Chapter 5 Mobile

> **IMPORTANT:** The requirements in this guide provide instructions for designing PC systems that will result in an optimal user experience with typical Windows-based applications running under either the Microsoft Windows Millennium Edition or Windows 2000 Professional or later operating systems. These design requirements are not the basic system requirements for running any version of Windows operating systems.

This chapter provides a summary of the PC 2001 requirements for mobile PCs, docking stations, and mini-docks. Mobile PC systems have trade-offs in thermal design, portability, battery run-time and battery life, size, weight, and connectivity that differ from the trade-offs made for desktop or workstation systems.

Unless a specific requirement or exception is defined in this chapter, all requirements apply for mobile PCs as defined elsewhere in this guide. If there is a conflict with requirements made elsewhere in this guide, the items in this chapter have precedence for mobile PCs.

Information on PC Card and CardBus requirements is listed in "Mobile References."

Mobile PC System Design Requirements

This section summarizes the additional design requirements and exceptions for mobile PCs.

MOBL–0061. Mobile PC performance meets Mobile PC 2001 minimum requirements

Minimum mobile PC 2001 performance requirements are:

- **MOBL–0061.1. Minimum 400 MHz processor**
- **MOBL–0061.2. Minimum 128 KB of cache, present and enabled**
- **MOBL–0061.3. 64 MB of RAM, minimum**

Note: The processor requirement does not specify a particular processor form factor or package type.

MOBL–0062. Mobile PC supports Smart Battery or ACPI Control Method battery

A mobile PC must use a Smart Battery or an ACPI control method battery as follows.

- **MOBL–0062.1. If implemented, Smart Battery meets PC 2001 requirements.** If Smart Battery is implemented, the following requirements apply:
  - An ACPI embedded controller-based (EC) System Management Bus (SMBus) interface is required, as described in Section 13 of ACPI 1.0b.
  - The Smart Battery must support the complete command set and meet the accuracy requirements defined in *Smart Battery Data Specification*, *Revision 1.1.*
  - A Smart Battery Charger, if used, must comply with the command requirements defined in *Smart Battery Charger Specification, Revision 1.1*.
  - Single battery system must comply with the intent of the *Smart Battery System Manager Specification, Revision 1.0,* and expose emulated Smart Battery System Manager registers to the operating system.
  - A multiple-battery system may use either a Smart Battery System Manager that complies with the *Smart Battery System Manager Specification, Revision 1.0,* or it may emulate the functionality of the Smart Battery System Manager. The battery selection or alternate control scheme must comply with the intent of the *Smart Battery System Manager Specification.* In either case, the multiple battery system must expose actual or emulated Smart Battery System Manager registers to the operating system.
  - Battery systems that support battery calibration must use the Smart Battery System Manager optional calibrate support bits in the BatterySystemStateCont register.

The intent is that battery systems returning Smart Battery system data by way of the EC SMBus interface as defined in the ACPI 1.0b specification do so in a manner consistent with the Smart Battery system specifications. They must return all battery data, the charger status, and all selector or system manager registers in a manner transparent to the operating system, allowing the standard Smart Battery system drivers provided with the operating system to work properly.

- **MOBL–0062.2. If implemented, ACPI Control Method Battery meets PC 2001 requirements.** If an ACPI Control Method Battery is implemented, it must meet the requirements defined in Section 11 of ACPI 1.0b and never over-report its capacity.

MOBL–0063. Mobile PC includes at least one USB port

At least one USB port must be built into a mobile PC and not be provided solely by a docked mobile PC. Docked mobile PCs, however, provide extra USB

connectors. This USB port can be either a high-power or low-power port, or it can be dynamically configurable at the discretion of the OEM, as provided for by Section 7 of the *Universal Serial Bus Specification, Revision 1.1*.

For additional information about USB ports and devices, see "USB" in Chapter 6.

MOBL–0064. If implemented, Mobile PC includes compliant IEEE 1394

The IEEE 1394 implementation must meet the IEEE 1394 device requirements found in Chapter 6, "Buses and Interfaces." If externally accessible sockets are provided, at least one IEEE 1394 supported socket must be provided.

MOBL–0065. Mobile PC includes CardBus

At least one 32-bit Type-2 CardBus slot (not 16-bit) is required. All CardBus implementations must comply with the requirements defined in Chapter 6, "Buses and Interfaces," including information about the default initialization of the CardBus controller under both Windows Me and Windows 2000 operating systems.

Information on PC Card and CardBus requirements is listed in "Mobile References."

MOBL–0066. Mobile PC keyboard and pointing device meet PC 2001 Mobile requirements

A mobile PC 2001 system must have an integrated pointing device and integrated input devices (keyboard or speech I/O).

The internal keyboard and any built-in pointing devices, such a mouse, stylus, pen, touch pad, touch screen, trackball, stick, and so on, required for a mobile PC must use standard system-board devices. The USB port can be used to support the requirement for external pointing device and keyboard connections.

For more information, see Chapter 7, "Input Devices," which also provides information about implementing the Windows and Application logo keys on mobile PCs.

MOBL–0069. Mobile PC meets PC 2001 Mobile graphics and video requirements

A mobile PC must meet the guidelines in Chapter 8, "Graphics Adapters," in addition to the guidelines listed below:

- **MOBL–0069.1. Mobile PC has integrated display.**
- **MOBL–0069.2. Mobile PC provides PC 2001 Mobile graphics capabilities.** Mobile PC meets all graphics requirements.

- **MOBL–0069.3. If implemented, external video connector meets mobile PC requirements.** Mobile PCs are not required to include an external video connector. If an analog video connector is implemented, it can be either a VGA connector or DVI connector. If a digital monitor interface is implemented, a DVI connector is required.
- **MOBL–0069.4. If implemented, TV output meets mobile PC requirements.** Mobile PCs are not required to include an external TV output.

MOBL–0070. Mobile PC includes PC 2001 hard disk as primary boot device

Mobile PC must include a PC 2001 hard disk as its primary boot device. The drive must meet the requirements in Chapter 12, "Storage."

MOBL–0071. Communications capabilities meet Mobile PC 2001 requirements

The presence of a CardBus slot on the mobile PC meets the PC 2001 requirement for providing access to the LAN and WAN, with the following exceptions:

- If modem capabilities are integrated in the base platform, the requirements for modems must be met as defined in Chapter 13, "Modems."
- For a network adapter, support is optional, rather than required, for remote new system setup capabilities. All other requirements for network communications must be met as defined in Chapter 14, "Network Communications."
- Support for remote wakeup is not required to be built into mobile PCs.

MOBL–0072. If implemented, CD or DVD drive meets PC 2001 requirements

If a mobile PC includes a CD or DVD drive, it must meet the requirements in Chapter 12, "Storage." The mobile PC must also support booting from the drive, whether it is integrated into the platform, contained in a user exchangeable bay device, or attached to the system by a dongle or other cable.

A mobile PC system, as purchased, might not include all peripherals required for operating system installation. This basic PC 2001 requirement is met as long as it is possible for the user to obtain the required device support for operating system installation, even if it requires a separate purchase.

Port Replicator and Docking Station Requirements

Docking stations and port replicators are expansion devices that physically mate to the mobile PC and provide cable management. Docking stations include feature enhancements such as PCI slots, network adapters, PC Card slots, and storage devices.

Expansion devices that connect to the mobile PC by a cable and use buses such as serialized PCI, USB, IEEE 1394 or a wireless connection, must meet their respective industry standards and requirements as specified in the appropriate bus and device chapters in this guide.

The requirements in this section apply for mobile PC that supports a docking system or port replicator. A mobile PC is not required to have a docking system.

For all port replicator implementations, the appropriate requirements in the bus chapter apply unless specific exceptions or additional requirements are listed in this section.

Port Replicator Definition

For the purposes of these requirements, a port replicator is an acceptable method for adding the following functionality to a mobile PC.

- Cable management by passing through the following connectors and buses. All the following pass-through connections must be compliant with their respective requirements, specifications, and standards:

  Any bus used exclusively for manageability

  Audio, including line-in, line-out, microphone, and headphone

  Floppy drive

  Game port

  IEEE 1394 PHY (see note)

  LAN

  MIDI port

  Modem

  Parallel or LPT port

  PS/2 port

  Serial port

  USB connector: pass-through connector is allowed to be low power

  Video

> **Note:** The IEEE 1394 socket available in the port replicator must meet the requirements for externally accessible IEEE 1394 sockets according to 1394–0093, "If the IEEE 1394 implementation provides external connectivity, system must use only sockets specified by IEEE 1394-1995 and its amendments" in Chapter 6.

- USB hub

  USB hub is compliant with requirements listed in Chapter 6, "Buses and Interfaces."

- Power supply (if needed)

Docking Station Requirements

This section describes the requirements for docking stations or docked mobile PCs.

For the purposes of these requirements, a docking station includes the functionality of a port replicator along with additional expansion in the form of enumerable devices or slots and connects to the mobile PC's PCI bus.

MOBL–0073. Docked mobile PC has the ability to identify the specific model of the dock and to uniquely identify the dock itself

Upon attachment to a docking station, the mobile PC must provide the operating system with the dock's model number and a unique ID for the dock using the _UID or _BDN ACPI methods. The system vendor may choose the format of the model number and unique dock ID as well as the mechanism for storing and retrieving the data.

For more information on the _UID and _BDN methods, refer to section 6.1.6 of ACPI 1.0b.

MOBL–0074. Docked mobile PC combination meets PC 2001 Mobile requirements

If a mobile PC is shipped with a PC 2001 docking station, the docked mobile PC must meet PC 2001 Mobile requirements.

MOBL–0075. Docking station includes driver support

Drivers for devices in a dock must fully support dynamic loading and unloading, power management, and Plug and Play event messages.

MOBL–0076. Docked mobile PC meets PC 2001 BIOS requirements

The docked mobile PC must meet the PC 2001 BIOS requirement for multiple adapters and multiple monitors. This provides fully operational graphics

capabilities in the mobile PC (either the LCD panel or external connector) in the event that a user adds another graphics adapter to the docking station. For more information, see GRPH–0199, "Onboard graphics devices can be used as a system boot device," in Chapter 8.

MOBL–0077. Pre–PC 2001 docking station requirements

PC 2001 mobile PCs with docking station support do not require new docking station designs. A PC 2001 mobile PC combined with a pre–PC 2001 docking station must meet the following requirements:

- The user cannot experience resource conflicts.
- All drivers for earlier docking stations must be made available as necessary to support the preinstalled operating system. OEMs can determine how to distribute these drivers, including methods such as an OEM Web site or the Windows update Web site.

  This requirement applies only to drivers for devices that were offered as part of the OEM-supplied configuration; it does not apply to devices added to the docking station by systems integrators or end users.

For example, in order for pre–PC 2001 docking stations to work properly with a PC 2001 mobile PC running Windows 2000, all drivers must be updated to support dynamic loading, Plug and Play, and power management messages. This requirement does not imply that new features must be added, but rather that the docked mobile PC and operating system must have full control over the features in the docking station.

MOBL–0078. Mobile/docking station interface uses ACPI-defined mechanisms

The docked mobile PC must enumerate, configure, and disable non-Plug and Play devices using ACPI-based methods, and implement all notification events and docking control as follows.

The mobile PC's ACPI BIOS must contain at least the following docking-related functions:

- DCK_CAP must be set to 1 in the FADT table.
- _Lxx methods must handle the dock insertion event and the Fail Safe Ejection notification. The _Lxx method must include a Notify to the dock object.
- ACPI descriptions for ports located on the mobile PC and passed through the docking connector must include an _EJD method.
- The _WAK method must perform a Notify to the dock object.

A dock object must be specified and must have a device named to represent the docking station, including:

- _UID method for presenting the dock's model number and unique ID to the operating system.
- Optional _BDN method for using the Plug and Play BIOS for dock model number and _UID.
- _DCK method connecting and disconnecting the docking bus.
- _STA method for checking the status of the dock.
- _EJx methods to identify which sleep states docking can occur. If hot docking is implemented, the _EJ0 control method must not return until the ejection is complete, as stated in ACPI 1.0b section 6.3.2.

For additional information on ACPI docking implementation, refer to ACPI 1.0b and "ACPI Docking for Windows 2000," listed in "Mobile References."

Removable ATA devices in the docking station and in the mobile PC are required to report changes using ACPI-based methods.

Note: Under Windows 2000, drive letter assignments do not change when drives are added or removed by way of a docking event. That is, all drives in the mobile PC retain their originally assigned drive letters. Note this difference from Windows Me.

MOBL–0079. Docking station supports warm docking

Attaching or ejecting a mobile PC from a docking station must not require powering off the system and must not require a system reboot.

The mobile PC's ACPI BIOS must contain one or more _EJx methods to inform the operating system of which sleep states are supported for docking operations.

For more information on the _EJx methods for Windows 2000, refer to Section 6.3.2.I of ACPI 1.0b and to "ACPI Docking for Windows 2000," listed in "Mobile References."

MOBL–0080. Docking system supports fail-safe docking

The system must provide a mechanism for notifying the operating system before undocking a mobile PC. The mechanism, in combination with operating system capabilities and methods defined in Sections 5 and 6 of ACPI 1.0b, must perform the following:

- The user can initiate undocking through Windows-based software choices and through an eject notification button on the docking station or the mobile PC.

- The eject notification button or software choice sends a signal to the operating system so that the user is warned if the system is in danger of losing resources or data.

- A safe-to-undock indicator is provided so the user knows when it is safe to remove the mobile PC. This indicator can be an LED or any other mechanism chosen by the vendor. If a physical mechanism automatically undocks the mobile PC, the safe-to-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.

Mobile References

Following are the references, services, and tools cited in this chapter that are available to help build hardware that works optimally with Windows operating systems.

"ACPI Docking for Windows 2000"

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

Advanced Configuration and Power Interface Specification, Revision 1.0b
> (ACPI 1.0b)

> http://www.teleport.com/~acpi/spec.htm

PC Card and CardBus Guidelines, Version 1.1

> http://www.pcdesguide.org/library/pccard.htm

Smart Battery Charger Specification, Revision 1.1
Smart Battery Data Specification, Revision 1.1
Smart Battery System Manager Specification, Revision 1.0

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

Universal Serial Bus Specification, Revision 1.1

> http://www.usb.org/developers/docs.html

Checklist for Mobile

MOBL–0061. Mobile PC performance meets Mobile PC 2001 minimum requirements

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MOBL–0066. Mobile PC keyboard and pointing device meet PC 2001 Mobile requirements

MOBL–0069. Mobile PC meets PC 2001 Mobile graphics and video requirements

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MOBL–0072. If implemented, CD or DVD drive meets PC 2001 requirements

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MOBL–0077. Pre–PC 2001 docking station requirements

MOBL–0078. Mobile/docking station interface uses ACPI-defined mechanisms

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MOBL–0080. Docking system supports fail-safe docking