

Mobile PC 98

This chapter provides a summary of the key PC 98 requirements for mobile PCs, mini-notebooks, docking stations, and port replicators. If there is a conflict with requirements or recommendations made elsewhere in this guide, the items in this chapter have precedence for mobile PCs. Unless a specific requirement or exception is defined in this chapter, the requirements defined in the “Basic PC 98” chapter apply for mobile PCs.

Important: The system requirements defined in this guide provide guidelines for designing PC systems that will result in the optimal user experience with typical Windows-based applications running under either the Microsoft Windows or Windows NT Workstation operating systems. These design requirements are *not* the basic system requirements for running the Windows operating system.

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Introduction to Mobile PC Platform Guidelines

Many of the features required for Basic PC 98 demand significant power and heat dissipation, which will not work physically in the notebook environment. For mobile PC users, the issues of greater importance are portability (weight) and availability (battery life). The mini-notebook, an emerging class of machines, presents new demands with more stringent constraints that also must be addressed.

New external buses, support for multimedia applications, and other changes in PCs challenge mobile PC designers to incorporate the features that users want in a way that does not reduce the value of the core system.

The overall goal for mobile PC design is the same as for PC 98 design—enhanced user experience—but the design tradeoffs are different. This section presents mobile PC requirements in a manner that will encourage industry innovation across a wide range of design solutions without creating extreme power demands. Mobile PC requirements allow OEMs the flexibility they need to manage power and heat considerations in their designs.

Because OnNow and ACPI standards are now spreading throughout the industry, 1998 represents a transition for mobile computing. The new standards allow the operating system to take over the critical operations, such as dynamic configuration and power management, in support of mobile PCs.

The key mobile PC design issues include:

- Low weight and small size.
- Available battery life to meet user expectations.
- Power demands and heat dissipation on notebook computers managed to ensure reliable operation of internal components.
- Mobile units docked or connected to AC power versus battery power (DC).

Many of the projected uses for PC 98 computers include CPU-intensive and memory-intensive activities that further stress the power demands on mobile PCs.

Mobile PC Design Requirements

This section summarizes the additional design exceptions and design requirements for mobile PCs beyond those defined for Basic PC 98.

1. Mobile PC performance meets PC 98 minimum requirements

Required

For mobile PC systems based on Intel Architecture processors, minimum PC 98 performance requirements include the following:

- Minimum required CPU performance is 166-MHz Pentium processor with MMX technology, or equivalent performance.
- Minimum required performance is an L2 cache with 256K, or equivalent performance.
- Minimum required system memory is 24 MB. The Basic PC 98 limitations for memory available to the operating system apply for mobile PCs.

Recommended: 32 MB RAM.

For mini-notebook requirements, see the “Mini-notebook Guidelines” section later in this chapter.

2. Mobile PC supports Smart Battery or ACPI-specified battery

Required

Recommended: Smart Battery.

If Smart Battery is implemented, the battery must meet the requirements defined in the *Smart Battery System Specification*, and the charger must comply with the *Smart Battery Charger Specification, Version 1.0*, both of which are available at <http://www.sbs-forum.org>.

If a multiple-battery system using Smart Battery is implemented, the system must have a battery selector that complies with the *Smart Battery Selector Specification, Version 1.0*, also available at <http://www.sbs-forum.org>.

An embedded controller or System Management Bus (SMBus) interface is required on systems that contain a Smart Battery solution, as described Section 13 of the ACPI 1.0 specification.

An ACPI Control Method Battery, defined in Section 11 of the ACPI 1.0 specification, also meets the PC 98 battery requirement.

3. Expansion capabilities of mobile PC are accessible to users

Required

Expansion capabilities in a mobile PC usually require external connections and, occasionally, additional internal components. The expansion slot is almost always physically blocked by access doors. Such doors are recommended for traveling integrity and to minimize entry of dust. This requirement is met if the user can access such external expansion slots without tools.

Internal expansion capabilities that require internal replacements, such as CPU, memory, built-in modem, and so on, are exempt from this requirement.

4. Mobile PC connections use icons plus keyed or shrouded connectors

Required

This requirement is the same as for Basic PC 98, except that for mobile PC designs, with small-height considerations, connector icons might not fit on the back of the case. In such cases, it is acceptable to wrap the icons to the bottom of the unit or place them on the inside of an access door.

5. Mobile PC includes a USB port

Required

For mobile PCs, a USB port must be built into the PC, not provided solely by port replicators or docking stations, although these units can provide extra USB connectors.

6. Mobile PC includes an IEEE 1394 port

Recommended

A docking station should include at least one IEEE 1394 port, as defined in the PC 98 system requirements in the “Basic PC 98” chapter in Part 2 of this guide. If implemented on a mobile PC unit, the IEEE 1394 port must comply with the requirements defined in the *1394 Device Power Management* specification when the final draft is approved by the 1394 Trade Association. For more information about power management requirements for IEEE 1394, see the “IEEE 1394” chapter in Part 3 of this guide.

7. USB-connected device does not maintain fully on power state

Required

An internal device that connects to the mobile PC using USB must not continually maintain the system in a fully-on power state. Such a device will override system power-management settings that control power-saving modes to protect battery life. When any USB device is connected but not active, the driver must allow system power management to suspend the notebook.

8. Mobile PC includes CardBus

Required

At least one 32-bit Type-2 CardBus slot (not 16-bit) is required. Additionally, Zoomed Video (ZV) support is recommended.

Note: Each device in a multifunction add-on device—such as a CardBus card—must separately meet the power management device class specifications for its device class and be independently power managed. This means that both device A and device B on the same add-on card do not have to be idle before the devices can be power managed. For information, including all requirements for CardBus support, see the “PC Card” chapter in Part 3 of this guide.

9. Mobile PC keyboard and pointing device meet PC 98 requirements

Required

The internal keyboard and any built-in pointing devices such as a mouse, stylus, pen, touch pad, touch screen, trackball, stick, and so on required for a mobile PC should use standard system-board devices. The USB port can be used to support the requirement for external pointing device and keyboard connections. Alternatively, two PS/2-style ports can be implemented for the pointing device and keyboard, or a single PS/2-style port can be provided for both the pointing device and the keyboard.

For more information, see the “I/O Ports and Devices” chapter in Part 4 of this guide, which also provides information about implementing the recommended Windows and application logo keys on mobile PCs.

10. Mobile PC includes wireless capabilities

Recommended

If implemented, IrDA fast IR is recommended for synchronizing data exchanges with new peripherals such as digital still cameras. In addition, the software must have access to turning off the interface (D3 power state) using bus-specific methods or the methods defined in Section 3.4 of the ACPI 1.0 specification.

Standards for wireless PC peripherals are being developed within IrDA, with completion expected in 1997. For information, see the “I/O Ports and Devices” chapter in Part 4 of this guide.

11. Mobile PC includes support for installing the operating system

Required

For mobile PCs, it is recognized that the system as purchased might not include all peripherals required for operating-system installation. Therefore, the Basic PC 98 system support for user installation of the operating system is required, but the user might need to access another PC 98 computer using a serial, parallel, or network connection to complete installation.

12. Mobile PC audio meets PC 98 audio requirements

Recommended

If audio is implemented in a mobile PC system, it should meet the requirements for PC 98 audio as defined in the “Audio Components” chapter in Part 4 of this guide.

13. Mobile PC includes communications device

Recommended

The recommended communication devices and guidelines are the same for mobile PCs as for Basic PC 98. The exception for modems is that if modem capabilities are integrated in the base platform, then V.80 or better is required. If modem capabilities are not integrated in the base platform, then V.80 is recommended. The exception for network adapters is that support is optional for remote new system setup capabilities as defined in the “Network Communications” chapter in Part 4 of this guide.

Notice that the presence of a CardBus slot on the mobile PC meets the Basic PC 98 requirement for providing either a modem or network adapter with a Mobile PC 98 system.

14. Built-in display adapter meets PC 98 minimum requirements

Required

The minimum required resolution for the built-in display is $800 \times 600 \times 16$ bpp or $1024 \times 768 \times 8$ bpp.

Important: For mobile PCs, most Basic PC 98 graphics requirements apply. However, the following are recommended rather than required for mobile PCs:

- Compliance with VESA 60-Hz noninterlaced refresh rate.
- General support for multiple adapters and multiple monitors.

Notice that if a docking station is implemented, the base unit BIOS must have support for multiple adapters and multiple monitors as defined in the “Graphics Adapters” chapter in Part 4 of this guide. This support allows a user to add a graphics adapter in the docking station.

- MPEG-2 and DVD-Video support features.
- 3-D features to accelerate texture mapping, lighting, and so on.
- Accelerated Graphics Port (AGP).

15. Mobile system supports hot pluggable devices and alternative server connections

Recommended

For a mobile system, the following are additional design considerations:

- Supporting hot-pluggable devices that do not require a system reboot for insertion or removal.
- Including alternative methods for server connection because a LAN or dialup connection might not always be available. Methods can include a floppy boot disk, PC Card network adapter, LAN on the system board, or docking to support remote new system setup.

Support for remote wake up is not required for mobile PCs running on battery power. A CardBus implementation that supports the power management event (PME) signal meets this requirement, whether or not cards are available for testing. For information about PME signal definition, see *PCI Bus Power Management Interface Specification for PCI to CardBus Bridge, Revision 1.0* or higher.

Docking Station Requirements

Mobile PC docking systems allow docking of a PC, with additional hardware capabilities. A docking station allows the end user to add other devices to the mobile PC system—for example, sound, network adapter, hard disks, CD-ROM, different display adapter, SCSI, modems, and so on.

Docking systems can support hot, warm, or cold docking. Warm docking refers to docking and undocking the mobile PC while the system is in a low power state (as defined in the ACPI 1.0 specification) but is not powered off. Hot docking refers to docking and undocking the mobile PC while the system is operating at full power and is in an active working state.

Resource conflicts can occur when a mobile PC is paired with a docking station that allows users to add non-proprietary expansion cards to the system. For a mobile PC and docking station pair, the system designer must ensure that the docking system is capable of arbitrating resources for conflicts that might occur if an expansion card is added to the docking station. However, the system designer does not need to add to the mobile PC unit all of the Basic PC 98 resource-arbitration capabilities.

The requirements in this section apply for mobile designs that include a docking station. There is no requirement that a mobile PC must have a docking station.

16. Mobile PC/docking station combination meets PC 98 requirements

Required

Manufacturers must submit the combined docking station and mobile PC for PC 98 compatibility testing, and this combination must pass testing.

The docking unit must be able to power the mobile system and charge the mobile system's battery under the control of the mobile system.

Some PC 98 requirements might apply to a mobile PC/docking station combination that do not apply to the mobile PC as a standalone unit. The intent for PC 98 is that such requirements apply only because of facilities present in the docking station. For example, if a docking station provides graphics capabilities that substitute for the graphics capabilities of the mobile unit, the Basic PC 98 graphics requirements apply for the mobile PC/docking station combination when the substituted graphics component is in use. If the mobile PC is supplying all graphics capabilities, then Mobile PC 98 graphics requirements still apply.

17. Docking station meets all Basic PC 98 requirements

Required

The PC 98 requirements, as defined in the "Basic PC 98" chapter in Part 2 of this guide, include requirements for OnNow and ACPI, Plug and Play, and bus and device specifications.

All PC 98 Plug and Play requirements must be met if the docking station allows addition of non-proprietary devices. Complete compliance is not necessary if the docking station does not allow addition of non-proprietary devices.

The docking station must meet the PC 98 BIOS requirement for multiple adapters and multiple monitors, which allows for the graphics capabilities in the mobile unit to be fully operational (either the LCD panel or external connector) in the event that an user adds another graphics adapter to the docking station.

Many docking stations support VCR-style docking in which the notebook is closed when docked, so the user is prevented from accessing the notebook display. It is recommended that users not be precluded from accessing their notebook display when docked and that users have the option of simultaneously using the main display on the docking station and the notebook display.

Note: The docking station can support expansion capabilities through user-accessible ISA connectors, although such designs are discouraged for PC 98. It is expected that 1998 is the last year ISA will be allowed for end-user expansion in docking stations.

18. Docking station interface is supported using ACPI-defined mechanisms*Required*

The docking station interface must be implemented using mechanisms defined in the ACPI 1.0 specification. Non-Plug and Play devices are enumerated using ACPI. All notification events and docking control must be implemented as defined in Sections 5.6.3 and 6.3 of the ACPI 1.0 specification.

19. Mobile PC/docking station combination supports automatic resource assignment and dynamic disable capabilities*Required*

The mobile PC unit that is part of a docking system does not require all of the resource-arbitration capabilities required for expandable PC systems. However, the system as a whole must be capable of completely and dynamically disabling add-on devices and of freeing all the resources used by that device when the mobile unit is docked. This requirement excludes fixed-resource devices such as the DMA controller, interrupt controller, and so on.

With this capability, individual devices in the mobile PC will be disabled when it is docked, allowing the appropriate devices in the docking station to be enabled.

The system could fail if an add-on card requires resources that conflict with a device on either the mobile PC or the docking station. The mobile PC/docking station combination must be able to resolve resource conflicts among all the devices in the docking system.

This means that docking station devices must be available to replace disabled devices in the mobile PC, and these devices must meet the basic Plug and Play resource arbitration requirements for PC 98, as described in the “Basic PC 98 General Device Requirements” section in the “Basic PC 98” chapter. However, it is up to the design engineer of a mobile PC/docking station combination to determine which component (mobile PC or docking station) will resolve the conflict when the mobile unit is docked.

For more information about resource arbitration when two devices such as two keyboards or two mice are present, see the “Automatic resource assignment and dynamic disable capabilities are supported” requirement in the “I/O Ports and Devices” chapter in Part 4 of this guide.

20. Docking station supports warm docking*Required*

Recommended: Support hot docking.

Docking or undocking a mobile unit from a docking station must not require powering off the system and must not require a system reboot.

Removable IDE devices are not required to meet this requirement.

21. Docking system supports fail-safe docking

Required

The system must provide a fail-safe system for docking and undocking the mobile unit. Working in conjunction with the operating system and ACPI (as defined in Sections 6.3 and 5.63 of the ACPI 1.0 specification), the mechanism for fail-safe docking must ensure the following:

- The undock button signals the user's intent to the system.
- Docking can occur only when the mobile unit is in the correct power state. The power state depends on whether the system is designed to support cold, warm, or hot docking.
- The user can initiate undocking through Windows-based software choices. Notice, however, that a hardware "button" must also be provided, because experience shows that users often do not find the software option and remove mobile units without operating system notification.
- The undock button or software choice sends a signal to the operating system so that the user is warned if resources are in danger of being lost.
- A safe-undock indicator is provided so the user can identify when it is safe to remove the mobile unit. This can be an LED or any other mechanism chosen by the vendor. If a physical mechanism automatically undocks the mobile PC or if hot docking is supported, then the safe-undock indicator is not required.

There is no requirement for mechanical lockout to block the user from removing the mobile unit without operating-system notification.

Port Replicator Requirements

A port replicator duplicates externally and extends features that are already available in a mobile PC—for example, an extra PC Card slot or keyboard and monitor connectors.

A port replicator with dedicated features allows the end user to add a specific feature to the original mobile PC—for example, a CD-ROM drive.

A mobile PC with a port replicator does not need to meet the expansion card requirements and does not need to meet all the resource requirements of a mobile PC/docking station combination. A port replicator is not required to provide an undock or eject button.

However, some mobile PC system designs include a port replicator that has dedicated features for networking, additional PC Card slots, a CD-ROM, and so on. This means that the system could have additional resource requirements to the point that all available IRQs in the system are already allocated; in this case, the PC Card slots (for example) would not have any IRQs available, rendering them useless.

In such cases, the port replicator must contain devices that replace any devices in the mobile PC that do not meet the IRQ, DMA, I/O port, and memory requirements for PC 98. This allows the operating system to disable the device on the mobile PC, to enable the corresponding device on the port replicator, and then to arbitrate resources among the remaining devices in the mobile unit and on the port replicator.

The requirements in this section apply for any port replicator designed for a PC 98 mobile PC. There is no requirement that a mobile PC must have a port replicator.

22. Port replicator supports automatic resource assignment and dynamic disable capabilities for replacement devices

Required

A port replicator that can accept expansion cards must contain devices that replace any devices in the mobile PC that do not meet Basic PC 98 requirements for IRQ, DMA, I/O port, and memory resources. This allows the operating system to disable the device on the mobile PC, to enable the corresponding device on the port replicator, and then to arbitrate resources among the remaining devices in the mobile unit and on the port replicator.

Devices in the system must be capable of being dynamically disabled so that the user can choose to free resources in order to allow other devices in the system to function.

Tip: To avoid resource shortages, the system designer can take advantage of the capability of Yenta-compliant CardBus controllers' capability to assign a shared PCI interrupt for R2 PC Cards, rather than using IRQs, as defined in the "PC Card 16 card driver supports sharing of level-mode interrupts" item in the "PC Card" chapter in Part 3 of this guide. For more information, see the related article at <http://www.microsoft.com/hwdev/busbios/>.

23. Port replicator supports warm docking

Required

Docking or undocking a mobile unit from a port replicator must not require powering off the system and must not require a system reboot.

Removable IDE devices are not required to meet this requirement.

Mini-notebook Guidelines

This section summarizes specific requirements for mini-notebook mobile PCs. All requirements in this chapter must be met by mini-notebooks unless an exception is specifically defined in this section.

For PC 98, a mini-notebook is defined as a system that has a carry weight of 3 pounds or less, including all hardware required to run the Windows operating system.

24. Mini-notebook performance meets PC 98 minimum requirements

Required

For mini-notebook systems, the minimum PC 98 performance requirements consist of the following:

- Minimum required CPU performance is 133-MHz Pentium processor with MMX technology, or equivalent performance.
- Minimum required system memory is 16 MB. The Basic PC 98 requirements apply: no more than 4 MB of system memory can be locked and unavailable to the operating system.
- Minimum required display is 640 × 480 × 8 bpp. Compliance with 15-bpp or 16-bpp specifications is recommended.
- System includes all functionality required to run the Windows operating system.

All other Mobile PC 98 and Basic PC 98 requirements beyond those listed here as the minimum requirements are optional for mini-notebooks.

Mobile PC 98 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.

1394 Device Power Management

<ftp://ftp.p1394pm.org/pub/1394pm/>

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

Advanced Configuration and Power Interface Specification, Revision 1.0

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

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>

Intel hardware developer site

<http://developer.intel.com>

PCI Bus Power Management Interface Specification for PCI to CardBus Bridge, Revision 1.0

<http://www.pcisig.com>

Plug and Play specifications

<http://www.microsoft.com/hwdev/specs/>

Power management specifications for device and bus classes

Guidelines for audible noise and other OnNow technologies

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

Smart Battery Charger Specification, Version 1.0

Smart Battery Selector Specification, Version 1.0

<http://www.sbs-forum.org>

Windows and Windows NT DDKs

MSDN Professional membership

Checklist for Mobile PC 98

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

1. Mobile PC performance meets PC 98 minimum requirements
Required
2. Mobile PC supports Smart Battery or ACPI-specified battery
Required
3. Expansion capabilities of mobile PC are accessible to users
Required
4. Mobile PC connections use icons plus keyed or shrouded connectors
Required
5. Mobile PC includes a USB port
Required
6. Mobile PC includes an IEEE 1394 port
Recommended
7. USB-connected device does not maintain fully on power state
Required
8. Mobile PC includes CardBus
Required
9. Mobile PC keyboard and pointing device meet PC 98 requirements
Required
10. Mobile PC includes wireless capabilities
Recommended
11. Mobile PC includes support for installing the operating system
Required
12. Mobile PC audio meets PC 98 audio requirements
Recommended

13. Mobile PC includes communications device
Recommended
14. Built-in display adapter meets PC 98 minimum requirements
Required
15. Mobile system supports hot pluggable devices and alternative server connections
Recommended
16. Mobile PC/docking station combination meets PC 98 requirements
Required
17. Docking station meets all Basic PC 98 requirements
Required
18. Docking station interface is supported using ACPI-defined mechanisms
Required
19. Mobile PC/docking station combination supports automatic resource assignment and dynamic disable capabilities
Required
20. Docking station supports warm docking
Required
21. Docking system supports fail-safe docking
Required
22. Port replicator supports automatic resource assignment and dynamic disable capabilities for replacement devices
Required
23. Port replicator supports warm docking
Required
24. Mini-notebook performance meets PC 98 minimum requirements
Required