

T10/05-245r2 SAT - SEND DIAGNOSTIC command and Self-Test Results

To: T10 Technical Committee
From: Wayne Bellamy (wayne.bellamy@HP.com), Hewlett-Packard
Date: November 11, 2005
Subject: T10/05-245r2 SAT - SEND DIAGNOSTIC command and Self-Test Results

Revision History

Revision 0 (September 8, 2005) first revision

Revision 1 (November 8, 2005) second revision

Change details:

- 1) Removed "strikeouts" for clarity. (Note: "r0" has them for ref. if needed)
- 2) Removed the additional SMART READ LOG and READ LOG EXT text from the SELF-TEST RESULTS field of the Self-Test Results log page parameters.
- 3) "Set to a value of " changed to "set to" throughout the document.
- 4) Check for 48-bit Address feature set for the SELF-TEST RESULTS, TIMESTAMP, and ADDRESS OF FIRST FAILURE fields of log page (10h).
- 5) Build translation table for the SENSE KEY, ADDITIONAL SENSE CODE, and ADDITIONAL SENSE CODE QUALIFIER fields.

Revision 2 (November 11, 2005) third revision

Change details:

- 1) Deleted most of the "blue" notes to the W.G. and editor.
- 2) Kept the version of Table 71 the W.G. preferred and deleted the extra table examples.
- 3) Changed "small caps" headings in Table 71 to normal text w/1st letter cap.
- 4) Remove everything except "NN" in RH column heading of Table 71 and changed all "non 8xh" entries in the column to "n/a".
- 5) Removed "strike-out" data in Table 70 and changed all "=" to "is set to".
- 6) Changed all "non-packet device" to "ATA device".
- 7) Get rid of all "n+x" designations (if possible...one case difficult) by changing to using the ATA field or byte names.
- 8) Change all "Of the 512 bytes returned" to "From the returned data the SATL shall select".
- 9) Get rid of all ATA opcodes that follow ATA command names and also add "with the Log address set to".
- 10) Change the SEND DIAGNOSTIC command SELFTEST failure ADDITIONAL SENSE CODE from INTERNAL TARGET FAILURE (44h/00h) to LOGICAL UNIT FAILED SELF-TEST (3Eh/03h).
- 11) As requested by T13 experts, removed EXECUTE DEVICE DIAGNOSTICS command from the SEND DIAGNOSTIC SELFTEST bit field description and replaced with the "test if SMART supported/enabled...if yes, do SMART Short self-test routine immediately in captive mode...if no, do ATA verify command "algorithm".

Related Documents

(T10) sat-r06 – SCSI to ATA Translation (SAT), Revision 6

(T10) sbc-2r16 – SCSI Block Commands -2, Revision 16

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(T10) spc-3r23 – SCSI Primary Commands -3, Revision 23

(T10) spc-4r01 – SCSI Primary Commands -4, Revision 01

(T13) ata7v1r4b – AT Attachment with Packet Interface -7 Volume1, Revision 4b

Overview

1. The SEND DIAGNOSTIC command is a mandatory SCSI command per SBC-2.
2. The “self-test” feature of this command must be supported per SPC-3 if the command is supported.
3. Complexity of the emulation is estimated to be “minimal” to support the SEND DIAGNOSTIC “SELFTEST” bit for the “default self-test” feature.
4. Complexity of the emulation is estimated to be “medium-well” to support the SEND DIAGNOSTIC “SELF-TEST CODE” field for additional self-tests and report results in the Self-Test Results log page.

Suggested Changes

8.11 SEND DIAGNOSTIC command

The SEND DIAGNOSTIC command provides a mechanism for an application client to request diagnostic operations be performed on the target, logical unit or both. The SATL shall implement the default self-test feature (see SPC-3).

Table 27 - SEND DIAGNOSTIC command CDB fields

| Field | Description or reference |
|----------------|---|
| OPERATION CODE | Set to 1Dh. This field value is specific to the SEND DIAGNOSTIC command. |
| SELF-TEST CODE | <ol style="list-style-type: none">1) If the SELFTEST field is set to 1b, the SATL shall disregard the content of this field.2) If the SELFTEST field is set to 0b, the SATL shall determine if the SMART EXECUTE OFF-LINE IMMEDIATE command is supported and enabled from the ATA device IDENTIFY DEVICE data word 84, bit 1, and word 85, bit 0. If the SMART EXECUTE OFF-LINE IMMEDIATE command is supported and enabled the SATL shall perform the appropriate action with the ATA device as defined in Table 28. If the SMART EXECUTE OFF-LINE IMMEDIATE command is not supported the SATL shall return a CHECK CONDITION status with SENSE KEY set to ILLEGAL REQUEST and ADDITIONAL SENSE CODE set to INVALID FIELD IN CDB. If the SMART EXECUTE OFF-LINE IMMEDIATE command is supported, but not enabled, the SATL shall return a CHECK CONDITION status with SENSE KEY set to ABORTED COMMAND and ADDITIONAL SENSE CODE set to ATA DEVICE FEATURE NOT ENABLED. |
| PF | Shall be set to 0b. |
| SELFTEST | <ol style="list-style-type: none">1) If set to 0b the SATL shall take the appropriate action as defined in Table 28.2) If set to 1b (i.e., default self-test feature) the SATL shall determine if the SMART EXECUTE OFF-LINE IMMEDIATE command is supported and enabled from the ATA device IDENTIFY DEVICE data word 84, bit 1, and |

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| | word 85, bit 0. If the SMART EXECUTE OFF-LINE IMMEDIATE command is supported and enabled the SATL shall issue a SMART EXECUTE OFF-LINE IMMEDIATE command to the ATA device to perform the Execute SMART Short self-test routine immediately in captive mode (see Table 29). If the command completes successfully, the SATL shall return GOOD status. If the command fails the SATL shall return a CHECK CONDITION status with SENSE KEY set to HARDWARE ERROR and ADDITIONAL SENSE CODE set to LOGICAL UNIT FAILED SELF-TEST. If the SMART EXECUTE OFF-LINE IMMEDIATE command is not supported or enabled, the SATL shall issue an ATA verify command (see 3.1.17) to the attached ATA device with one in the Sector Count register and a value in the LBA registers from zero to the maximum LBA supported by the device in its current configuration (see Table 45, note ^d). If the command completes successfully, the SATL shall return GOOD status. If the command fails the SATL shall return a CHECK CONDITION status with SENSE KEY set to HARDWARE ERROR and ADDITIONAL SENSE CODE set to LOGICAL UNIT FAILED SELF-TEST. |
| DEVOFFL | Shall be set to 0b. |
| UNITOFFL | Shall be set to 0b. |
| PARAMETER LIST LENGTH | Shall be set to 0b. |
| CONTROL | (see 6.4) |
| | |

Table 28 - SELF-TEST CODE field

| Code | Name of Test | Description of Test |
|------|--------------------------------|---|
| 000b | | Default self-test. Used when SELFTEST bit is set to 1. |
| 001b | Background short self-test | The SATL shall perform the following: <ol style="list-style-type: none"> 1) return status for the command as soon as the CDB has been validated and initialize the Self-Test Results log page (see 10.2.2 and SPC-3), and 2) shall issue an ATA SMART EXECUTE OFF-LINE IMMEDIATE command to the ATA device to perform the Execute SMART Short self-test routine immediately in off-line mode (see Table 29). |
| 010b | Background extended self- test | The SATL shall perform the following: <ol style="list-style-type: none"> 1) return status for the command as soon as the CDB has been validated and initialize the Self-Test Results log page (see 10.2.2 and SPC-3), and 2) shall issue an ATA SMART EXECUTE OFF-LINE IMMEDIATE command to the ATA device to perform the Execute SMART Extended self-test routine immediately in off-line mode (see Table 29). |
| 011b | Reserved. | unspecified. |
| 100b | Abort background self-test | The SATL shall issue an ATA SMART EXECUTE OFF-LINE IMMEDIATE command to the ATA device to perform the Abort off-line mode self-test routine (see Table 29). If the command |

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| | | completes successfully, the SATL shall return GOOD status. If the command fails the SATL shall perform the appropriate action as defined in SPC-3. |
| 101b | Foreground short self-test | The SATL shall issue an ATA SMART EXECUTE OFF-LINE IMMEDIATE command to the ATA device to perform the Execute SMART Short self-test routine immediately in captive mode (see Table 29). If the command completes successfully, the SATL shall update the Self-Test Results log page prior to returning GOOD status. If the command fails the SATL shall first update the Self-Test Results log page (if capable, see SPC-3) then return a CHECK CONDITION status with SENSE KEY set to HARDWARE ERROR and ADDITIONAL SENSE CODE set to LOGICAL UNIT FAILED SELF-TEST. |
| 110b | Foreground extended self-test | The SATL shall issue an ATA SMART EXECUTE OFF-LINE IMMEDIATE command to the ATA device to perform the Execute SMART Extended self-test routine immediately in captive mode (see Table 29). If the command completes successfully, the SATL shall update the Self-Test Results log page prior to returning GOOD status. If the command fails the SATL shall first update the Self-Test Results log page (if capable, see SPC-3) then return a CHECK CONDITION status with SENSE KEY set to HARDWARE ERROR and ADDITIONAL SENSE CODE set to LOGICAL UNIT FAILED SELF-TEST. |
| 111b | Reserved | unspecified. |

Table 29 – SMART EXECUTE OFF-LINE IMMEDIATE commands

| Subcommand | Register | Register value |
|---|----------|----------------|
| Execute SMART Short self-test routine immediately in off-line mode | Features | D4h |
| | LBA Low | 01h |
| | LBA Mid | 4Fh |
| | LBA High | C2h |
| | Command | B0h |
| Execute SMART Extended self-test routine immediately in off-line mode | Features | D4h |
| | LBA Low | 02h |
| | LBA Mid | 4Fh |
| | LBA High | C2h |
| | Command | B0h |
| Abort off-line mode self-test routine | Features | D4h |
| | LBA Low | 7Fh |
| | LBA Mid | 4Fh |
| | LBA High | C2h |
| | Command | B0h |
| Execute SMART Short self-test routine immediately in captive mode | Features | D4h |
| | LBA Low | 81h |

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| | LBA Mid | 4Fh |
| | LBA High | C2h |
| | Command | B0h |
| Execute SMART Extended self-test routine immediately in captive mode | Features | D4h |
| | LBA Low | 82h |
| | LBA Mid | 4Fh |
| | LBA High | C2h |
| | Command | B0h |

[NOTE to editor: “Pop” the following information into the log parameters section.]

10.2 Log Pages

10.2.4 Self-Test Results log page

The Self-Test Results log page (see Table 69) provides the results from the most recent self-tests (see SPC-3).

Table 69- Self-Test Results log page fields

| Field | Description or reference |
|--|---|
| PAGE CODE | Set to 10h. This field value is specific to the Self-Test Results log page. |
| PAGE LENGTH | (see SPC-3). |
| Self-test results log parameters (see SPC-3) | |
| | |

Table 70 - Self-test results log parameters

| Field | Description or reference |
|----------------|---------------------------------|
| PARAMETER CODE | unspecified. |
| DU | Shall be set to 0b (see SPC-3). |
| DS | Shall be set to 0b (see SPC-3). |
| TSD | Shall be set to 0b (see SPC-3). |
| ETC | Shall be set to 0b (see SPC-3). |

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| TMC | Shall be set to 0h (see SPC-3). |
| LBIN | Shall be set to 1b (see SPC-3). |
| LP | Shall be set to 1b (see SPC-3). |
| PARAMETER LENGTH | (see SPC-3). |
| SELF-TEST CODE | (see SPC-3). |
| SELF-TEST RESULTS | The SATL shall determine if the ATA device supports the 48-bit Address feature set from bit 10 of word 83 of the data returned from an IDENTIFY DEVICE command. If bit 10 of word 83 is set to 1 the SATL shall issue a READ LOG EXT command with the Log address set to 07h (i.e., Extended SMART self-test log) to the ATA device. From the returned data the SATL shall select the Self-test execution status bits from the Self-test execution status byte to return to the application client for this field (see ATA/ATAPI - 7). If bit 10 of word 83 is set to 0 the SATL shall issue a SMART READ LOG command with the Log address set to 06h (i.e., SMART self-test log) to the ATA device. From the returned data the SATL shall select the Content of the self-test execution status byte (i.e., byte n + 1 of the Self-test log descriptor entry) for the Self-test execution status bits to return to the application client for this field. |
| SELF-TEST NUMBER | unspecified. |
| TIMESTAMP | The SATL shall determine if the ATA device supports the 48-bit Address feature set from bit 10 of word 83 of the data returned from an IDENTIFY DEVICE command. If bit 10 of word 83 is set to 1 the SATL shall issue a READ LOG EXT command with the Log address set to 07h (i.e., Extended SMART self-test log) to the ATA device. From the returned data the SATL shall select the Life timestamp (most significant byte) and Life timestamp (least significant byte) of the Extended Self-test log descriptor entry to return to the application client for this field. If bit 10 of word 83 is set to 0 the SATL shall issue a SMART READ LOG command with the Log address set to 06h (i.e., SMART self-test log) to the ATA device. From the returned data the SATL shall select the Life timestamp (most significant byte) and Life timestamp (least significant byte) of the Self-test log descriptor entry to return to the application client for this field. |
| ADDRESS OF FIRST FAILURE | The SATL shall determine if the ATA device supports the 48-bit Address feature set from bit 10 of word 83 of the data returned from an IDENTIFY DEVICE command. If bit 10 of word 83 is set to 1 the SATL shall issue a READ LOG EXT command with the Log address set to 07h (i.e., Extended SMART self-test log) to the ATA device. From the returned data the SATL shall select the Failing LBA (47:40), Failing LBA (39:32), Failing LBA (31:24), Failing LBA (23:16), Failing LBA (15:8), and Failing LBA (7:0) of the Extended Self-test log descriptor entry to return to the application client for this field. If bit 10 of word 83 is set to 0 the SATL shall issue a SMART READ LOG command with the Log address set to 06h (i.e., SMART self-test log) to the ATA device. From the returned data the SATL shall select the Failing LBA (most significant byte), Failing LBA (next most significant byte), Failing LBA (next least significant byte), and Failing LBA (least significant byte) of the Self-test log descriptor entry to return to the application client for this field. |
| SENSE KEY | 10.2.5 |
| ADDITIONAL SENSE CODE | 10.2.5 |
| ADDITIONAL SENSE CODE QUALIFIER | 10.2.5 |
| | |

10.2.5 Sense key, additional sense code, and additional sense code qualifier

The SATL shall determine the values for the SENSE KEY, ADDITIONAL SENSE CODE, and ADDITIONAL SENSE CODE QUALIFIER fields from the Self-test execution status byte returned from a SMART READ DATA command issued to the ATA device. The values returned shall be translated into sense data for the SENSE KEY, ADDITIONAL SENSE CODE, and ADDITIONAL SENSE CODE QUALIFIER fields as shown in Table 71.

Table 71: ATA Self-test execution status values translated to SCSI sense keys and sense codes

| ATA | SCSI | | |
|----------------------------------|-----------------|--|-----|
| Self-test execution status value | Sense Key | Additional Sense Code | NN |
| 0 | NO SENSE | NO ADDITIONAL SENSE INFORMATION | n/a |
| 1 | ABORTED COMMAND | DIAGNOSTIC FAILURE ON COMPONENT NN (80h – FFh) | 81h |
| 2 | ABORTED COMMAND | DIAGNOSTIC FAILURE ON COMPONENT NN (80h – FFh) | 82h |
| 3 | ABORTED COMMAND | DIAGNOSTIC FAILURE ON COMPONENT NN (80h – FFh) | 83h |
| 4 | HARDWARE ERROR | DIAGNOSTIC FAILURE ON COMPONENT NN (80h – FFh) | 84h |
| 5 | HARDWARE ERROR | DIAGNOSTIC FAILURE ON COMPONENT NN (80h – FFh) | 85h |
| 6 | HARDWARE ERROR | DIAGNOSTIC FAILURE ON COMPONENT NN (80h – FFh) | 86h |
| 7 | MEDIUM ERROR | DIAGNOSTIC FAILURE ON COMPONENT NN (80h – FFh) | 87h |
| 8 | HARDWARE ERROR | DIAGNOSTIC FAILURE ON COMPONENT NN (80h – FFh) | 88h |
| 9-14 | NO SENSE | NO ADDITIONAL SENSE INFORMATION | n/a |
| 15 | NO SENSE | NO ADDITIONAL SENSE INFORMATION | n/a |