master password</u>	<u>(7:1)</u>	<u>Reserved</u>		<u>8</u>	<u>Security Level</u>	<u>0=High</u> <u>1=Maximum</u>	<u>(15:9)</u>	<u>Reserved</u>	
<u>Bit</u>	<u>Field Name</u>	<u>Description</u>														
<u>0</u>	<u>Identifier</u>	<u>0=set User password</u> <u>1=set Master password</u>														
<u>(7:1)</u>	<u>Reserved</u>															
<u>8</u>	<u>Security Level</u>	<u>0=High</u> <u>1=Maximum</u>														
<u>(15:9)</u>	<u>Reserved</u>															
<u>1-16</u>	<u>Password (32 bytes)</u>															
<u>17</u>	<u>Master Password Identifier (valid if word 0, bit 0 = 1, and if the device supports the Master Password Identifier feature)</u>															
<u>18-255</u>	<u>Reserved</u>															

Table 8 – Identifier and Security Level bit Interaction**1.10.4 Normal outputs**

See [Table 62]

1.10.5 Error outputs

Abort shall be set to one if the device is Locked or in Frozen mode. The device may return error status if an Interface CRC error has occurred. See [Table 76].

1.11 SECURITY UNLOCK - F2h, PIO data-out

1.11.1 Feature Set

This command is mandatory for devices that implement the Security Mode feature set.

1.11.2 Description

This command transfers 512 bytes of data from the host. [Table 11](#) defines the content of this information.

When Security is Disabled:

- c. If the Identifier bit is set to Master, then the password supplied shall be compared with the stored Master password.
- d. If the Identifier bit is set to User, then the device shall return command aborted.

When Security is Enabled, and the Master Password Capability is 'High':

- c. If the Identifier bit is set to Master, then the password supplied shall be compared with the stored Master password.
- d. If the Identifier bit is set to User, then the password supplied shall be compared with the stored User password.

When Security is Enabled, and the Master Password Capability is 'Maximum'

- b. If the Identifier bit is set to Master, then the device shall return command aborted.
- d. If the Identifier bit is set to User, then the password supplied shall be compared with the stored User password.

~~If the Identifier bit is set to Master and the device is in high security level, then the password supplied shall be compared with the stored Master password. If the device is in maximum security level then the unlock shall be rejected device shall return command aborted.~~

~~If the Identifier bit is set to user then the device shall compare the supplied password with the stored User password.~~

If the password attempt counter has already decremented to zero, then the device shall return command aborted even if a correct password has been supplied.

If the password compare fails then the device shall return command aborted to the host and decrements the ~~unlock attempt~~password attempt limit counter. ~~This counter shall be initially set to five and shall be decremented for each password mismatch when SECURITY UNLOCK is issued and the device is locked.~~ When this counter reaches zero, IDENTIFY DEVICE or IDENTIFY PACKET DEVICE word 128 bit 4 shall be set to one, and SECURITY UNLOCK and SECURITY ERASE UNIT commands shall be return command aborted until a power-on reset or a hardware reset. SECURITY UNLOCK commands issued when the device is unlocked have no effect on the unlock counter.

Upon successful completion, this field of IDENTIFY DEVICE or IDENTIFY PACKET DEVICE shall be updated:

word 128, bit 2 shall be set to cleared to zero (not locked)

1.11.3 Inputs

Word	Name	Description
00h	Feature	N/A
01h	Count	N/A
02h-04h	LBA	N/A
05h	Command	F2h

1.11.4 Normal outputs

See [Table 62]

1.11.5 Error outputs

If the device is in Frozen mode or an invalid password is supplied or the ~~attempt~~password attempt limitcounter has ~~expired~~decremented to zero, the device shall return command aborted.

~~Abort shall be set to one if the device is in Frozen mode.~~ The device may return error status if an Interface CRC error has occurred. See [Table 76].

1.11.6 Output Data Structure (Sent by the Host)

Table 11 – SECURITY UNLOCK data

<u>Word</u>	<u>Content</u>									
<u>0</u>	<u>Control word</u> <table border="1"> <thead> <tr> <th><u>Bit</u></th> <th><u>Field Name</u></th> <th><u>Description</u></th> </tr> </thead> <tbody> <tr> <td><u>0</u></td> <td><u>Identifier</u></td> <td><u>0=compare User password</u> <u>1=compare Master password</u></td> </tr> <tr> <td><u>(15:1)</u></td> <td><u>Reserved</u></td> <td></td> </tr> </tbody> </table>	<u>Bit</u>	<u>Field Name</u>	<u>Description</u>	<u>0</u>	<u>Identifier</u>	<u>0=compare User password</u> <u>1=compare Master password</u>	<u>(15:1)</u>	<u>Reserved</u>	
<u>Bit</u>	<u>Field Name</u>	<u>Description</u>								
<u>0</u>	<u>Identifier</u>	<u>0=compare User password</u> <u>1=compare Master password</u>								
<u>(15:1)</u>	<u>Reserved</u>									
<u>1-16</u>	<u>Password (32 bytes)</u>									
<u>17-255</u>	<u>Reserved</u>									