

To: X3T9.2 Committee (SCSI)

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Subject: LOG counter definitions

I had some discussions with engineers in my company about the error counter descriptions in the SCSI-2 draft. It turns out that there are no descriptions, just the titles that are listed in table 7-57 (Rev. 9). There seems to be a lot of room to make interpretations on what errors apply to which counter and how many increments occur to those counters when the error occurs.

I have made a SCSI-2 quiz out of the issues put to me. Please go through the questions and decide what your answer would be. If you feel (as I do) that more than one answer is possible, let's reconvene the LOG SENSE/SELECT committee to tell us what the "right" answers are.

The product is a direct access device with these characteristics:

logical block size 512 bytes

ECC on fly sector size 128 bytes

The "without substantial delay" ECC protects 128 data bytes at a time while the "with substantial delay" ECC protects 512 data bytes and requires the same syndrome to result 3 times (on 3 different retries) before correction is applied.

All error recovery bits (MODE SENSE page 1, byte 2) are zero except the PER bit, which is a one.

Read Retry Count is 20 (decimal).

Write Retry Count is 3 (decimal).

Read Error Counters that are implemented:

- 0 - Errors corrected without substantial delay
- 1 - Errors corrected with possible delays
- 2 - Total read retries
- 3 - Total errors corrected
- 4 - Total times correction algorithm is processed
- 5 - Total bytes processed
- 6 - Total uncorrected errors

The common question to answer for each of the following scenarios is: which of the seven counters are changed, and by how much? Note that all of these scenarios contain a command that will end with CHECK CONDITION status (with PER bit equal to one).

1. A READ command with 4 block transfer length is issued. A seek error is recovered by rezeroing the drive and reseeking. All data is read correctly on the first try.

2. A READ command with 4 block transfer length is issued. The "on the fly" ECC detects and corrects errors in the 1st and 2nd quarters of the first block and the 3rd quarter of the fourth block. No other retries or ECC is applied.

3. A READ command with 4 block transfer length is issued. 5 retries are needed to read the second block and 20 retries fail to recover the third block. The "with possible delays" ECC recovers that block. Note: assume retries are done only when "on the fly" ECC cannot recover the error.

4. The EER bit in MODE SENSE error recovery page is set. A READ command with 4 block transfer length is issued. The 2nd and 3rd quarters of the first block have errors corrected with "on the fly" ECC. In second block, the 1st quarter has an "on the fly" correctable error but the 2nd quarter has an "on the fly" uncorrectable error. 4 retries are needed to get a repeated syndrome so the "with possible delays" ECC can recover the error. The third block uses 3 retries to get a repeated syndrome, but the error is still uncorrectable. When deciding how to increment the Total Bytes Processed counter, remember that the TB bit is cleared and only the first two blocks are transferred to the host.

5. If the PER bit is set to zero, do the correctable errors in all of the above examples still get counted or are they ignored because CHECK CONDITION status isn't generated?

6. If the RC (Read Continuous) bit is set, are errors counted or are they ignored?

7. If the DCR bit is set and the error cannot be recovered with retries but the syndrome is repeatable and indicates a correctable error, does the error count as a correctable error (counters 1 and 3) or as an uncorrectable error (counter 6)?

MY ANSWERS:

1. Counter 5 (Total bytes processed): add 2048.

Counter 3 (Total errors corrected): add 1.

All others unchanged.

No other counter seems to involve seek errors. Is this an oversight? If the seek error was unrecoverable, then counter 6 (total uncorrectable errors) is incremented instead of counter 3.

2. Counter 5 (Total bytes processed): add 2048.

Counter 0 (Errors corrected without delay): add 2.

Counter 3 (Total errors corrected): add 2.

All others unchanged.

Count it as two errors because two different logical blocks had errors in them requiring correction. The "per logical block" criteria seems better than "per command" or "per bad spot within a logical block".

3. Counter 5 (Total bytes processed): add 2048.

Counter 2 (Total Read retries): add 1.

Counter 4 (Total times correction algorithm applied): add 25.

Counter 1 (Errors corrected with delays): add 1.

Counter 3 (Total errors corrected): add 2.

All others unchanged.

Counter 2 adds one because one logical block was recovered using retries. Counter 1 adds one because one logical block was recovered using ECC "with delays". Counter 3 adds two because two logical blocks had correctable errors. Counter 4 adds 5 for the retry recoverable error and 20 for the retry unrecoverable error.

4. Counter 5 (Total bytes processed): add 1536.

Counter 4 (Total times correction algorithm applied): add 7.

Counter 0 (Errors corrected without delays): add 1.

Counter 1 (Errors corrected with delays): add 1.

Counter 3 (Total errors corrected): add 2.

Counter 6 (Total uncorrectable errors): add 1.

Counter 2 (Total read retries) is unchanged.

Counter 5 is 1536 because 3 logical blocks were processed, even though one had an uncorrectable error. Since the drive stops on any uncorrectable error, the fourth block wasn't processed. I hope all the others are obvious from my previous explanations.

5. Yes, the counters still count even if reporting of recoverable errors via CHECK CONDITION status is disabled.

6. Errors corrected without delays (counter 0) can still be counted properly, but all others must be ignored because the normal corrections mechanisms are turned off by the RC bit. We can't even tell if they would be correctable or uncorrectable errors.

7. It's an uncorrectable error (counter 6). If it isn't recovered within the allowed criteria, it's an uncorrectable error.