

## Hardware RAID Issues

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There are some issues that I have been working with customers which at first I thought belonged in the RAID Study group since they apply mainly to RAID systems. After attending two of the RAID Study groups I have come to the conclusion that they are more appropriate issues for SPI. Maybe an ANNEX to SPI that addresses RAID Issues.

The RAID Study group is focusing more on addressing and software architecture and not addressing the hardware issues. I had sent a letter to Doug Hagerman, and received a reply, attached. He considered the topics good issues. The RAID working group Meeting on Thursday morning was completely focused on software issues.

The letter to formalize the work being done by the RAID working group focused only on the software issues.

Most of the issues effect SPI directly:

1. If the TERMPWR bypassing capacitor on a unit is too large it pulls down the TERMPWR line during hot plugging causing data errors.

Solution, limit the size of the TERMPWR bypassing Cap in 6.2 and figure 9. Currently only a minimum size is specified, a maximum size. I would like to suggest a maximum of 10 uf.

2. Hot plugging signal loading current is specified in 7.1.3 for units but it may need some clarification. When a unit is hot plugged, there is no guarantee of how the connector mates, not all contacts make connection at the same time. A terminator is connected to TERMPWR even though it is in disconnect mode, it may clamp the signal line until TERMPWR is present. The capacitors must be charged. TERMPWR will not be above 3 volts until after the control and signal lines have made connection. Several parts claim to work for hot plugging, but have diode clamps. The Unitrode terminators are the only ones that don't.

SPI does not adequately address the active terminators with disconnect mode. These are not just at the end of the bus, but can be on every unit attached to the bus. In these cases the hot plugging current and the capacitance must be considered part of the unit.

Proposed addition 7.1.1 f) Active Terminators use on Hot Plugging units must not load the lines during hot plugging. TERMPWR is not guaranteed to mate before the other signals. Power will be delayed while the TERMPWR and Regulator capacitors are charging.

3. 7.1.4 states a maximum capacitance of 25 pf per unit, several customers are reporting problems when 8 units are attached to the bus with the minimum spacing of 12 inches between units. At the minimum distance between units they have found the maximum capacitance is really 12 to 15 pf for all units to work.

These cases the cable is flat, closer to the high range of the impedance spec. A capacitance of 25 pf every foot is too large, either the minimum distance needs to be longer or the spec for capacitance needs to be lower. If the minimum distance or the 25 pf is not changed, wording should be added that 7 or more units at minimum distance between units may not work.

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4. Differential SCSI specifies EIA485, EIA485 allows a common mode voltage of +12 to -7 volts. If EIA485 rules are used the 330 ohm resistors in the termination must be at least 0.5 Watts. There are 7 ground wires in the Differential SCSI Primary cable. I would like to propose a statement that limits the common mode to +5 volts and 0 volts be added to 7.2. This would allow the design of monolithic terminators. The normal common mode for most drivers on the market is 2.5 volts.

5. (Not directly pertaining to RAID) A note should be added to section 6.4 stating that the cable length and the minimum distance between units limits fast single ended SCSI to 11 units. This is a maximum cable length of 3 meters with a minimum spacing of 0.3 meters between units. Slow single ended SCSI to 21 units. This is maximum cable length of 6 meters with a minimum spacing of 0.3 meters even if wide SCSI allows up to 32 devices.

6. (An Information note to section 7.1.1 b) The lower voltage SCSI-III current measurement reduces the maximum current to 21.4 mA at 0.5 Volts as measured by SCSI-II or 1 mA less than the SCSI-II maximum of 22.4 mA.

7. ANNEX for RAID/Hot Plugging limiting the current required by a drive during hot swap should be limited. Currently it is impossible to design a power system to handle all the drives currently on the market without severe over designing. Some of the drives have been measured at over 12 Amps.

The drives should be limited to a maximum current with current limiting techniques. 5 1/4 inch drives should be limited to a value like 5 Amps. The 3 1/2 inch drives to a value like 3 Amps. This would make it easier to design the RAID power supply systems, without the limits drives could draw extremely high currents which have caused problems of voltage droop and capacitors blowing from the surge. A specified limit would guarantee that all vendors drives that met the current limits would work in a RAID enclosure.

Thank you,

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