

# SMART Self-Test Reference for P400e SATA SSDs

## Introduction

This technical note describes the self-test modes, commands, values, and result checks for the self-monitoring, analysis, and reporting technology (SMART) used for the P400e SATA SSDs.

All example test times are based on the 512GB drive, which is expected to be worst case; smaller drives should take less time.

## Offline Mode Self-Test

The offline mode self-test is well defined:

- The device reports command completion before processing the subcommand routine.
- The device remains ready to receive a new command during processing of the subcommand routine.
- All offline mode self-test commands are executed as background tasks.

## Short Self-Test in Offline Mode

Reads and verifies ~21GB in user logical block addresses (LBAs).

Input ATA LTF Command		Output ATA LTF Command	
Name	Description	Name	Description
Feature	D4h	Feature	00h
Count	00h	Count	00h
LBA low	01h	LBA low	01h
LBA middle	4Fh	LBA middle	00h
LBA high	C2h	LBA high	00h
Device	A0h	Device	E0h
Command	B0h	Command	50h

Command execution time: ~106 seconds (executed as a background task).



## Extended Self-Test In Offline Mode

Covers all the user LBAs.

Input ATA LTF Command		Output ATA LTF Command	
Name	Description	Name	Description
Feature	D4h	Feature	00h
Count	00h	Count	00h
LBA low	02h	LBA low	02h
LBA middle	4Fh	LBA middle	00h
LBA high	C2h	LBA high	00h
Device	A0h	Device	E0h
Command	B0h	Command	50h

Command execution time: ~2583 seconds (executed as a background task).

## Conveyance Self-Test in Offline Mode

Reads and verifies ~36GB in user LBAs.

Input ATA LTF Command		Output ATA LTF Command	
Name	Description	Name	Description
Feature	D4h	Feature	00h
Count	00h	Count	00h
LBA low	03h	LBA low	03h
LBA middle	4Fh	LBA middle	00h
LBA high	C2h	LBA high	00h
Device	A0h	Device	E0h
Command	B0h	Command	50h

Command execution time: ~196 seconds (executed as a background task).

## Abort Offline Mode Self-Test Routine

Aborts the offline mode self-test routine.

Input ATA LTF Command		Output ATA LTF Command	
Name	Description	Name	Description
Feature	D4h	Feature	00h
Count	00h	Count	00h
LBA low	7Fh	LBA low	7Fh
LBA middle	4Fh	LBA middle	4Fh
LBA high	C2h	LBA high	C2h
Device	A0h	Device	E0h
Command	B0h	Command	50h

## Captive Mode Self-Test

When processing a self-test in captive mode, the device processes the self-test routine after receipt of the command. At the end of the self-test routine, the device places the results of this self-test routine in the self-test execution status byte and reports command completion. If an error occurs while a device is performing the self-test routine, the device may discontinue its testing, place the results of this self-test routine in the self-test execution status byte, and complete the command.

### Short Self-Test In Captive Mode

Reads and verifies ~1.75GB in user LBAs.

Input ATA LTF Command		Output ATA LTF Command	
Name	Description	Name	Description
Feature	D4h	Feature	00h
Count	00h	Count	01h
LBA low	81h	LBA low	01h
LBA middle	4Fh	LBA middle	00h
LBA high	C2h	LBA high	00h
Device	A0h	Device	00h
Command	B0h	Command	D0h

Command execution time: ~8 seconds.

### Extended Self-Test in Captive Mode

Covers all the user LBAs.

Input ATA LTF Command		Output ATA LTF Command	
Name	Description	Name	Description
Feature	D4h	Feature	00h
Count	00h	Count	00h
LBA low	82h	LBA low	82h
LBA middle	4Fh	LBA middle	4Fh
LBA high	C2h	LBA high	C2h
Device	A0h	Device	E0h
Command	B0h	Command	50h

Command execution time: ~2566 seconds.



## Conveyance Self-Test In Captive Mode

Reads and verifies ~1.75G in user LBAs.

Input ATA LTF Command		Output ATA LTF Command	
Name	Description	Name	Description
Feature	D4h	Feature	00h
Count	00h	Count	01h
LBA low	83h	LBA low	01h
LBA middle	4Fh	LBA middle	00h
LBA high	C2h	LBA high	00h
Device	A0h	Device	00h
Command	B0h	Command	D0h

Command execution time: ~8 seconds.

## Check Self-Test Result

### Read Device SMART Data Structure

This command checks the self-test result.

Self-test execution status byte is in offset 353 within the device SMART data structure (512-byte structure). (Refer to “Self-Test Execution Status Byte” in the Appendix.)

Input ATA LTF Command		Output ATA LTF Command	
Name	Description	Name	Description
Feature	D0h	Feature	00h
Count	01h	Count	00h
LBA low	00h	LBA low	7Fh
LBA middle	4Fh	LBA middle	4Fh
LBA high	C2h	LBA high	C2h
Device	A0h	Device	E0h
Command	B0h	Command	50h

## Appendix

### Self-Test Execution Status Byte

The self-test execution status byte reports the status of the self-test routine as follows:

1. For bits 3:0 (that is, the percent of self-test remaining), the value indicates an approximation of the percentage of the self-test routine remaining until completion in 10% increments. Valid values are nine through zero.
  - 1a. A value of zero indicates that the self-test routine is complete. A value of nine indicates 90% of total test time remains.
2. For bits 7:4 (that is, self-test execution status), the value:
  - 2a. Indicates the current self-test execution status (see Table 1).
  - 2b. May be cleared to zero when the device processes a power-on reset.
  - 2c. Will be retained when the device processes a software reset or hardware reset.

**Table 1: Self-Test Execution Status Values**

Value	Description
0h	A previous self-test routine has completed without error or no self-test status is available.
1h	The self-test routine was aborted by the host.
2h	The self-test routine was interrupted by the host with a hardware or software reset.
3h	A fatal error or unknown test error occurred while the device was executing its self-test routine, and the device was unable to complete the self-test routine.
4h	The previous self-test completed with a test element that failed, and the test element that failed is unknown.
5h	The previous self-test completed with the electrical element of the test having failed.
6h	The previous self-test completed with the servo and/or seek test element of the test having failed.
7h	The previous self-test completed with the read element of the test having failed.
8h	The previous self-test completed with a test element that failed, and the device is suspected of having handling damage.
9h–Eh	Reserved.
Fh	Self-test routine in progress.

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## Revision History

Rev. A .....	12/11
• Initial release.	