CHAPTER 11

SCSI

This chapter presents the requirements and recommendations for the small computer system interface (SCSI).

SCSI is a flexible I/O bus that is used in the design of a wide variety of peripherals, including disk drives, CD drives, tape drives, scanners, and magneto-optical drives. The SCSI host adapter is the circuitry that serves as an interface between the system and one or more SCSI peripherals. A host adapter can be a card that plugs into the system's expansion bus, such as a PCI card, or it can be designed directly into the system board.

The use of SCSI in a PC 99 system is optional, but if SCSI is used, all components must comply with the requirements defined in this chapter.

Contents

SCSI Host Adapter Requirements

This section summarizes class specifications and standards for SCSI host adapters.

11.1. SCSI host controller supports bus mastering

Required

The host controller must support PCI bus mastering; PCI bus mastering must be enabled by default.

11.2. Bootable SCSI controller supports El Torito No Emulation mode

Required

A bootable SCSI storage controller must support the No Emulation mode defined in *El Torito—Bootable CD-ROM Format Specification, Version 1.0*, or an equivalent method that supports the Windows 2000 Professional CD-ROM installation process.

11.3. Option ROM supports Int 13h Extensions

Required

PC 99A clarification: This requirement also applies for RAID controllers implemented on client systems such as workstations.

The Int 13h Extensions ensure correct support for high-capacity drives, consistent drive-letter mapping between real and protected modes, and other capabilities for both Windows 98 and Windows 2000. Support for the fixed-disk access subset of Int 13h Extensions must be provided in the system BIOS and in any option ROMs for storage devices that include BIOS support.

The Int 13h Extensions are defined in the "Layered Block Device Drivers" section of the Windows 95 DDK and in the Windows 2000 DDK.

PC 99A clarification: The Int 13h Extensions are defined in "Chapter 14: Int 13 Extension APIs" in the "Storage Technology Reference" in the Windows 95 DDK (included with the Windows 98 DDK and available online at http://www.microsoft.com/ddk/ddkdocs/win98ddk/storage_60q9.htm).

11.4. Option ROM supports virtual DMA services

Required

Plug and Play SCSI host adapters must support virtual DMA services in the host-adapter option ROM and must support bus mastering. Virtual DMA supports scatter/gather capabilities, solving the problem of mapping linear addresses (segment:offset) into physical addresses.

11.5. Bus type is clearly indicated on connectors for all adapters, peripherals, cables, and terminators

Required

Connectors for each SCSI adapter, peripheral, cable, and terminator must be clearly labeled to indicate the bus type. All external SCSI connectors must display the appropriate SCSI icon defined in *Small Computer Interface Parallel Interface* (SPI) standard, Annex H, and must display any clarifying abbreviations or acronyms. The following are applicable acronyms and their definitions:

- DIFF – differential. A signaling method that employs differential drivers and receivers to improve signal-to-noise ratios and increase maximum cable lengths. This includes both low voltage differential (LVD) and high voltage differential (HVD) types.

- SE – single-ended. A signaling method that employs drivers and receivers to increase circuit density.
- LVD – low voltage differential. A signaling method similar to DIFF but with lower signaling voltages supporting higher transfer rates.

11.6. Differential devices support DIFFSENS as defined in SPI standard

Required

Without DIFFSENS, the differential bus drivers, a single-ended device, or both could be damaged if a single-ended device is connected to a differential bus.

The standard for DIFFSENS is defined in Section 5.4.2 of the SPI standard.

11.7. Automatic termination circuit and SCSI terminators meet SCSI-3 standard

Required

SCSI add-on adapters and on-board controllers must use automatic termination, which allows a user to add external devices without removing the PC case. Terminators used in the SCSI host adapter must be regulated terminators, also known as active, SCSI-3 SPI, SCSI-2 alternative-2, or Boulay terminators. SCSI termination built onto internal cables must meet SCSI-3 standard.

11.8. Terminator power is supplied to the SCSI bus with overcurrent protection

Required

This requirement has two components:

- **11.8.1 Host adapter must supply terminator power.** The base requirement for system-board implementations using PCI or another expansion bus is that the host adapter must supply terminator power (TERMPWR) to the SCSI bus. All terminators on the host adapter, as well as those on the internal and external SCSI bus, must be powered from the TERMPWR lines on the SCSI bus.
- **11.8.2 The circuit that supplies TERMPWR must have built-in overcurrent protection.** Devices that provide TERMPWR must also provide some means of limiting the current through use of a self-resetting device. For example, a positive-temperature coefficient device or circuit breaker can be designed into the circuit. These devices open during an overcurrent condition and close after the condition ends.

Mobile PC Note

Although recommended, this item is not required for battery-powered systems that implement the SCSI host adapter as a PC Card device, because of battery consumption issues.

11.9. External connector meets SCSI-2 or later standard

Required

Although an external connector is optional, if an external connector is provided, it must be a high-density connector and must meet the requirements defined in the SCSI-2 or later standard.

11.10. Controller and peripherals implement SCSI bus data protection signal

Required

The SCSI host adapter and all SCSI peripherals must implement the SCSI bus data protection signal defined in the SPI standard, and data protection must be enabled by default. This signal was formerly referred to as the parity signal.

SCSI Peripheral Requirements

This section summarizes requirements related to specifications and standards for SCSI peripherals.

11.11. SCSI connections use keyed and shrouded connectors

Required

For internal and external configurations, the SCSI bus cable must be plugged into shrouded and keyed connectors on the host adapter and devices. This ensures that the cable is properly positioned so the user cannot plug in cables incorrectly.

For internal configurations, Pin 1 orientation must be designated on one edge of the ribbon cable and also on the keyed connector of the SCSI peripheral device. For more information, see requirement 3.18, “Connections use icons, plus keyed or shrouded connectors, with color coding.”

11.12. External devices use automatic termination or an accessible on-board termination switch

Required

The recommended implementation for an external SCSI peripheral device is to provide automatic termination. In the absence of automatic termination, a mechanical means must be provided for setting termination and the switch must be accessible to the user without opening the device chassis.

11.13. Shielded device connector meets SCSI-2 or later standard

Required

Device connectors must meet the standards defined in the SCSI-2 or later standard.

11.14. Removable media devices support media status notification

Required

SCSI removable media storage devices must support media status notification as specified in requirement 18.2, “Removable media devices support media status notification.”

PC 99A clarification: See the clarifications at item 18.2.

Plug and Play for SCSI Host Adapters and Peripherals

This section summarizes the Plug and Play requirements for SCSI devices.

11.15. Each device has a Plug and Play device ID

Required

For each system-board device, there must be a Plug and Play device-specific ID.

Each SCSI controller or peripheral device must provide device IDs as defined in the *Plug and Play SCSI Specification, Version 1.0*, and in the specification for the bus it uses as defined in the related chapter in Part 3 of this guide.

For example, a PCI device must comply with PCI 2.1 and also must provide a Subsystem ID and Subsystem Vendor ID as defined in Chapter 9, “PCI.” PCI controllers integrated into core logic on the system board do not have to provide Subsystem IDs and Subsystem Vendor IDs, but must meet other PCI 2.1 requirements.

11.16. Dynamic resource configuration is supported for all devices

Required

For SCSI on-board controllers and add-on adapters, the system must be capable of automatically assigning, disabling, and relocating the resources used by the device. Configuring the device or adding it to the system must not require changing jumpers or switches on either the device or the system board.

In the event of an irreconcilable conflict with other devices, the operating system must be able to disable the adapter. Disabling a device must result in freeing its resources for use by other devices.

Note: This requirement does not apply to jumper settings used by the OEM to make basic system-related settings in the factory. This requirement applies only to settings that the end user must make to configure the hardware.

11.17. Resource configuration meets bus requirements

Required

Plug and Play resource-configuration requirements are defined by the bus used by the SCSI controllers and peripheral devices, as defined in the related chapter for the specific bus in Part 3 of this guide.

11.18. SCAM support is disabled by default

Required

SCSI Configured Automatically (SCAM) support is not recommended. If support is present, it must be disabled by default. SCAM is not supported by Windows operating systems; enabling SCAM can cause the system to become unstable or inoperable.

Plug and Play for SCSI must be implemented as defined in *Plug and Play SCSI Specification, Version 1.0.*

11.19. SCSI devices that support hot-plugging meet PC 99 requirements

Required

To ensure reliable support for hot-plugging capabilities, the following requirements must be met by any SCSI devices that allow hot-plugging:

- **11.19.1 Hot-plugging for PCI devices uses ACPI-based methods.** Windows 98 and Windows 2000 support dynamic enumeration, installation, and removal of devices connected by way of the PCI bus only if there is a supported hardware insert/remove notification mechanism as defined in Section 5.6.3 of the ACPI 1.0 specification.

  In order to properly function with the native support in the operating system, developing industry standards such as those referred to as PCI Hot Plug and Compact PCI must use ACPI-based methods for supporting hardware insertion and removal as defined in the ACPI 1.0 specification.
- **11.19.2 All removable media support media status notification.** Removable media must support the appropriate media status notification method to ensure that no loss of data or system failure results when such media is removed from the system. See requirement 11.14, “Removable media devices support media status notification.”

Recommended: A locking mechanism to ensure that devices are removed only under operating system control or during sleep or off states. For implementation details and additional design guidelines, see the article about hot-plugging support at http://www.microsoft.com/hwdev/busbios/rem_devs.htm.

11.20. SCSI controllers provide multi-initiator support

Recommended

Multi-initiator support allows two SCSI controllers—each installed in a separate computer system—to coexist on a shared SCSI bus with a set of shared devices. If this capability is supported, the SCSI IDs must be changeable from the default SCSI controller ID of 7 and the boot-time SCSI bus reset operation must be able to be disabled on each controller attached to a shared bus.

This capability is recommended for hardware that will be used on systems using the clustering service available under Microsoft Windows 2000 Advanced Server.

To use this service, a SCSI adapter and a SCSI peripheral must provide multi-initiator support for at least two initiators.

Power Management for SCSI Devices

This section summarizes the specific power management requirements for the SCSI bus class. Power management requirements for other device classes are defined in Part 4 of this guide.

11.21. Bus and device meet PC 99 power management requirements

Required

Storage devices must comply with the *Storage Device Class Power Management Reference Specification, Version 1.0* or later. The ability to cause a wake-up event as defined in *Storage Device Class Power Management Reference Specification* is an optional feature.

Additional power management requirements are specified based on industry-defined standards for the bus used by the controller, as defined in the related chapter for the specific bus in Part 3 of this guide. See also Part 4 of this guide for the related device class power management requirements for a particular device type.

For mobile drives, it is recommended that a Read operation typically be completed within 5 seconds of applying power or issuing a START UNIT command; for desktop systems, the recommendation is 10 seconds.

The drive spinup time recommendation is not expected to become a requirement in future versions of this guide.

11.22. Hardware supports the STOP/START UNIT command as defined in the SPI standard

Required

SCSI peripherals must be able to fully recover from a software-initiated spin down without rebooting the system or cycling power. To properly support power management on SCSI drives and to ensure that the operating system responds to appropriate driver calls, the STOP/START UNIT command must be implemented as defined in the SPI (SCSI-3) standard.

11.23. STOP/START UNIT command is used to decrease power consumption

Required

Wherever appropriate, such as for storage disks, the STOP UNIT command must be used to decrease the power consumption of the base platform.

Removing power should not be used as the method for spinning down storage disks.

SCSI References

The following represents some of the references, services, and tools available to help build hardware that is optimized to work with Windows operating systems.

Compaq, Intel, Phoenix BIOS Boot Specification, Version 1.01
http://www.ptltd.com/techs/specs.html
http://www.microsoft.com/hwdev/respec/pnpspecs.htm

El Torito—Bootable CD-ROM Format Specification, Version 1.0
http://www.ptltd.com/techs/specs.html

MMC-2 Multi-Media Command Set-2
ftp://ftp.symbios.com/pub/standards/io/t10/drafts/mmc2/

Microsoft Windows 98 DDK, Windows 2000 DDK, and DirectX 5.0 DDK
http://www.microsoft.com/ddk/
(or MSDN Professional subscription)

National Committee for Information Technology Standards (NCITS) Reduced Block Commands (RBC)Draft Proposal T10/97-260r0
ftp://ftp.symbios.com/pub/standards/io/t10/drafts/rbc/

PCI Local Bus Specification, Revision 2.1 (PCI 2.1) and later
http://www.pcisig.com/specs.html

Plug and Play SCSI Specification, Version 1.0
http://www.microsoft.com/hwdev/respec/pnpspecs.htm
http://msdn.microsoft.com/library/

Small Computer Interface (SCSI-2) [X3T9.2-375R] standard
Small Computer Interface (SCSI-3) *Parallel Interface* (SPI) [X3T9.2/91-10] standard
Other SCSI standards and documents
Global Engineering Documents
Fax: (303) 397-2740
Phone: (800) 854-7179 (U.S.)
(613) 237-4250 (Canada)
(303) 792-2181 (Outside North America)

SCSI draft standards and other working documents are available at
ftp://ftp.symbios.com/pub/standards/io/t10/

Small Form Factor (SFF) Committee publications
FaxAccess: (408) 741-1600 (fax-back)
Fax: (408) 867-2115

Storage Device Class Power Management Reference Specification, Version 1.0
http://www.microsoft.com/hwdev/specs/PMref/PMstore.htm

White papers and guidelines for Microsoft operating systems
http://www.microsoft.com/hwdev/storage/

Checklist for SCSI

If a recommended feature is implemented, it must meet the requirements for that feature as defined in this document.

11.1. SCSI host controller supports bus mastering
Required

11.2. Bootable SCSI controller supports El Torito No Emulation mode
Required

11.3. Option ROM supports Int 13h Extensions
Required

11.4. Option ROM supports virtual DMA services
Required

11.5. Bus type is clearly indicated on connectors for all adapters, peripherals, cables, and terminators
Required

11.6. Differential devices support DIFFSENS as defined in SPI standard
Required

11.7. Automatic termination circuit and SCSI terminators meet SCSI-3 standard
Required

11.8. Terminator power is supplied to the SCSI bus with overcurrent protection
Required

11.9. External connector meets SCSI-2 or later standard
Required

11.10. Controller and peripherals implement SCSI bus data protection signal
Required

11.11. SCSI connections use keyed and shrouded connectors
Required

11.12. External devices use automatic termination or an accessible on-board termination switch
Required

11.13. Shielded device connector meets SCSI-2 or later standard
Required

11.14. Removable media devices support media status notification
Required

11.15. Each device has a Plug and Play device ID
Required

11.16. Dynamic resource configuration is supported for all devices
Required

11.17. Resource configuration meets bus requirements
Required

11.18. SCAM support is disabled by default
Required

11.19. SCSI devices that support hot-plugging meet PC 99 requirements
Required

11.20. SCSI controllers provide multi-initiator support
Recommended

11.21. Bus and device meet PC 99 power management requirements
Required

11.22. Hardware supports the STOP/START UNIT command as defined in the SPI standard
Required

11.23. STOP/START UNIT command is used to decrease power consumption
Required