

CHAPTER 4

Workstation PC 97

This chapter presents the requirements and recommendations for network workstations under the Microsoft Windows family of operating systems.

Version 1.1

Includes changes to References for Workstation PC 97

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Overview for Workstation PC 97

This section presents the key design features for Workstation PC 97. *PC 97 Hardware Design Guide* provides the first definition of this PC category for the “Designed for Microsoft Windows” logo program.

Although the design requirements for Workstation PC 97 can support running either the Windows 95 or Windows NT operating system, these requirements are optimized to support complex Win32-based applications, which usually run on Windows NT Workstation, for users whose principal computing work involves using mission-critical networked applications, engineering or scientific applications, or media-authoring or software development tools. Although Windows NT Workstation is used on standalone systems, the PC 97 requirements support the more common use of Windows NT Workstation as a platform for network productivity.

These are the key design issues for Workstation PC 97:

- PC 97 requirements for implementing the new Advanced Configuration and Power Interface (ACPI), new bus class and device class power management requirements, and implementing USB in the system.
- Recommendations for input components and graphics adapter capabilities, based on the intended use of the workstation.

Important The system requirements defined in *PC 97 Hardware Design Guide* provide guidelines for designing PC systems that best run Windows 95 and Windows NT. These design requirements are not the basic system requirements for running the Windows operating system. Also, hardware features are described as *Required*, *Recommended*, or *Optional* for the “Designed for Microsoft Windows” logo program:

- **Required:** These are the basic hardware features that must be implemented to qualify for the “Designed for Microsoft Windows” logo.
Recommended: These features add functionality supported by the Windows operating systems. For “Designed for Microsoft Windows” logo testing, if a recommended feature is implemented, it must meet the standards for that feature as defined in this guide. Some recommended features might become requirements under the logo program in the future.
- **Optional:** These features are neither required nor recommended, but if the feature is implemented in a PC 97 system, it must meet the specified requirements. These features will not become requirements under the logo program in the future.

System Requirements for Workstation PC 97

This section summarizes the requirements for the basic components of Workstation PC 97 systems.

1. Minimum microprocessor:

Pentium-class 166 MHz or equivalent, or RISC-based processor

Required

Recommended: two or more microprocessors.

The minimum microprocessor capability is required to support the demands of the complex computational and graphics-intensive software that will be used on a Workstation PC 97 system. The processor requirement for RISC-based systems is one of the following:

- MIPS R4x00 or equivalent
- Digital Alpha 21064 (EV4) or higher processors
- IBM PowerPC Architecture for RISC-based systems

If multiprocessor support is provided in a Workstation PC 97 system with x86-based processors, such support must comply with MultiProcessor Specification Version 1.4 or higher (available from Intel). An ARC- or ACE-compliant RISC-based system meets the requirements for multiprocessor support. Notice, however, that dual processors will never become a logo requirement.

2. L2 cache with 256K minimum, for Pentium-class processor

Required

Recommended: 512K cache.

The minimum Level 2 cache is required for performance on x86-based Workstation PC 97 systems. This requirement does not apply for a Pentium Pro-class system with a built-in L2 cache.

If multiprocessor support is provided with Pentium-class processors, each processor must have a separate L2 cache.

3. Minimum system memory: 32 MB

Required

Recommended: 64 MB. For multiprocessor systems, 64 MB minimum is required.

At least 28 MB of system memory must be completely available for the system to use and cannot be locked from use by the operating system. For multiprocessor systems, at least 60 MB must be completely available for the system to use.

Note This minimum requirement for memory available to the operating system does not preclude applications that use dynamically allocated memory for audio or video playback or other temporary uses of system memory.

4. Workstation PC 97 meets Basic PC 97 general system requirements

Required

This includes the following specific requirements, as defined in the “Basic PC 97” chapter in this guide:

- Advanced Configuration and Power Interface (ACPI) support
- Hardware support for OnNow initiative
- BIOS support for OnNow initiative (for x86-based systems only)
- BIOS support for boot devices (for x86-based systems only)
- BIOS boot support for USB keyboard (for x86-based systems with only USB keyboards)

Industrial Design Requirements for Workstation PC 97

This section summarizes the physical design requirements for Workstation PC 97 systems. These requirements are in addition to those related to the OnNow initiative for power-state indicators and easily accessible power switches.

5. All expansion slots in the system accessible for users to insert cards

Required

The expansion slots cannot be physically blocked by components or devices provided with the system. This does not exclude configurations that allow space for only half-height cards for some slots or passive back planes used for connectors, and so on.

6. Audible noise meets PC 97 standards

Recommended

A PC 97 system should be “silent” in the Sleeping state and as quiet as possible during active operations. Recommended test procedures and measurements will be documented by Microsoft.

The need to limit audible noise comes from the OnNow design initiative. A PC that uses OnNow technologies will be active even when not under direct operation by the user. These operations must happen silently so as not to interfere with other activities in the work site.

7. System and component design practices follow accessibility guidelines

Recommended

Accessibility design guidelines are provided in Appendix C, “Accessibility,” in this guide. These guidelines were developed in consultation with the Trace Research and Development Center at the University of Wisconsin. Notice that this recommendation will not become a requirement.

General Device Requirements for Workstation PC 97

This section defines the general requirements for devices on a Workstation PC 97 system. The requirements in this section apply for every device, whether it is present included in the PC system or provided as an add-on device.

8. Workstation PC 97 meets Basic PC 97 general device requirements

Required

This includes the following specific requirements, as defined in the “Basic PC 97” chapter in this guide:

- Each device and driver meets PC 97 device requirements
- Each bus complies with written specifications and PC 97 requirements
- Each bus and device complies with current Plug and Play specifications
- Unique Plug and Play device ID for each system device and add-on device
- Option ROMs meet Plug and Play requirements (for x86-based systems only)
- “PNP” vendor code used only when defining a legacy device’s CompatibleID
- All devices support correct 16-bit decoding for I/O port addresses
- Devices and buses support hot plugging if using USB, 1394, or PC Card
- The user is protected from incorrectly connecting devices
- Minimal user interaction needed to install and configure devices
- Device driver and installation meet Windows and Windows NT standards
- Multifunction add-on devices meet general device requirements for each device
- Standard system board devices use ISA-compatible addresses

Buses and Devices for Workstation PC 97

This section defines specific requirements for buses and devices provided in a Workstation PC 97 system, in addition to the basic requirement for supporting the Advanced Configuration and Power Interface specification, as defined earlier in this chapter.

System Buses for Workstation PC 97

This section summarizes the general requirements for system buses. Additional requirements are defined in Part 3 of this guide for particular buses.

9. Universal Serial Bus, with one USB port, minimum

Required

Universal Serial Bus (USB) provides a bidirectional, isochronous, dynamically attachable serial interface for adding peripheral devices such as game controllers, communications devices, and input devices on a single bus.

The USB implementation in the system must meet the requirements defined in USB specifications, plus any additional requirements for PC 97 defined in the “USB” chapter in Part 3 of this guide.

10. Support for other high-speed expansion capabilities

Recommended

Additional support for expansion capabilities can be provided using PCI v. 2.1, IEEE 1394, or CardBus, or other high-speed buses. Any expansion bus implemented in the system must meet the requirements defined in the related chapter in Part 3 of this guide.

11. If present, PCI bus meets PCI v. 2.1 and higher, plus PC 97 requirements

Required

If PCI is used, the PCI bus must meet the requirements defined in PCI v. 2.1 or higher, plus any additional requirements for PC 97 defined in the “PCI” chapter in Part 3 of this guide.

12. ISA expansion bus

Optional

If an ISA bus is implemented in a Workstation PC 97 system, all the requirements defined in the “ISA” chapter in Part 3 of this guide must be met.

Notice that including ISA in the system will probably require support for traditional keyboard, parallel, and serial ports. For requirements related to these devices, see the “Serial, Parallel, and Wireless Support” and “Input Components” chapters in Part 4 of this guide.

PC 97 requirements exclude using ISA as the bus for the graphics adapter. For Workstation PC 97, the network adapter is also excluded from using the ISA bus.

I/O Devices for Workstation PC 97

This section defines the general requirements for I/O devices. Additional requirements are defined in the sections titled “Graphics Adapter and Monitor for Workstation PC 97” and “Storage and Related Peripherals for Workstation PC 97” later in this chapter.

Tips for Selecting I/O Performance Components. For PC manufacturers who want to select high-performance components for Workstation 97 systems, these are design features to look for in I/O components:

- Adapter supports bus mastering, especially for use with processors that have Pentium Pro-equivalent register sets.
- PCI adapter properly supports higher-level PCI commands for intelligent data transfer.
- Drivers are tuned for 32-bit performance.

13. Keyboard connection and keyboard

Required

Recommended: USB connection. The external connection requirements can also be met using a PS/2-style port or wireless capabilities in the system. For complete requirements for keyboard ports and peripherals, see the “Input Components” chapter in Part 4 of this guide.

14. Pointing device connection and pointing device

Required

Recommended: USB connection. The external connection requirements can also be met using a PS/2-style port or wireless capabilities in the system. For complete requirements for mouse ports and peripherals, see the “Input Components” chapter in Part 4 of this guide.

15. High-precision input device in addition to mouse

Recommended

Recommended: USB connection. For workstations that support engineering or CAD computing, a digitizer, drawing tablet, or other special pointing device is Recommended. Any pointing device included with the system must meet the PC 97 requirements for input devices.

16. Connection for external parallel devices

Required

Recommended: SCSI or external bus such as USB, IEEE 1394, or PC Card. This can also be provided as a parallel port with ECP mode capabilities. For complete requirements for parallel ports, see the “Serial, Parallel, and Wireless Support” chapter in Part 4 of this guide.

17. Connection for external serial devices

Required

Recommended: USB or PC Card. This can also be provided as a 16550A serial port. For complete requirements for serial ports, see the “Serial, Parallel, and Wireless Support” chapter in Part 4 of this guide.

18. Wireless capabilities in PC system

Recommended

If wireless capabilities are included in the system, PC 97 requirements must be met, as defined in the “Serial, Parallel, and Wireless Support” chapter in Part 4 of this guide.

19. CD-ROM or network adapter support for installing the operating system

Required

For Workstation PC 97, a network adapter included with the system is strongly recommended.

The PC 97 system must include I/O device support to allow the user to install (or reinstall) the operating system. For the Windows NT operating system, either a CD-ROM drive or network adapter must be included in the system, because Windows NT does not support installing the operating system from a floppy disk drive.

- CD-ROM drive: if this device is present, the host controller must meet requirements defined in the related chapters in Part 3 of this guide, and the device must meet the requirements defined in the “Storage and Related Peripherals” chapter in Part 4 of this guide.
- Network adapter: if the network interface is implemented in the PC system (either on the system board or through an expansion card), the network adapter must meet the requirements defined in the “Network Communications” chapter in Part 4 of this guide. These requirements include support for an NDIS 4.0 miniport driver plus automatic detection of cable and transceiver type.

An ISA-based network adapter solution is not allowed for a Workstation PC 97 system.

Note It is recognized that OEMs supply PC systems to corporations in situations where the customer will insert network adapters at the end-user site. Workstation systems designed for specific corporate customer features are exempt from this PC 97 requirement.

20. Audio support in PC system meets PC 97 requirements

Recommended

If audio is implemented in a PC 97 system, it must meet the minimum requirements defined in the “Audio Components” chapter in Part 4 of this guide.

21. Communications device provided with PC system

Required

The following device options can meet this requirement:

- Modem. If modem capabilities are implemented in the PC system, the device must meet the requirements defined in the “Modems” chapter in Part 4 of this guide.
- ISDN or cable modem for high-speed communications. High-speed communication capabilities are strongly recommended for Workstation PC 97. For information about requirements for ISDN and cable modems, see the “Network Communications” chapter in Part 4 of this guide.
- Network adapter. Requirements for a network adapter are defined earlier in this section.
- ATM adapter. If this adapter is included in a Workstation PC 97 system, it must meet the requirements defined in the “Network Communications” chapter in Part 4 of this guide.

Note It is recognized that OEMs supply PC systems to corporations in situations where the customer will insert network adapters at the end-user site or where the customer has particular feature demands. Workstation systems designed for specific corporate customers are exempt from this PC 97 requirement.

Graphics Components for Workstation PC 97

This section summarizes the Workstation PC 97 requirements for graphic components, including graphics adapter and monitor.

Tips for Selecting Performance Components for Graphics Subsystem.

For PC manufacturers who want to select high-performance components for Workstation 97 systems, these are design features to look for in graphics components:

- Adapter supports bus mastering.
- Adapter supports write combining (WC) memory type to allow speculative writers to linear frame buffer with processors that have Pentium Pro-equivalent register sets.
- Driver sets up memory-type range registers using the Windows NT 4.0 range registers.
- Drivers are tuned for 32-bit performance.
- With Pentium Pro-class processors, 4 MB display RAM is highly recommended to support WC optimizations under Windows NT 4.0.

If the target use is the engineering desktop, the following should be considered:

- Strong wire frame and shaded triangle performance in 2D hardware acceleration
- Support for OpenGL acceleration
- Support for 3D acceleration
- Support for Parametrix Technologies Corporation (PTC), SDRC, and SoftImage

22. Display adapter meets PC 97 minimum requirements

Required

As defined in the “Basic PC 97” chapter in this guide, the graphics subsystem must include the following support:

- Minimum resolution: 1024x768x16 bpp

Recommended: 1280x1024x24 bpp

For Workstation PC 97, the graphics-intensive requirements for many Win32-based productivity applications require a higher minimum resolution than that specified for Basic PC 97.

Recommended: 4 MB display RAM

For workstations with Pentium Pro-class processors or with intended uses such as engineering, CAD computing, or other graphics-intensive applications, the extra display RAM is strongly recommended.

- Primary graphics adapter does not use legacy bus
- System operates normally with default VGA mode driver
- Support for multiple adapters and multiple monitors

Recommended: Support for NTSC or PAL TV output. (This will not become a requirement for Workstation PC 97.)

For complete details related to basic graphics adapter requirements, see the “Graphics Adapters” chapter in Part 4 of this guide.

23. Hardware acceleration for 2-D and 3-D graphics

Recommended

Various hardware acceleration features for 2-D and 3-D graphics can be implemented to improve overall graphics performance. For Workstation PC 97 systems that will support precise graphics applications, such as engineering or CAD software, graphics hardware 3-D acceleration should support OpenGL capabilities built into the Windows NT operating system. Microsoft DirectDraw and Direct3D are used by applications to accelerate graphics display by providing direct manipulation of video display memory, hardware bltters, hardware overlays, and page flipping.

For information about required and recommended features if hardware acceleration is implemented for 2-D and 3-D graphics, see the “Graphics Adapters” chapter in Part 4 of this guide.

24. Color monitor supports DDC 2.0 Level B and 800x600, minimum

Required

If a monitor is provided with a Workstation PC 97 system, it must meet the minimum capabilities defined for PC 97. For complete PC 97 requirements for monitors, see the “Video Components” chapter in Part 4 of this guide.

25. System supports MPEG-1 playback

Required

Microsoft provides operating system support through Microsoft ActiveMovie. For information about performance and graphics hardware requirements to support video playback, see the “Video Components” chapter in Part 4 of this guide.

Storage and Related Peripherals for Workstation PC 97

This section summarizes the requirements for storage devices for Workstation PC 97. For system requirements related to CD-ROM, see the “System Buses and I/O Devices for Workstation PC 97” section earlier in this chapter.

Tips for Selecting Performance Components for Storage. For PC manufacturers who want to select high-performance components for Workstation 97 systems, these are design features to look for in storage components:

- Controller supports bus mastering (a Workstation PC 97 requirement).
- Disks support reduced latency and fast rotational speeds.
- Disks support at least 2:1 memory interleaving when SDRAM is not used.
- Drivers are tuned for 32-bit performance.

26. Host controller for storage device meets PC 97 requirements*Required*

Recommended to support multiple storage devices: SCSI host controller.

The host controller must meet requirements defined for the bus it uses; for SCSI or IDE controllers, it must also meet the requirements in the “ATA and ATAPI” or “SCSI” chapter in Part 3 of this guide.

27. Primary host controller supports bus mastering*Required*

For Workstation PC 97, the primary host controller must support bus mastering, whether using IEEE 1394, IDE, or SCSI.

28. Workstation PC 97 meets storage requirements defined for Basic PC 97*Required*

This includes the following specific requirements, as defined in the “Basic PC 97” chapter in this guide:

- Support Int 13h Extensions in system and option ROMs (for x86-based systems only)
- Hard disk drive meets requirements defined in the “Storage and Related Peripherals” chapter in Part 4 of this guide
- Media status notification support for removable media

29. DVD-ROM drive*Recommended*

Any DVD device included in a Workstation PC 97 system must meet the requirements defined for DVD in the “Storage and Related Peripherals” chapter in Part 4 of this guide.

Note If a Workstation PC 97 system includes DVD-Video support, the PC must also provide PC 97 playback support for DVD content, as defined in the “Video Components” chapter in Part 4 of this guide.

References for Workstation PC 97

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

Plug and Play specifications

<http://www.microsoft.com/hwdev/pnpspecs.htm>

Microsoft Device Driver Kits (DDKs) for Windows operating systems

Microsoft Developer Network (MSDN) Professional membership

Advanced Configuration and Power Interface (ACPI) specification

<http://www.teleport.com/~acpi/>

Power Management specifications for device and bus classes

Guidelines for audible noise and other OnNow technologies

<http://www.microsoft.com/hwdev/onnow.htm>

MultiProcessor Specification Version 1.4

Intel part number 242016-002

Phone: (800) 879-4683

Version 1.1 References Update:

Advanced Configuration and Power Interface Specification, Revision 1.0

<http://www.teleport.com/~acpi/>

Intel hardware developer site

<http://developer.intel.com>

MultiProcessor Specification, Version 1.4

Intel part number: 242016-002

<http://developer.intel.com>

OpenGL conformance rules from the OpenGL Architectural Review Board

http://www.sgi.com/Products/Dev_environs_ds.html

UseNet news group for OpenGL at comp.graphics.opengl

Windows NT DDK

MSDN Professional membership

Checklist for Workstation PC 97

System Requirements for Workstation PC 97

1. *Minimum microprocessor: Pentium-class 166 MHz or equivalent, or RISC-based processor*
Required
2. *L2 cache with 256K minimum, for Pentium-class processor*
Required
3. *Minimum system memory: 32 MB*
Required
4. *Workstation PC 97 meets Basic PC 97 general system requirements*
Required

Industrial Design Requirements for Workstation PC 97

5. *All expansion slots in the system accessible for users to insert cards*
Required
6. *Audible noise meets PC 97 standards*
Recommended
7. *System and component design practices follow accessibility guidelines*
Recommended

General Device Requirements for Workstation PC 97

8. *Workstation PC 97 meets Basic PC 97 general device requirements*
Required

Buses and Devices for Workstation PC 97

System Buses for Workstation PC 97

9. *Universal Serial Bus, with one USB port, minimum*
Required
10. *Support for other high-speed expansion capabilities*
Recommended
11. *If present, PCI bus meets PCI v. 2.1 and higher, plus PC 97 requirements*
Required
12. *ISA expansion bus*
Optional

I/O Devices for Workstation PC 97

13. *Keyboard connection and keyboard*
Required
14. *Pointing device connection and pointing device*
Required
15. *High-precision input device in addition to mouse*
Recommended
16. *Connection for external parallel devices*
Required
17. *Connection for external serial devices*
Required
18. *Wireless capabilities in PC system*
Recommended

19. *CD-ROM or network adapter support for installing the operating system*
Required

20. *Audio support in PC system meets PC 97 requirements*
Recommended

21. *Communications device provided with PC system*
Required

Graphics Components for Workstation PC 97

22. *Display adapter meets PC 97 minimum requirements*
Required

23. *Hardware acceleration for 2-D and 3-D graphics*
Recommended

24. *Color monitor supports DDC 2.0 Level B and 800x600, minimum*
Required

25. *System supports MPEG-1 playback*
Required

Storage and Related Peripherals for Workstation PC 97

26. *Host controller for storage device meets PC 97 requirements*
Required

27. *Primary host controller supports bus mastering*
Required

28. *Workstation PC 97 meets storage requirements defined for Basic PC 97*
Required

29. *DVD-ROM drive*
Recommended
