

T10/98-006 R0

Voting Results on T10 Letter Ballot 98-004r0 on  
Forwarding SPI-2 to first public review

Organization	Name	S	Vote	Add'l Info
Adaptec, Inc.	Lawrence J. Lamers	P	Yes	Cmnts
AMP, Inc.	Charles Brill	P	Yes	
Amphenol Interconnect	Michael Wingard	P	Yes	
Ancot Corp.	Gary Porter	P	Yes	
Apple Computer	Ron Roberts	A	Yes	
Berg Electronics	Doug Wagner	P	Yes	
Cable Design Technologies	Richard Wagner	P	Yes	
Ciprico Inc.	Gerry Johnsen	P	Yes	
Circuit Assembly Corp.	Ian Morrell	P	Yes	
Tandem, a Compaq Company	Pete Tobias	P	Yes	
Congruent Software, Inc.	Peter Johansson	P	Yes	
Dallas Semiconductor	Charles Tashbook	P	Yes	
Data General / Clariion	Gary S. Peterson	P	Yes	
Digital Equipment Corp.	William Ham	A	No	Cmnts
Diogenes SCSI	Keith W. Parker	P	Yes	
Distributed Processing Tech.			DNV	
Eastman Kodak Co.	Robert Reisch	P	Yes	
ENDL	I D Allan	P	Yes	
Exabyte Corp.	Constanc e L. Kepharr	P	Yes	
FSI Consulting Services			DNV	
Fujitsu	Chris Nieves	P	Yes	
Harting, Inc. of N. America	Marcos Barrionuevo	P	Yes	
Hewlett Packard Co.	J. R. Sims, III	P	Yes	
Hitachi Cable Manchester, Inc	Zane Daggett	P	Yes	
Hitachi Storage Products	Anthony Yang	P	Yes	
Honda Connectors	Thomas J. Kulesza	P	Yes	
IBM Corp.	George Penokie	P	No	Cmnts
Iomega Corp.	tim bradshaw	P	Yes	
KnowledgeTek, Inc.	Dennis Moore	P	Yes	
Linfinit Micro	Dean Wallace	P	Yes	
LSI Logic Corp.	Alan Littlewood	P	Yes	
Madison Cable Corp.	Robert A. Bellino	P	Yes	
Maxtor Corp.	Pete McLean	P	Yes	
Methode Electronics, Inc.	Bob Masterson	P	Yes	
Molex Inc.	Joe Dambach	P	Yes	
Oak Technology, Inc.	Robin Freeze	P	Yes	
Ophidian Designs	Edward A. Gardner	P	Yes	IV
Philips Key Modules	Bill McFerrin	P	Yes	
QLogic Corp.	skip jones	P	Yes	
Quantum Corp.	James McGrath	A	Yes	
Seagate Technology	Gene Milligan	P	No	IV Cmnts
Silicon Systems, Inc.	Dave Guss	P	Yes	
Sony Electronics, Inc.	Jan F. Rebalski	A	Yes	
Storage Technology Corp.	Erich Oetting	P	Yes	
Sun Microsystems Computer Co	Robert Snively	P	No	Cmnts
Symbios, Inc.	John Lohmeyer	P	Yes	
SyQuest Technology, Inc.	Patrick Mercer	P	Yes	
Toshiba America Info Sys	Tokuyuki Totani	P	Yes	
UNISYS Corporation	Ken Hallam	P	Yes	
Unitrode Corporation	Paul D. Aloisi	P	Yes	
Western Digital Corporation	Jeffrey L Williams	P	Yes	
Woven Electronics	Doug Piper	P	Yes	

## Key:

P Voter indicated he/she is principal member  
A Voter indicated he/she is alternate member  
O Voter indicated he/she is observer member  
? Voter indicated he/she is not member or does not know status

YesC Yes with comments vote  
 Abs Abstain vote  
 DNV Organization did not vote  
 IV Individual vote (not organizational vote)  
 Cmnts Comments were included with ballot  
 NoCmnts No comments were included with a vote that requires comments  
 DUP Duplicate ballot (last ballot received from org. is counted)  
 PSWD The password was not correct (vote not counted)  
 ORG? Organization is not voting member of T10 (vote not counted)

Ballot totals:

46 Yes  
 4 No  
 0 Abstain  
 2 Organization(s) did not vote  
 52 Total voting organizations  
 5 Ballot(s) included comments

This 2/3rds majority ballot passed.

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Comments attached to Yes ballot from Lawrence J. Lamers of Adaptec, Inc.:

Adaptec votes YES on forwarding SPI-2 with the following comment:

Comment 1

Figure A.2 used to show the output current for the lvd driver may be incorrect

because there is an unstated assumption regarding the output impedance of the driver. The equations used to generate the output figure do not result in a solution if the impedance is less than 1000 ohms. Also the bias voltage appears to be canceled out in the equations when doing a resistive transformation.

The corresponding value for the loaded impedance in Table A.1 is too high to get a valid solution for the equations. The value should be 103 ohms maximum.

Lawrence J. Lamers  
Ljlamers@corp.adaptec.com

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Comments attached to No ballot from William Ham of Digital Equipment Corp.:

SPI-2 letter ballot comments

Vote no for multiple technical and editorial reasons:

Comment 1:

Section 6 - Editorial change:

Replace " The function of interconnect .....for the Q cable" with:

The function of the interconnect is (1) to carry the signals driven by the

SCSI device drivers or the SCSI bus terminators to the connectors of the receiving devices or terminators on the bus, (2) to carry the terminator power

from TERMPWR sources to the terminators and (3) to provide continuity between reserved pins and ground pins between devices and terminators. Minimum driven

signals shall result in received signals that meet the requirements contained in clause 7. Signals for this requirement are DB(0) thru DB(15), DB(P), DB(P1), C/D, I/O, MSG, BSY, SEL, ATN, REQ, ACK, DIFFSENS, and RESET for the A and P cable and the similar signals for the Q cable. Minimum TERMPWR shall be

delivered to the terminators from minimum TERMPWR sources per the requirements

in section 7.5.

Comment 2:

Section 6.2 - technical problem

Most SCSI cable will not meet the 1.41 dB at 60 MHz requirement for many lengths allowed in the document. Also, at 25 meters the total attenuation is 2.375 dB for the 0.095 dB/m so there is a conflict between the 5 MHz specification and the allowed lengths (specified in other sections). I suggest the following wording to remove the conflicts:

"The maximum 5 MHz differential sine wave test signal attenuation shall be 1.41 dB at the maximum SCSI device driver to SCSI device receiver distance or 0.0564 dB/m." [Note that this is a considerable tightening of the requirement at 5MHz but these numbers are self consistent and I think that they are doable

and will work for most existing SCSI cables - needs to be verified].

Comment 3:

Section 6.6 - technical

Replace "Twisted pair .....transceivers" with:

"Balanced interconnect media (e.g. twisted flat, discrete wire twisted pair, matched printed circuit board traces) should be used with differential transceivers."

Comment 4:

Table 42, section 9.1, section 9.3 - technical

The term "Cable skew delay" is incorrect and inconsistent with other terminology used to describe interconnect properties and requirements in the referenced places in the document. The term "delay" is uniformly and appropriately used elsewhere in the document to describe requirements on SCSI devices where the device is required to wait a "delay period" before doing something. The term "skew" is uniformly and appropriately used elsewhere in the document to denote timing differences between different but nominally identical signals. The interconnect does not have any concept of a "cable skew delay". This would be a delay in the skew appearing in the

interconnect.

The interconnect does, however, have a skew property that results from difference in the signal propagation time along different electrical paths. This propagation time is the actual signal path physical length divided by the

actual propagation velocity (or more precisely the integral of this quotient along the path). The propagation time is sometimes awkwardly termed propagation time delay. Thus the term "cable delay skew" (NOT "cable skew delay") would be technically accurate as a way to denote the difference in propagation time along different electrical paths (which is the intent of the entries in this document). The term "cable propagation time skew" is less confusing and less awkward.

Recommendation: Globally replace "cable skew delay" with "cable propagation time skew"

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Comments attached to No ballot from George Penokie of IBM Corp.:

E - Section A.2.5 - A reference should be made to where  $V_a$  and  $V_n$  are defined.

A good reference would be either figure 45 or table A.2.

E - Section A.2.5 - The third paragraph should be changed to "The output signal rise or fall times (see  $t_r$  in figure A.8) between...'

T - Section A.2.5 - figure A.7 - note a - There is no such thing as a 0.1% surface mount metal film type resistor. The tolerance should be made 1%.

E - Section A.2.6 - 2nd paragraph - There is an extra . before the  $V_{applied}$ .

E - Section A.2.6 - figure A.8 - The two  $V_{ss}$ 's should be changed to  $V_s$  to match the text.

E - Section A.2.6 - figure A.9 - The following should be added as a note within this figure: 'The longest physical dimension between the device connector pins and any test circuit component shall be no greater than 0,1 meter.'

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Comments attached to No ballot from Gene Milligan of Seagate Technology:

Some of the changes agreed to, I think, in the editorial sessions seem to have disappeared. In addition I have some comments that there was not time to deal with in the earlier drafts. I think SPI-2 is nearly ready for forwarding and plan to change my vote to yes after the following items are resolved:

1) On the cover page change "Any duplication of this document for commercial or for-profit use is strictly prohibited." to "Any commercial or for-profit duplication is strictly prohibited."

2) The T10 format uses both an ISO/IEC and a NCITS document number. However the final document is editorially slightly different. If this practice is to continue, SPI-2 should be 14776-112.

3) The T10 reflector information should include the sign-up statement.

- 4) Why are the abstract and patent statement not in a formal portion of the document (I presume the page they are on will be discarded by ANSI and certainly will be discarded by ISO/IEC.
- 5) In the abstract "This standard defines mechanical, electrical, timing requirements, command, and the task management delivery protocol required to transfer commands and data between SCSI devices attached to an SCSI parallel interface." should be changed to "This standard defines mechanical, electrical, timing, command, and the task management delivery protocol requirements to transfer commands and data between SCSI devices attached to an SCSI parallel interface."
- 6) I think "systems integrators" should be "system integrators".
- 7) What did the Chair of T10 conclude regarding the AMD glitch filter patent call response? Why is the long debated SCAM patent response being ignored?
- 8) Why is termination underlined in the table of contents?
- 9) The editor's notes should be removed and if desired moved to a separate document.
- 10) The separate document should have the Rev 18 changes added.
- 11) The foreword's statement "The SCSI-3 Interlocked Protocol standard is divided into the following clauses:" although not part of the standard should be revised to address the SPI-2 standard."
- 12) "Committee approval of the standard does not necessarily imply that all committee members voted for approval." should be changed to "Committee approval of this standard does not necessarily imply that all committee members voted for approval."
- 13) Is T10 actually down to three members? I thought it had to be disbanded if it fell below five members.
- 14) While "The SCSI protocol is designed to provide an efficient peer-to-peer I/O bus with up to 32 device IDs, including one or more hosts." in the introduction while technically correct is highly misleading of the real world situation. I suggest changing it to "The SCSI protocol is designed to provide an efficient peer-to-peer I/O bus with the maximum number of hosts and peripherals determined by the bus width (typically 8 or 16 with 32 allowed)."
- 15) Why does the list of advantages begin with g and end with h?
- 16) Advantage g appears to be an advantage of SCSI, not of parallel SCSI.
- 17) Advantage h appears more like a requirement than an advantage. Is this all an errant cut and paste?
- 18) The statement "A priority system awards interface control to the highest priority SCSI device that is contending for use of the bus." should be explained to recognize fairness e.g. "A default priority system awards interface control to the highest priority SCSI device that is contending for use of the bus and an optional fairness algorithm is defined."
- 19) ANSI does not agree with the statement "and voting procedures of the American National Standards Institute" and I think the statement should be "and voting procedures accredited by the American National Standards

Institute".

20) Comment ( ) except for the correct lettering in this case applies to items (a) and (b) in the Scope.

21) Because of excessive redundancy between the Introduction and the scope several of the comments above concerning the introduction also apply to the scope. The best solution would be to minimize the redundancy and fix the remainder.

22) Delete "It indicates the applicability of a standard to the implementation of a given transport."

23) The 3.1.14 connection: definition has an extraneous "n".

24) In the 3.1.21 fast-5: and 3.1.22 fast-10: definitions change "Previous SCSI standards referred to this transfer rate as slow." to "Previous SCSI standards referred to this transfer range as slow."

25) Why is magnitude defined as a positive value and as an absolute value?

26) In the vendor specific definition change "i.e." to "e.g." and delete "etc."

27) The symbol definitions show "\*" as the multiplication symbol. But at the last editing session I thought that the difficulty in making the \* not be a superscript led to changing it to "x" or "X" (I could not tell which over the phone).

28) 3.1.30 invalid:, 3.1.37 mandatory, 3.1.44 optional:, and 3.1.60 reserved: should be deleted in favor of the key word definitions. It may be desirable to capture the compliance statement in the mandatory key word.

29) Change "3.3.4 may: A keyword that indicated flexibility of choice with no implied preference." to "A keyword that indicates flexibility of choice with no implied preference."

30) Change "3.3.5 obsolete: A keyword indicating that an item was defined in prior SCSI standards but has been removed from this standard." to "A keyword indicating an item that was defined in a prior SCSI standard that has been removed from this standard." or "A keyword indicating an item that is defined in a prior SCSI standard and that has been removed from this standard."

31) In 3.3.6 optional: delete "then".

32) The desire for recipients not to check for more recent, or inadvertent use, of reserved bits has been in place for a long while. Is it not time to be more blatant than "Recipients may check reserved bits, bytes, words or fields for zero values and report errors if non-zero values are received."?

33) "3.3.8 shall: A keyword indicating a mandatory requirement. Designers are required to implement all such mandatory requirements to ensure interoperability with other products that conform to this standard." should be changed to "A keyword indicating a mandatory requirement. Designers are required to implement all such requirements to ensure interoperability with other products that conform to this standard." or to "A keyword indicating a mandatory requirement."

34) Change "These words and terms are defined either in 3.1 or in the text where they first appear." to "These words and terms are defined either in

clause 3 or in the text where they first appear."

35) Is the definition "Decimal numbers are indicated with a comma(e.g., two and one half is represented as 2,5)." I think it should be "Decimals are indicated with a comma(e.g., two and one half is represented as 2,5)."

36) All but the last sentence of the first paragraph of 4.1.1 seems to be in the wrong clause.

37) Referring to 4.1.3 and in terms of the SPI-2 standard, what does "e) other physical placement descriptions may be used." mean? Is this an instruction to news letter writers?

38) What does "SCSI bus connectors referred to in this standard use both the functional definition and a physical description (e.g., device stub connector, terminator bus path connector)." mean?

39) I think the standard would be clearer if "The mating interface of stub connectors is considered to be the stub connection if the path between the true stub connection and the mating interface is contained wholly within the connector housing. Such connectors are termed housing-only connectors." were recast. Elsewhere "housing-only connectors." used in terms of the connection to a SCSI device which seems to be completely contrary to this definition.

40) "This standard continues the practice of ignoring the effects of housing-only stub connectors with no device or intermediate interconnect attached since the stub length, leakage and capacitance is very small. It also ignores the effects of bus-path connectors for the same reason." should be deleted.

41) What does "For devices that are attached to the bus path with housing-only stub connectors the contribution of the housing-only connector to the stub and load is ignored. In this case the stub begins with the device stub connector. If one adds an intermediate interconnection to connect the device to the bus path this additional interconnect (including its connectors) and the device all contribute to the stub and bus loading. This requires that the performance at the device connector be better than the minimum requirements for stub connections." mean? Does this mean that devices that meet all the mandatory requirements will not work and only better than standard devices will work? Or does this mean that devices will be presented with signals that are better than standard?

42) Regarding Note 3 and Figure 4 is the implication that the stub beyond the terminator is a preferred configuration?

43) I think it would be better if Figure 4 were drawn with the Terminators at both ends of the connection with all devices branching off between the terminators. I think it would also be clearer if the terminators were drawn as little boxes similar to the devices.

44) In note 4 change "The loop passes the connecting point to the transceivers within the enclosure in such a manner that stub lengths are minimized." to "The loop should pass the connecting point to the transceivers within the enclosure in such a manner that stub lengths are minimized."

- 45) Regarding 4.1.4 what does "Any D.C. leakage within enabled terminators is part of the performance requirements in and ..." mean?
- 46) "If either the bus termination loading or the bus loading is less than the maximum allowed, the other entity may increase its loading as long as the total for both entities does not exceed the maximum allowed." This is interesting but implies a closed environment rather than an open environment and seems to be prejudicial to interoperability. This statement should be deleted or changed to "If the enabled terminators are within a SCSI device and if either the bus termination loading or the bus loading is less than the maximum allowed, the other entity may increase its loading as long as the total for both entities does not exceed the maximum allowed." However I favor the deletion since this is essentially redundant to the last paragraph of 4.1.5.
- 47) In the first paragraph of 4.1.6 delete "etc." which is redundant to "e.g."
- 48) In 4.1.7 change "SCSI Architecture Model-2 Standard." to "SCSI Architecture Model-2 standard."
- 49) Please add Device Server and Task Manager to the glossary.
- 50) In clause 5 change "This standard fully defines all the supported SCSI device connectors except the 80-contact alternative 4 non-shielded SCSI device connector and the 68-contact alternative 4 shielded SCSI device connector. Those two connectors are defined by EIA (see 2)." to "This standard defines all the supported SCSI device connectors. The 80-contact alternative 4 non-shielded SCSI device connector and the 68-contact alternative 4 shielded SCSI device connector are defined by reference to EIA standards (see 2)."
- 51) Table 13 has two columns referring to Note 3 but Table 13 has only two notes.
- 52) In Clause 6 change "This interconnect is defined as the electrical media (including connectors and passive loads) used to connect the TERMPWR, terminators, and SCSI devices in a SCSI bus." to "The interconnect is defined as the electrical media (including connectors and passive loads) used to connect the TERMPWR, terminators, and SCSI devices in a SCSI bus."
- 53) Change "The function of interconnect is to carry the signals driven by SCSI device drivers and TERMPWR sources to the connectors of the receiving devices on the bus and to the terminators." to "The function of the interconnect is to carry the signals driven by SCSI device drivers and TERMPWR sources to the connectors of the receiving devices on the bus and to the terminators." But I don't think terminators drive signals. I think they bias signals. So better yet change it to "The function of interconnect is to carry the signals driven by SCSI device drivers and biased by TERMPWR sources to the connectors of the receiving devices on the bus and to the terminators."
- 54) Editorial work is needed for "Minimum driven signals shall result in received signals that meet the requirements contained in clause 7. Signals for this requirement include TERMPWR, DB(0) thru DB(15), DB(P), DB(P1), C/D, I/O, MSG, BSY, SEL, ATN, REQ, ACK, and RESET for the A and P cable and the similar signals for the Q cable." since A cables do not include DB(8) thru DB(15) and thru is spelled through. I suggest changing the requirement to DB(0) through



- DB(31) and deleting "and the similar signals for the Q cable." as the other Q cable signals are covered by "include".
- 55) Regarding the requirement in 6.1 "If twisted-pair cables are used, the twisted pairs in the cable shall be wired to physically opposing contacts in the connector." the 50 pin alternative 2 connector does not have physically opposing contacts. This requirement needs to be reworked in view of the connector alternatives and the specified contact assignments.
- 56) Regarding "The items under signal name labeled TERMPWR, TERMPWRQ, and RESERVED are not signals and are not required to meet the cable characteristics for signals in 6.2." why relieve the reserved cable lines from meeting the requirements of signal lines since these lines could be assigned as signals in the future?
- 57) The note in figure 22 should allow the equal condition for both values.
- 58) How is Table 17 interpreted if the SCSI devices are 24 pF? If pico Farads needs to be in the table, it is presently abbreviated two different ways both of which I believe are wrong and not consistent with the way it is abbreviated elsewhere in the document.
- 59) Note 3 of Table 17 is defective.
- 60) What does Note 4 of Table 17 mean when in one case the maximum distance is a Note on the number of devices? Does Note 4 take precedence over Note 1 or Note 1 over Note 4?
- 61) The last paragraph of 6.5 seems to be a system requirement and not strictly a cable requirement. However I have no objection to it if the cable suppliers agree that their cables can overcome any adverse system conditions when connected. I am not suggesting that it be deleted but am asking if there is a more appropriate location for the requirement?
- 62) Note 3 of Table 18 should be changed from "3 Values specified by the distance corresponding to the differential maximum distance between terminators shall apply even if a slower transfer rate is negotiated." to "Values specified by the distance between terminators corresponding to the differential maximum transfer rate range shall apply even if a slower transfer rate is negotiated."
- 63) It is not clear whether the note in Table 20 and 21 applies to a cable or to the SCSI Bus path with devices connected. I presume it is a cable measurement since it would be problematic to connect term power to all other signals and grounds.
- 64) The title of Table 22 is "Absolute maximum electrical input requirements at the device connector" but it includes minimum requirements as well as maximum requirements.
- 65) I have repeatedly argued that the voltages specified in Table 22 for HVD are component specifications and are not appropriate for the SCSI environment. They merely lead to FUD about an inadvertent inclusion of another version SCSI device on the HVD bus. In addition to the likely hood that the cables would burn up with these values, if they did occur they would also occur with LVD.
- 66) Regarding Table 23, I do not understand the concept of 20 micro amps of current for the MSE case when Vcc is being connected to both the + and -

signal pins. In one instance you get many amps until maximum smoke.

67) In 7.1.1 change "CONFORMING" to "conforming".

68) Does "f) the terminator shall not source current to the signal line whenever its terminal voltage is above 3,24 V D.C. except in applications where the bus is less than 0,3 m." imply that terminators shall have a cable length measurement capability along with adaptive circuitry? Or is the real requirement hinge upon the D.C. resistance of the cable?

69) I think the first paragraph of 7.1.2 should include the OR-tied exclusion for the active negation drivers.

70) Is there a disconnect between the 48 mA of Table 24 and double the terminator current which is greater than 48 mA?

71) Should the operating area of Figure 23 be increased to include the 50.8 mA resulting from the terminator specifications?

72) In the body text after Figure 23 change "because these signals are vulnerable to double clocking on the true-to-false transition." to "because these signals are vulnerable to glitches on the true-to-false transition which could lead to false ACK or REQ detection."

73) Why does Table 25 have a Note 9 but only one other note which is not numbered?

74) In Note 9 the +/- should not be a subscript.

75) Regarding the transient specification below Table 25, why are the equivalent specifications not included in the equivalent HVD and LVD sections?

76) Change "The filter period shall not be so long as to mask out the subsequent valid transition edges of the incoming REQ/REQQ and ACK/ACKQ signals." To "If implemented, the glitch filter period shall not be so long as to mask out the subsequent valid transition edges of the incoming REQ/REQQ and ACK/ACKQ signals."

77) Table 26 is titled "SE input and output voltage characteristics" but specifies other things such as capacitance and current.

78) It appears that Note 10 would be more appropriate after Table 26.

79) In Table 27 the meaning of the blank entries is not clear.

80) Under Figure 31 change "To compensate for the negation biasing effect of the termination of the 2 and 4 assertion pair is stronger than the 1 and 3 negation pair." To "To compensate for the negation biasing effect of the terminators, the 2 and 4 assertion pair is stronger than the 1 and 3 negation pair."

81) The meaning of blank entries in Table 30 is not clear. Consider this a global comment.

82) There is an extraneous "I" in Table 31. Sorry it is not an extraneous "I" it is part of a difficult to notice absolute convention. Are taller "I"s available?

83) Delete "Higher input resistance values are allowed if the system

integrator guarantees that the resistor value chosen will overcome all leakage from devices on the bus and will therefore produce reliable SE mode detection (see table 32)." and replace it with a tolerance.

84) Change "a) the device is capable of full logical operation for at least 100 ms, and" to "a) the device is capable of logical operation for at least 100 ms, and" since devices are not capable of full logical operation while they are in the high impedance state especially if the desired mode is single ended.

85) The requirement that "A device shall not change its present signal driver or receiver mode based on the DIFFSENS voltage level unless a new mode is sensed continuously for at least 100 ms." Seems excessive for noise filtering and may lead to MTBF reduction. The noise filtering on the Reset line is 25 microseconds (although this does not seem to be explicitly stated in SPI-2). For greater reliability I suggest changing the requirement to "A device shall not change its present signal driver or receiver mode based on the DIFFSENS voltage level unless a new mode is sensed continuously for at least 25 micro seconds." or to "A device shall not change its present signal driver or receiver mode to a different mode other than high impedance based on the DIFFSENS voltage level unless a new mode is sensed continuously for at least 100 ms "

86) Does 7.3.2 contramand the 100 ms requirements?

87) In 7.3.2 the requirement of the second paragraph is repeated in the fifth paragraph.

88) Regarding 7.3.4 change "When the multimode alternate is implemented the signal ground connections should be through the ground drivers to allow switching to LVD mode." To "When the MSE alternate is implemented the signal ground connections should be through the ground drivers to allow switching to LVD mode."

89) Should the 25 mA for ground drivers and the 25.4 mA for termination match by having the ground drivers at 50.8 mA? I hope not since it seems too late.

90) In 7.4.1 and elsewhere is termination singular or plural. The verbs do not appear to match.

91) In the Normative references and in Table 35 and global change EIA TIA RS-485 to ISO/IEC 8482:1993, Standard for Electrical Characteristics of Generators and Receivers for use in Balanced Digital Multipoint Systems.

92) Change "Note: these additional requirements for driver asymmetry do not affect the operation of these HVD drivers at fast-20 and lower data transfer rates." To "Note: the additional requirements for driver asymmetry do not affect the operation of HVD drivers at fast-20 and lower data transfer rates."

93) Change "In the test circuit for testing these characteristics is shown in figure 39 the magnitude of the steady state differential output voltage of a fast-40 HVD driver shall comply with the following requirements:" to "The test circuit for testing the following characteristics is shown in figure 39.

The magnitude of the steady state differential output voltage of a fast-40 HVD driver shall comply with the following requirements:"

94) What does "1 V ( |V A | or |V N | ( 6 V and 0,42 |V N | + 0,69 V ( |V A | ( 2,49 |V N | - 1,59 V where |V A | and |V N | are defined as V OD in figure

39." mean? Why does it begin with 1 V? Why are there only open brackets and no close brackets?

95) In Table 36 what is "The II requirement"?

96) Change "NOTE 17 - LVD SCSI devices are not detected by HVD SCSI devices. On all HVD SCSI devices except ones that have a SCA-2 connector the signals do not match. As a result some drivers are shorted to ground therefore damage may occur to SCSI devices if a HVD SCSI device is plugged into a bus that contains LVD transceivers" to "NOTE 17 - LVD SCSI devices are not detected by HVD SCSI devices not complying to this standard. On all HVD SCSI devices except ones that have a SCA-2 connector the signals do not match. As a result some drivers are shorted to ground therefore damage may occur to SCSI devices if a HVD SCSI device is plugged into a bus that contains LVD transceivers." Including the missing period as missing periods may be problematic. The wording of Note 17 may need to be adjusted depending upon the committee's intent. Was it the intent that new designs of HVD not be burdened with detecting LVD while burdening LVD with detecting HVD?

97) Referring to Table 38 is 0.2 V dropout regulator correct or should it be a 0.2 V drop regulator?

98) Change Note 18 from "NOTE 18 - SCSI devices connected with a SE A cable (table 3) is not able to meet the source current requirements in table 38 unless the TERMPWR conductor size is 0,080 98 mm 2 (28 AWG) minimum because the SE A cable contains only one TERMPWR line." To "NOTE 18 - SCSI devices connected with a SE A cable (table 3) are not able to meet the source current requirements in table 38 unless the TERMPWR conductor size is 0,080 98 mm 2 (28 AWG) minimum because the SE A cable contains only one TERMPWR line."

99) In Note 19 change SCSI device to SCSI devices or to a SCSI device or to the hated an SCSI device.

100) Change "10(F" to "10 (F". But the stated reason is correct for the low value and wrong for the high value.

101) How did "The TERMPWR lines may be used for distribution of power for purposes other than for SCSI bus termination as long as the voltage delivered to the SCSI bus terminators remains adequate to supply the requirements of the terminators under all conditions of SCSI bus operation and under all conditions of other loading." become accepted? This defeats the specifications that led to "fuse" and wire size requirements.

102) Regarding Clause 8 what is the difference between an initiator and a initiator port? Equivalent question for a target port. Why add these terms?

103) the title of 8.3.1 should be Single ended not Signal-ended.

104) Note 22 is redundant to earlier material that already presented this concept. Delete it.

105) In 8.4 the statement "Any signal other than BSY, SEL, and RST may employ OR-tied or non-OR-tied drivers." seems to undo requirements of other clauses for REQ and ACK. Delete it.

106) Regarding "No signals other than BSY, SEL, RST, and DB(P,P1,P2,P3) are simultaneously driven by two or more SCSI devices." actually the DB(0-31) signals may be if plug and play SCSI devices intended for SCAM compliant systems are installed in systems not implementing SCAM until someone changes address assignments.

107) Is the requirement to not drive DB(0-31) false during the arbitration phase missing? It would be redundant to Table 41 as is the statement about the parity bits. It is confusing to be redundant about one signal and not the others. I always suggest removing the redundancy.

108) Why does clause 9 state "The timing specifications in this clause may be applied to SCSI parallel interface."? This is the SCSI parallel interface.

109) In Figure 51 change "SEPT" to "SEP T".

110) In 10.2 add the requirement for which the title was composed. The text makes no mention of RST.

111) In 10.3 and 10.4 (d) change "until the transceiver is enabled." to "until the transceivers are enabled."

112) Add "g) Resumption of I/O processes is vendor specific but shall not occur sooner than 200 milliseconds after the completion of the insertion or removal event."

113) In 10.4 change "a) All I/O processes for the SCSI device being inserted or removed shall be quiesced." to "a) All I/O processes for the SCSI device being removed shall be quiesced prior to removal." and add "h) ) Initiation or resumption of I/O processes for a newly inserted SCSI device is vendor specific but shall not occur sooner than 200 milliseconds after the completion of the insertion or removal event."

114) In 10.3 and 10.4 (d) change "shall employ transceivers that conform to the requirements in 7.1.2, 7.2.2, 7.3.2, and 7.4.2 for glitch-free power on/off." to "shall employ transceivers that conform to the applicable requirements in either 7.1.2, 7.2.2, 7.3.2, or 7.4.2 for glitch-free power on/off." However take note of comment (73) that 7.2.2, 7.3.2 and 7.4.2 do not include the equivalent requirements as in 7.1.2.

115) Why is this requirement of comment (114) included in 10.3 which presumably was structured to allow glitches? Is it concern over RST? If something like this is the concern, why is the 10.4 (g) requirement not included in 10.3?

116) Why is note 30 not in all the subclauses except 10.2?

117) I thought that NCR had defined another case which caused BSY to be asserted during an insertion or removal event. Should this case be documented or have I remembered incorrectly?

118) Since an implimantor has no way to cause the bus to be in more than one phase change Clause 11 from "The SCSI bus shall never be in more than one phase at any given time." to "The SCSI bus phases are defined such that the SCSI bus is never in more than one phase at any given time."

119) Referring to 11.1.1 what is the difference between "an exception condition" and "an unsuccessful task termination"? In addition does 11.1.1 in this regard conflict with 11.3 "followed by the BUS FREE phase but many such instances are error conditions"?

- 120) Which has precedence the provision that a SCSI device may go bus free at any time or the circumstances of Note 34?
- 121) There seems to be a conflict between Note 34 and Note 35. Note 34 states that it is a requirement to wait for SEL and Note 35 states that it is merely a recommendation.
- 122) Note 36 mistakenly states a mandatory requirement which is redundant to other clauses. This can be fixed by deleting the note or by changing it to informing and referencing the text in the body that already stated the requirement.
- 123) Referring to 11.1.5, have REQx and ACKx been defined somewhere?
- 124) Referring to Note 39 is it beneficial to include in the standard "An initiator is allowed to anticipate a new phase based on the previous phase, the expected new phase, and early information provided by changes in the C/D, I/O, and MSG signals. However, the anticipated phase is not valid until the REQx signal is asserted at the beginning of the next."? Does this go contrary to not being in two phases? Will everything be OK if the target changes the early information again before asserting REQ?
- 125) In 11.1.5.3 the term "unexpected disconnect" is used. Is it intended that "unexpected disconnect" and "unexpected bus free" be used interchangeably? Is "unexpected disconnect" a special case of "unexpected bus free" applying only after the nexus has been identified? If the answer to the latter is yes, has the standard identified this fact?
- 126) I think the Target Transfer Disable message should be changed to Obsolete.
- 127) I think the Terminate Task message should be changed to Obsolete.
- 128) Referring to 11.7 what are "SCSI-3 interlaced protocol devices"?
- 129) Move the second period above Table 68 to above Table 67.
- 130) In A.2 change "The driver requirements are defined in terms of the voltages and currents defined in figure 41." to "The driver requirements are defined in terms of the voltages and currents depicted in figure 41."
- 131) In A.2.1 change "To assure sufficient voltage to define a valid logic state at any device connection on a fully loaded LVD bus a minimum differential output voltage shall be generated." to "To assure sufficient voltage to establish a valid logic state at any device connection on a fully loaded LVD bus a minimum differential output voltage shall be generated." But does this prohibit generating a maximum differential output? To solve this problem make the change to "To assure sufficient voltage to define a valid logic state at any device connection on a fully loaded LVD bus at least a minimum differential output voltage shall be generated."
- 132) Change "There shall also be upper limits to the differential output voltages and to the symmetry of the differential output voltage magnitudes between logic states to define the maximum voltage that is able to be attained and assure a first-step transition to the opposite logic state." to "The SCSI device shall also comply with the upper limits for the differential output voltages and to the symmetry of the differential output voltage magnitudes between logic states in order to assure a first-step transition to the opposite logic state." Breaking this into several sentences would be even better.
- 133) Does the statement "Because the applied V1 and V2 simulates the effects

of the bus termination bias, the assertion drivers and negation drivers shall have different strengths to achieve the near equality in  $V_A$  and  $V_N$  shown in figure A.2. This test is therefore a requirement for asymmetrical drivers." add anything that has not already been specified? If yes, clarify the statement. If no, delete it. If clarifying it, different strengths are not required because of simulation and which is this test?

134) In A.2.2 change "This requirement is shown graphically in figure A.4." to "See figure A.4."

135) In A.2.4 change "To limit the maximum steady-state voltage at any device connector, the driver output voltage shall be restricted. The highest output voltage occurs with no output current.

The voltage between each output terminal of the driver circuit and its common shall be between 0 V and 3,6 V when measured in accordance with figure A.6. This requirement shall be met in all logical or high impedance states ( $0 V < V_{O-(OC)} < 3,6V$  and  $0 V < V_{O+(OC)} < 3,6 V$ )." to

"To limit the maximum steady-state voltage at any device connector, the voltage between each output terminal of the driver circuit and its common shall be between 0 V and 3,6 V when measured in accordance with figure A.6. This requirement shall be met in all logical or high impedance states ( $0 V < V_{O-(OC)} < 3,6V$  and  $0 V < V_{O+(OC)} < 3,6 V$ ). The highest output voltage occurs with no output current." or to:

"To limit the maximum steady-state voltage at any device connector, the voltage between each output terminal of the driver circuit and its common shall be between 0 V and 3,6 V when measured in accordance with figure A.6. This requirement shall be met in all logical or high impedance states ( $0 V < V_{O-(OC)} < 3,6V$  and  $0 V < V_{O+(OC)} < 3,6 V$ )." to:

136) In A.2.5 change "The slew rates specified above are requirements for a driver when using the LVD test circuit in figure A.7 they are not the observed rise rate or fall rate that would be observed on an actual SCSI bus." to "The slew rates specified above are requirements for a driver when using the LVD test circuit in figure A.7. They are not the observed rise or fall rates on an actual SCSI bus."

137) Change "Measurement equipment used for compliance testing shall provide a bandwidth of 2 GHz minimum." to "Measurement equipment used for rise and fall rate testing shall provide a bandwidth of 2 GHz minimum."

138) To avoid the confusion that occurred with the SE test circuit, add the device connector to all the test circuits with specified capacitance and a lack of device connector location (e.g. figure A.7).

139) In (d) is 40 Hz correct? I think it should be 40 MHz.

140) Is it intended that the rise and fall times are measured with respect to the overshoot values rather than the steady state values?

141) In A.2.6 change "Measurement equipment used for compliance testing shall provide a bandwidth of 400 MHz minimum." to "Measurement equipment used for dynamic signal output balance testing shall provide a bandwidth of 400 MHz minimum."

142) What does "The requirements in this section apply only to the signals that implement the state transition type." mean? When it's meaning is clarified if it remains change section to clause or subclause depending upon the meaning.

143) In A.3 change "Table A.5 defines the voltages and currents used for the requirements in this section." to "Table A.5 defines the voltages and currents for the requirements in this subclause."

144) In Table A.6 with reference to voltages "(input voltage - referenced to circuit common)" the "-" is confusing. I suspect this should be "(input voltage referenced to circuit common)".

145) What is the purpose of A.3.3? Is it only to add another note to the standard?

146) In A.4.1 delete "The limits in this subclause will be controlled by table 22 in all cases."

147) What does "The maximum applicable current from table 22 is  $I_{max}$  ." mean?

148) Because of "Transceiver output/input currents, II-L and II+L" and because of the definition of "off" it is very confusing what is being measured.

149) Change "NOTE 54 - SCAM devices with assigned ID's neither recognize, respond to nor initiate SCAM selection." to "NOTE 54 - SCAM devices with assigned ID's neither recognize, respond to, nor initiate SCAM selection."

150) In Figure B.1 for HVD and LVD devices what does "Note - Signals are shown asserted low." mean. Does it mean asserted towards the bottom of the page?

151) The mandatory requirement of Note 66 needs to be moved to the body text.

152) With regard to C.2 is "The SCSI parallel protocol requires that between 3000 nsec and 3600 nsec from RST being released, the SCSI ID for all arbitrating SCSI devices shall appear on the bus." true? I think the only requirements are to not place the SCSI ID on the bus before a specified time. As far as I know the SCSI devices can take 37 weeks after the release of RST to first put their IDs on the bus.

153) In Note 71 I think "the arbitration process which could immediately precede a subsequent arbitration which this SCSI device may participate in." should be changed to "the arbitration process which immediately precedes a subsequent arbitration which this SCSI device may participate in."

154) Change "The fairness algorithm shall be followed as described in the following steps:" to "The fairness algorithm shall be accomplished as described in the following steps:" or to "The fairness algorithm shall be per the following steps:"

155) With regard to "3) Remove SCSI IDs greater than or equal to the SCSI devices own SCSI ID from fairness register." how can there be an equal ID? Does this algorithm also provide a method to double the number of targets on the bus?

156) In the second step (2) and (3) change "This insures that this SCSI device" to "This ensures that this SCSI device". But what does "This insures that this SCSI device does unfairly participate in consecutive arbitrations,



(as the case for a multi-LUN SCSI device or queueing implementations)." mean?

157) I think Note 73 is describing requirements stated elsewhere. If this is the case reword it to eliminate the "shall". Otherwise move the requirement to the body text.

158) I think Note 74 should be moved to after the third step (2) to make it clear that step (4) has substance.

159) May a device which is permanently configured as device 0 claim compliance with the fairness algorithm without implementing it?

160) Add ASTM D-4566 to the informative references.

161) Change "NOTE 77 - NOTE: The details" to "NOTE 77 - The details".

162) Reword Annex I to eliminate the eight "must"s.

163) Clause 1 physical interconnects should include SPI.

164) Change "3.1.1 A cable: A 50-conductor cable (see 3.1.45 and 3.1.51) that provides an primary 8-bit DATA BUS and control signals." to "3.1.1 A cable: A 50-conductor cable (see 3.1.45 and 3.1.51) that provides a primary 8-bit DATA BUS and control signals."

165) Change "3.1.14 connection: An initial connection or reconnection. A connection only occurs between one initiator and one target on the same bus. A connection begins with an initial connection or a reconnection and n ends with the next disconnect." to "3.1.14 connection: An initial connection or reconnection. A connection only occurs between one initiator and one target on the same bus. A connection begins with an initial connection or a reconnection and ends with the next disconnect."

166) But even after deleting the extraneous "n" the connection definition is a circular definition.

167) Regarding "3.1.19 driver: The circuitry used to force the state of the bus." in some cases drivers do not force both states of the bus. The OR-tied drivers do not force the false state.

168) Change "3.1.21 fast-5: Negotiated to receive synchronous data at a transfer rate less than or equal 5 megatransfers per second. Note: Previous SCSI standards referred to this transfer rate as slow." to "3.1.21 fast-5: Negotiated to receive synchronous data at a transfer rate less than or equal to 5 megatransfers per second. Note: Previous SCSI standards referred to this transfer rate as slow."

169) Shouldn't there be some explanation of the relationship of nexus and task?

170) Regarding 3.1.78 is it true that all upper level protocols are application specific. Are SCSI drivers not upper level protocols?

171) Add EIA 364-23A (low-level contact resistance test procedure for electronic connectors) as a normative reference.

172) Regarding clause 6.5 shouldn't there be a reference to a figure which

shows what the cable core is?

173) In 7.3.1 "A multimode terminator switches to the termination mode that is appropriate for the bus based on the value of the DIFFSENS input voltage." should be changed to "A multimode terminator shall switch to the termination mode that is appropriate for the bus based on the value of the DIFFSENS input voltage."

174) Regarding Note 12, is "conventional single-ended" defined somewhere?

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Comments attached to No ballot from Robert Snively of Sun Microsystems Computer Co:

I have the following comments SPI-2, T10 project 1142D, Revision 17. Comment number 2 below must be corrected to change my negative vote to an affirmative vote.

1) Intro, Abstract, Clause 1: Documents this standard will replace.

At present, there is no mention in the abstract, scope, or introduction of precisely which documents this standard is to replace. While it is implicit from the list of physical interconnects that SCSI-2, SPI, SPI amendment, SIP, and Fast-20 are replaced by this document, it is nowhere explicit that this is true.

It would be helpful to the user to have this information made explicit.

2) 3.2, 7.0, 7.1, 7.2, and 7.3 "MSE" and special requirements.

MSE is defined as multimode single ended in the abbreviation section. No hint is given as to what those modes might be.

In section 7.0, this nomenclature is again used while defining allowable input voltage ranges. Notable by its absence from tables 22 and 23 is a specification for non-multimode Single Ended operation.

However, a new term is invented in section 7.3 to describe what I believe is the intent of the term MSE. That term is "LVD/SE multimode" alternative. Reference is made to a multimode terminator and a multimode transceiver. No additional parameters are provided, because it is assumed that when operating in single ended mode, the single ended parameters should be used.

It seems to me that the simplest mechanism to resolve this is to remove the concept of "multimode single ended" and simply recognize that multimode transceivers shall meet the single-ended requirements. This requirement is already met, although rather unclearly, for fast-5 and fast-10 in table 22 and 23. For fast-20, there appears to be an explicit requirement in table 22 that disallows the presence of any fast-5 or fast-10 devices on the same bus. I do not believe that is the intent, since speed behavior can be negotiated once a device is installed. I believe that to make all this work properly, the MSE input voltage specified in table 22 will also have to be increased to 5.5 volts.

An alternative solution is to create a new definition for fast-20 single-ended that is incompatible with fast-5 and fast-10

operation, while still eliminating the concept of MSE. Then multimode transceivers supporting fast-5 and fast-10 LVD and SE would support "slow single ended" parameters, while multimode transceivers supporting fast-20 LVD and SE would support "fast single ended" parameters. I believe that this solution is undesirable.

3) 3.3.5, obsolete keyword is unused.

The "obsolete" keyword is unused at present. I actually believe it should be used for a few cases (see 9 below).

4) Section 7.1.4, Table 26

It appears to me that this table is mis-titled and some of the notes are inappropriate. The table references input and output voltage when it should be referencing capacitance.

5) Section 8.1, signal descriptions

In the description of REQ, REQQ, ACK, and ACKQ, the plural form "buses" is used where the possessive form "bus's" should be used. This is also true in

6) Section 8.3.3, differential description

In the single ended description the "released" state is defined. This state is equally relevant in the differential case, but is inadvertently omitted.

7) Section 9.1, reference to LVD timing requirements

In the timing description, a reference to Table 29 should be made so that people understand that there are additional timing requirements not specified in this section that are very important to proper operation. Historically, the LVD glitches have also been found in some HVD implementations.

8) Section 10, introductory text inadequate

It should be clearly noted in this section that these cases are distinguished for compatibility reasons and in most cases describe a system environment independent of the SCSI standard. This is a taxonomy to be used by SCSI implementers, not a standards requirement.

9) Section 11.5.2, Some link control message codes should be obsolete

The CONTINUE TASK and TARGET TRANSFER DISABLE link control message codes should be promoted to obsolete. In practice, they have been rarely used and have frequently resulted in vendor specific work-arounds to make them operate correctly. The precise use of these messages and the precise relationship to other machine states is incompletely defined and may result in non-interoperable SCSI devices. This is made amply clear by the cautions and warnings associated with each of these commands.

10) 11.5.4.2, ABORT TASK SET

The ABORT TASK SET message is defined as fulfilling the requirements of SAM. However, SAM-2 allows a variant in the definition of task set which is very important and should also be referenced.

11) Table 64, Term Routing

It is not quite clear what "term routing" means. Perhaps a fuller explanation of what is intended would make this clearer.

My first guess from the context and from my general SCSI knowledge is that the routing refers to where the object is first known and to the users of that object, but any number of other conflicting interpretations may be equally intended.

Curiously enough, many of the terms are not used within the body of this standard at all, but are only used in the description of the procedures already defined by SAM. An example is "command byte count". I assume that these are included just so that the parallels with SAM can be defined without requiring reference to SAM.

12) Annex B, SCAM should be obsolete

SCAM should be obsoleted. It unnecessarily adds to the cost of disk devices that do not otherwise require it.

13) Annex K, overlapped commands

I believe "overlapped command" is the SCSI-2 term and "incorrect initiator connection" is the SPI-2 term.

\*\*\*\*\* End of Ballot Report \*\*\*\*\*