C H A P T E R   1 1

SCSI

This chapter presents the PC 98 requirements and recommendations for the small computer system interface (SCSI). The use of SCSI in a PC 98 system is optional, but if SCSI is used, all components must comply with the requirements defined in this chapter.

SCSI is a flexible I/O bus that is used in the design of a wide variety of peripherals, including disk drives, CD-ROM 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.

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SCSI Host Adapter Requirements

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

1. Host controller supports bus mastering
Required

The host controller must support bus mastering.

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,* by IBM and Phoenix, or an equivalent method that supports the Windows NT CD-ROM installation process.

3. Option ROMs support Int 13h Extensions
Required

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 and Windows NT. 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 Windows NT 5.0 DDK and in the "Layered Block Device Drivers" section of the Windows 98 DDK.

4. Option ROMs support 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.

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* (SCSI-3) *Parallel Interface* (SPI) specification, Annex F, and must display any clarifying abbreviations or acronyms.

6. Differential devices support DIFFSENS as defined in SCSI-3 specification
Required

Without DIFFSENS, the differential bus drivers and/or a single-ended device will burn up if a single-ended device is put on a differential bus.

The specification for DIFFSENS is defined in Section 5.4.2 of the SCSI-3 specification.

7. Automatic termination circuit meets SCSI-3 specification
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.

8. SCSI terminator built onto internal cables meets SCSI-3 specification
Required

For SCSI subsystem configurations, internal cables must be preconfigured with active termination at one end of the cable.

9. Terminator power is supplied to the SCSI bus with over-current protection
Required

For system-board implementations using PCI or another expansion bus, 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.

Devices that provide TERMPWR must also provide some means of limiting the current, through use of a self-setting device. For example, a positive-temperature coefficient device or circuit breaker can be designed into the circuit. These devices open during an over-current condition and close after the condition ends.

This item is a recommendation for battery-powered systems that implement the SCSI host adapter as a PC Card device, because of battery power-consumption issues.

10. External connector meets SCSI-2 or higher specification
Required

If an external connector is implemented, it must be a high-density connector and must meet the requirements defined in the SCSI-2 or higher specification.

11. Internal terminator is as close as possible to the last peripheral on the cable
Recommended

The internal terminator should be as physically close as possible to the last peripheral on the cable. There should be some means, such as written instructions on the cable, to ensure that the user always connects internal peripherals starting with the plug closest to the terminator.

SCSI Peripheral Requirements

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

12. SCSI bus parity signal meets SCSI-2 specification
Required

All SCSI peripherals must implement the SCSI bus parity signal defined in the SCSI-2 specification.

13. Cables meet SCSI-3 Clause 6 requirements
Required

Clause 6 of the SCSI-3 specification defines the various characteristics of cables for SCSI devices.

14. User cannot incorrectly plug in cables
Required

For an internal configuration, the internal 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. Pin 1 orientation must be designed on one edge of the ribbon cable and also on the keyed connector of the SCSI peripheral device.

For an external configuration, the SCSI connector must not use the same connector type as any non-SCSI connector on the system.

15. 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, an external pluggable terminator must be connected to the last open device connector on a bus. If a mechanical means is provided for setting termination, the switch must be accessible to the user without opening the PC case.

16. Shielded device connector meets SCSI-2 or higher specification
Required

Device connectors must meet the specifications defined in the SCSI-2 or higher specification.

17. Removable media includes media status notification support
Recommended

A specification has not yet been completed for implementing media event status notification. However, the projected specification will be similar to the Media Event Status Notification subsection of SFF 8090 (Mt. Fuji specification). This specification is available at ftp://fission.dt.wdc.com/pub/standards/SFF/specs/.

When a completed specification is available, support for media status notification will become a requirement.

Plug and Play for SCSI Host Adapters and Peripherals

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

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

For a 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 the "PCI" chapter in Part 3 of this guide.

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.

19. Automatic resource assignment and dynamic disable capabilities supported for all devices
Required

For SCSI on-board controllers and add-on adapters, the system must be capable as necessary of automatically assigning, disabling, and relocating the resources used by the device. Changing this device or adding it to the system must not require changing jumpers or switches on either the adapter or the system board. In the event of an irreconcilable conflict with other devices, the operating system must be able to disable the device in order to prevent the system from stalling.

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.

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.

21. Bus and device meet PC 98 power requirements
Required

Additional power management requirements are specified based on industry standards for the bus used by the controller and for the device. For more information, see the related chapter for the specific bus class in Part 3 in this guide. See also Part 4 of this guide for the related device class requirements based on compliance with the specific device class power management reference specification.

22. Hardware supports the STOP/START UNIT command as defined in the SCSI-2 specification
Required

The hardware in 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, be sure to correctly implement the STOP/START UNIT command as defined in the SCSI-2 specification.

23. STOP/START UNIT command can be used to decrease power consumption
Recommended

Wherever appropriate—for example, for storage disks—the STOP UNIT command can be used to decrease the power consumption of the base platform. In order for any form of power management to work on SCSI, the device should be capable of supporting many tens of thousands of START/STOP UNIT commands over the life of a device.

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.

Device class power management reference specifications
   http://www.microsoft.com/hwdev/onnow.htm

El Torito—Bootable CD-ROM Format Specification, Version 1.0
Compaq, Intel, Phoenix BIOS Boot Specification, Version 1.01
   http://www.ptltd.com/techs/specs.html

PCI Local Bus Specification, Revision 2.1 (PCI 2.1)
   PCI SIG
   Phone: (800) 433-5177
   http://www.pcisig.com

Plug and Play SCSI Specification, Version 1.0
   http://www.microsoft.com/hwdev/specs/

Small Computer Interface (SCSI-2) [X3T9.2-375R] specification
Small Computer Interface (SCSI-3) *Parallel Interface* (SPI)
[X3T9.2/91-10] specification
   SFF Committee publications
   FaxAccess: (408) 741-1600 (fax-back)
   Fax: (408) 867-2115

   Global Engineering Documents
   Phone: (800) 854-7179 (US)
           (613) 237-4250 (Canada)
           (303) 792-2181 (Outside North America)
   Fax: (303) 397-2740
   ftp://ftp.symbios.com/pub/standards/io/

Windows and Windows NT DDK
   MSDN Professional membership

Checklist for SCSI

If a recommended feature is implemented, it must meet the PC 98 requirements for that feature as defined in this document.

1. Host controller supports bus mastering
Required

2. Option ROMs support Int 13h Extensions
Required

3. Option ROMs support virtual DMA services
Required

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

5. Differential devices support DIFFSENS as defined in SCSI-3
Required

6. Automatic termination circuit meets SCSI-3 specification
Required

7. SCSI terminator built onto internal cables meets SCSI-3 specification
Required

8. Terminator power is supplied to the SCSI bus, with over-current protection
Required

9. High-density external connector meets SCSI-2 specification
Required

10. Internal terminator is close as possible to the last peripheral on the cable
Recommended

11. SCSI bus parity signal meets SCSI-2 specification
Required

12. Cables meet SCSI-3 Clause 6 requirements
Required

13. User cannot incorrectly plug in cables for internal connections
Required

14. Internal SCSI peripherals do not terminate the SCSI bus
Recommended

15. External connectors use automatic termination or an accessible on-board termination switch
Required

16. High-density, shielded device connector meets SCSI-2 specification
Recommended

17. Removable media includes media status notification support
Recommended

18. All components comply with Plug and Play SCSI specifications
Required

19. Each device has a Plug and Play device identifier
Required

20. Automatic resource assignment and dynamic disable capabilities are supported for all devices
Required

21. Bus and device meet PC 98 power requirements
Required

22. Hardware supports the STOP/START UNIT command as defined in SCSI-2
Required

23. STOP/START UNIT command can be used to decrease power consumption
Recommended