

"Write Read Verify" Feature Set

To: T13 Technical committee
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Change History:

- R0: Initial proposal
- R1: Change Reset behavior, clarify ReadVerify behavior, remove required signature from SET FEATURES to enable the feature.
- R2: Revise document to simplify behavior of WriteReadVerify command. All error logging was removed
- R2b: Changed set features to have a sector count and a mode. Changed read compare to read verify.
- R3: Make changes to behavior on how delayed errors are reported during read verify.
- R4: Changes made to clarify the device behavior in an error condition.
- R5: Changes made to IDENTIFY DEVICE data. Editorial changes from last meeting on error reporting and DF. Add DCO bit.

1 Introduction

The purpose of this proposal is to define a new feature set.

- 1) The T13 editor is requested to assign new (currently 'reserved')
 - a) Two SET FEATURE subcommand codes (Table 1)
 - i) Enable 'Write Read Verify' feature set
 - ii) Disable 'Write Read Verify' feature set
 - b) Four IDENTIFY DEVICE words
 - i) supported features extension 4 (1 word)
 - ii) enabled features extension 4 (1 word)
 - iii) WriteReadVerify sector count (2 words)
 - c) Four IDENTIFY PACKET DEVICE words
 - i) supported features extension 4 (1 word)
 - ii) enabled features extension 4 (1 word)
 - iii) WriteReadVerify sector count (2 words)
 - d) one bit within the new 'supported features extension 4' word
 - e) one bit within the new 'enabled features extension 4' word

2 Changes to Clause 4 (General operational requirements)

(Insert this as a new section 4.xx)

2.1 Write Read Verify feature set

The optional Write Read Verify feature set allows a host to control Read After Write behavior in a device.

This feature set is available for all devices.

The device may report whether the feature set is supported and/or enabled via the IDENTIFY DEVICE command.

To enable or disable the feature of Write/Read/Verify, the host may execute a SET FEATURES command with one of two subcommand codes.

This feature set shall not be controllable via the DEVICE CONFIGURATION OVERLAY (DCO) command.

It is possible that the device may experience a performance degradation when the WriteReadVerify feature is enabled.

These commands are affected by this feature:

- WRITE DMA
- WRITE DMA EXT
- WRITE DMA FUA EXT
- WRITE DMA QUEUED
- WRITE DMA QUEUED EXT
- WRITE DMA QUEUED FUA EXT
- WRITE MULTIPLE
- WRITE MULTIPLE EXT
- WRITE MULTIPLE FUA EXT
- WRITE SECTOR(S)
- WRITE SECTOR(S) EXT

See clause 3.1.1.2 for a description of device behavior when this feature set is supported and enabled.

3 Changes to Clause 4 (Commands)

3.1 SET FEATURES

Table 1 - SET FEATURES register definitions

Value	Description
TBD	Enable Write Read Verify feature set
TBD+80h	Disable Write Read Verify feature set

3.1.1.1 Disable Write Read Verify feature set

Subcommand code TBD disables the Write Read Verify feature set. When this feature set is not supported, the command shall be aborted. A subsequent IDENTIFY DEVICE or IDENTIFY PACKET DEVICE command shall reflect the disabled state of the feature set.

3.1.1.1.1 Inputs

Table 2 - Inputs for Disable Write Read Verify feature set

Register	7	6	5	4	3	2	1	0
Features	TBD							
Sector Count	na							
LBA Low	na							
LBA Mid	na							
LBA High	na							
Device	obs	na	obs	DEV	na	na	na	na
Command	EFh							

3.1.1.2 Enable Write Read Verify feature set

Subcommand code TBD enables the Write Read Verify feature set. When this feature set is supported and enabled, the device shall exhibit the following behavior. When this feature set is not supported, the command shall be aborted.

3.1.1.2.1 Inputs

Table 3 - Inputs for Enable Write Read Verify feature set

Register	7	6	5	4	3	2	1	0
Features	TBD							
Sector Count	Verify Sector Count							
LBA Low	Mode							
LBA Mid	na							
LBA High	na							
Device	obs	na	obs	DEV	na	na	na	na
Command	EFh							

Sector Count register

Shall specify the maximum number of sectors that shall be verified after any power-on reset or spin-up. See Table 4.

Device register -

DEV shall specify the selected device.

Table 4 - Write Read Verify feature sector counts

Mode	Description
00	Enabled Always. The device shall perform a Write Read Verify for all write command received from the host.
01h	The first 65,536 sectors (located ANYWHERE, not just the LBA=0 thru LBA=65535) written by the host after every spinup (or reset) or after issuing this set features will be verified.
02h	Device may determine, for itself, how many sectors to do ('automatic' setting)
03h	The first (Verify Sector Count x 1024) sectors written by the host after every spinup or after issuing this set features will be verified
04h-FFh	Reserved
<u>When Mode 3 is not selected, the Verify Sector Count is defined as Ignored</u>	

(The following section is not part of the SET FEATURES command section, but should be in the feature set description)

- 1) A subsequent IDENTIFY DEVICE or IDENTIFY PACKET DEVICE command shall reflect the enabled or disabled state of the feature set.
- 2) If the Write Cache is enabled, the device may report status to the Host before writing the data to the media. When the device Write Cache is enabled, the device may report "good" status to the host even if the data is in the device Write Cache and not Written and Verified to the media. This is important to reduce the performance degradation when we use the Write Read Verify function.
- 3) Read Verify behavior:
 - a) Is unaffected by whether Write Caching is enabled or disabled.
 - b) If the WriteReadVerify feature is disabled, or if the device has already verified the maximum number of sectors configured for this feature set, then no further action shall be taken.
 - c) After the device has written the sectors to the media, it shall attempt to read (Verify) those same sectors. A read from the media shall be performed before verification. The verification of sectors is defined as vendor specific.
 - d) If drive detects any errors (in the sectors 'written') during "Verify" the device shall report an error to host. The write to media, the read from the media, and verify is preformed before reporting "COMMAND COMPLETE" to the host.
 - e) If necessary, the device may perform an internal retry algorithm for the write, read, and verify operation before reporting status to the host.
 - f) The device may perform its internal sector relocation algorithm. The behavior of how sectors are reassigned or relocated is defined as vendor specific to the device.
 - g) If an unrecoverable error condition is encountered by the device during the write, read, or verify operation, the device shall report an error to the host.

When Write Cache is "Enabled", and an error is encountered (after reporting "good" status) during the Read Verify operation, the device should report the delayed error to the host. In the condition of a delayed error, the device shall abort the next command after an error is encountered during the read verify operation.

The device shall not execute additional commands after an error is encountered, when the Write Cache is enabled. In this error condition, the device shall set the DF bit to 1. This condition may only be cleared by a power cycle. The device in General Purpose Logging may record additional error information; error information may also be

recorded in vendor specific logs. Additional error reporting is defined as optional and vendor specific. This is the behavior for existing commands when Write Read Verify is disabled or not supported. Most devices usually report Device Fault error for any command if the drive is unable to complete a cached write.

- 4) Reset Behavior
- 5) [editors note: make the set features apply immediately]
 - a) Power on Reset --> Write Read Verify feature is disabled or set to default setting.
 - b) Hard Reset --> Write Read Verify feature is disabled or set to default setting.
 - c) Soft Reset --> Write Read Verify feature is disabled or the current mode is remained depends on the "Enable/Disable reverting to power-on defaults" setting.

3.2 IDENTIFY DEVICE

Table 5 - IDENTIFY DEVICE data

Word	O/M	F/V	Description
TBD	M	F	Features supported extension 4
			15 Shall be cleared to zero
			14 Shall be set to one
			TBD 1 = Write Read Verify feature set is supported
			TBD 1 = Write Read Verify feature set is enabled
			TBD Write Read Verify Sector Count Part 1 of 2 (mode 3 only)
			TBD Write Read Verify Sector Count Part 2 of 2 (mode 3 only)
			TBD Mode 2 details????
			TBD WriteReadVerify DCO Supported
			All others are Reserved

3.2.1.1 Word (TBD): Features supported extension 4

Word TBD shall indicate additional features/command sets supported. If a defined bit is cleared to zero, the indicated features/command set is not supported. If bit 14 of word TBD is set to one and bit 15 of word TBD is cleared to zero, the contents of word TBD contain valid information. If not, information is not valid in these words.

If bit TBD of word TBD is set to one, the Write Read Verify feature set is supported.

3.2.1.2 Word (TBD): Features enabled extension 4

Word TBD shall indicate additional features/command sets enabled. If a defined bit is cleared to zero, the indicated features/command set is not enabled. If bit 14 of word TBD is set to one and bit 15 of word TBD is cleared to zero, the contents of word TBD contain valid information. If not, information is not valid in these words.

If bit TBD of word TBD is set to one, the Write Read Verify feature set is enabled.

3.2.1.3 Words (TBD-TBD): Write-Read-Verify sector count

Words TBD-TBD shall indicate the number of sectors to be verified after spinup, as set by the SET FEATURES command for the 'Enable Write Read Verify feature set'. Write Read Verify sector count only applies to mode 3.

3.3 IDENTIFY PACKET DEVICE

Table 18- IDENTIFY PACKET DEVICE data

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			<u>TBD 1 = Write Read Verify feature set is supported</u>
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