



220-801  
220-802  
Third Edition

Quick Reference

# **CompTIA® A+ Quick Reference (220-801 and 220-802)**

**Mark Edward Soper**

**PEARSON**

800 East 96th Street  
Indianapolis, Indiana 46240 USA

## **CompTIA® A+ Quick Reference (220-801 and 220-802)**

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## About the Author

**Mark Edward Soper** has been working with PCs since the days of the IBM PC/XT and AT as a salesperson, technology advisor, consultant, experimenter, and technology writer and content creator. Since 1992, he has taught thousands of students across the country how to repair, manage, and troubleshoot the hardware, software, operating systems, and firmware inside their PCs. He has created many versions of his experimental computer known as “FrankenPC” for this and previous books. Mark earned his CompTIA A+ Certification in 1999 and has written four other A+ Certification books covering previous and current versions of the A+ Certification exams for Pearson imprints.

Mark has contributed to many editions of *Upgrading and Repairing PCs*, working on the 11th through 18th and 20th editions; co-authored *Upgrading and Repairing Networks*, Fifth Edition; and has written two books about digital photography, *Easy Digital Cameras* and *The Shot Doctor: The Amateur’s Guide to Taking Great Digital Photos*.

In addition, Mark has contributed to Que’s Special Edition *Using* series on Windows Me, Windows XP, and Windows Vista and to Que’s *Windows 7 In Depth*. He has also contributed to *Easy Windows Vista* and has written two books about Windows Vista: *Maximum PC Microsoft Windows Vista Exposed* and *Unleashing Microsoft Windows Vista Media Center*. Mark has also written two books about Windows 7: *Easy Microsoft Windows 7* and *Sams Teach Yourself Microsoft Windows 7 in 10 Minutes*. Mark has also created a number of hardware tutorial videos available from the OnGadgets&Hardware podcast channel at [www.quepublishing.com](http://www.quepublishing.com).

Mark has also written many blog entries and articles for [MaximumPC.com](http://MaximumPC.com) and *Maximum PC* magazine. He has taught A+ Certification and other technology-related subjects at Ivy Tech Community College in Evansville, Indiana.

# Dedication

*In memory of Mark Reddin: 1969-2012. Thanks very much for your work and your life.*

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First of all, I thank God for the opportunity to work in a field I love and for His encouragement over the years to arrive at this point in my career.

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# Introduction

This quick reference is a late-stage, exam-prep resource designed for use as a review shortly before your scheduled CompTIA A+ exams. It is not intended to be a comprehensive curriculum.

If you are using this resource, you should have already learned the material through a class or formal study method. This *CompTIA A+ Quick Reference* provides brief, straightforward explanations on major topics of the two CompTIA A+ exams: the 220-801 exam and the 220-802 exam.

Chapters 1 through 5 cover the five domains included on the 220-801 exam: Chapter 1, “Hardware,” is 40% of the exam. Chapter 2, “Networking,” is 27% of the exam. Chapter 3, “Laptops,” is 11% of the exam. Chapter 4, “Printers,” is 11% of the exam. Chapter 5, “Operational Procedures,” is 11% of the exam.

Chapters 6 through 9 cover the four domains included on the 220-802 exam: Chapter 6, “Operating Systems,” is 33% of the exam. Chapter 7, “Security,” is 22% of the exam. Chapter 8, “Mobile Devices,” is 9% of the exam. The final chapter, Chapter 9, “Troubleshooting,” is 36% of the exam.

As you prepare for the exam, use this *Quick Reference* as an overall review of the exam topics. Each objective is discussed in this text. If you need more in-depth information about a topic, be sure to refer to your original study material.



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## Laptops

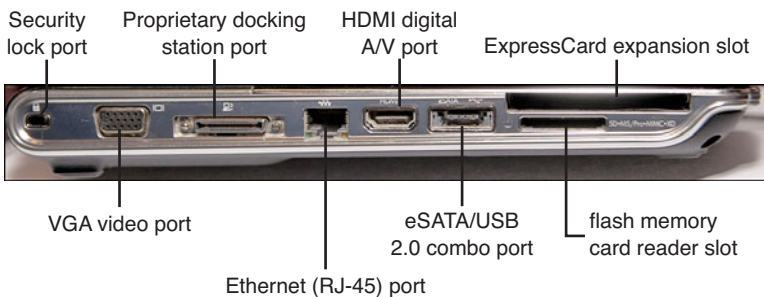
Laptops is one of nine domains in the 2012 CompTIA A+ exams. Laptops accounts for 11% of the 220-801 exam. This domain focuses on the unique features of laptop hardware.

## Install and Configure Laptop Hardware and Components

This section reviews expansion options for laptops as well as hardware and device replacement.

### Expansion Options

The major expansion options available on any kind of laptop include ExpressCard and PCMCIA (PC Card, CardBus) slots, SODIMM memory modules, USB drives, and flash memory devices. Figure 3-1 illustrates these ports as well as a proprietary port for a docking station on a typical laptop.



**Figure 3-1** Expansion, security, video ports on a typical laptop.

### ExpressCard

ExpressCard (a.k.a. Express Card) is the principle high-speed expansion slot on most late-model laptops. It connects via the PCIe (PCI Express) bus. ExpressCard /34 and /54 are used for adding high-speed ports and devices (FireWire, USB 3.0, eSATA, Gigabit Ethernet, TV tuners). ExpressCard is up to 2.5× faster than CardBus.

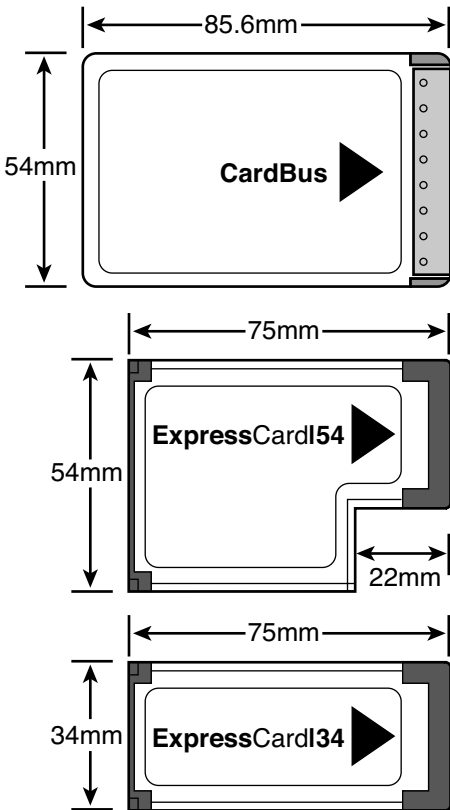
### PCMCIA Card

PCMCIA cards fall into two categories: PC Card (16-bit) and CardBus (32-bit). These cards are the expansion buses used on older laptops. Laptops with CardBus slots can also accept PC Cards. These

cards were used to add USB and FireWire ports, Wi-Fi wireless networking, Fast Ethernet networking, and dial-up analog modems. Many PC Card and CardBus Type II cards used dongles (proprietary removable cable adapters) to connect to standard telephone, network, or other types of cables.

The most common thickness for PCMCIA cards is Type II. Thinner Type I cards were used primarily for additional RAM, and thicker Type III was used mainly for hard disks.

Figure 3-2 compares ExpressCards and CardBus cards to each other. A PC Card looks like a CardBus card, but doesn't have a gold connector.



**Figure 3-2** Visual comparison of CardBus, ExpressCard /54, and ExpressCard /34 cards.

## SODIMM Memory Modules

Small outline DIMMs (SODIMMs) are used to expand memory in laptops. Laptops typically have two SODIMM slots, and recent laptops include DDR2 or DDR3 DIMMS (see Figure 3-3).

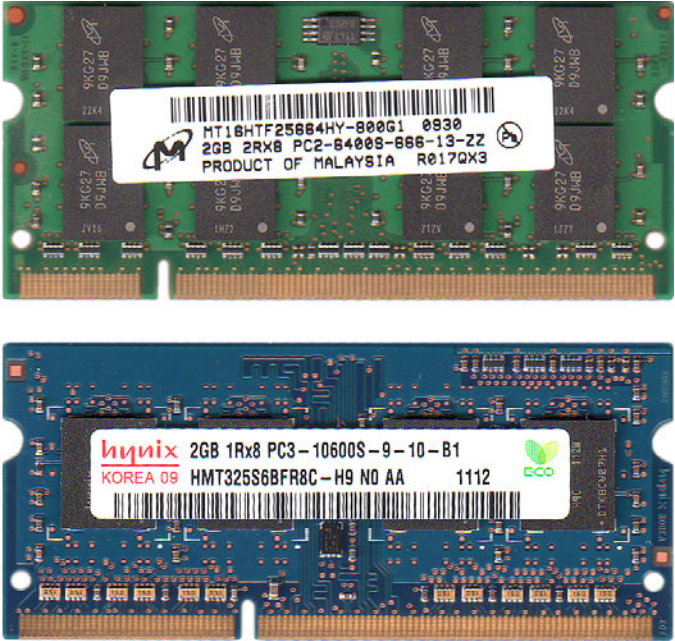


Figure 3-3 A DDR2 SODIMM (top) compared to a DDR3 SODIMM (bottom).

### USB Drives

USB flash memory drives connect without difficulty to virtually any laptop’s USB 2.0 or USB 3.0 ports. However, some portable USB hard disks might require more power than a laptop’s USB 2.0 or USB 3.0 port can provide. Use a Y-cable to draw power from a second port as needed (see Figure 3-4).

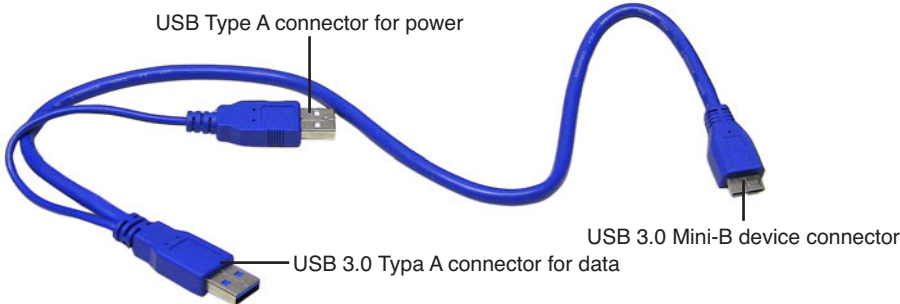


Figure 3-4 A USB 3.0 y-cable that provides extra power for a USB 3.0 portable hard disk.

## Flash Memory Modules

Typical laptops include a flash memory card reader for SD (Secure Digital) and SDHC (SD High Capacity) cards. Most also support Sony Memory Stick/Pro and Olympus/Fujifilm xD-Picture Card. Refer back to Figure 3-1 for a typical example.

## Hardware Device Replacement

As a computer technician, you might be called on to replace a number of components in a laptop. Some, such as memory, hard disks, and optical drives, require little disassembly; whereas others, such as the keyboard, CPU, and LCD display, might require more extensive disassembly processes.

The following sections provide general guidance. For details, consult the service manual for the particular laptop you need to repair.

## Battery Removal and Replacement

Remove the battery and AC power source before performing any other component replacements, as follows:

1. Turn off the computer.
2. Disconnect the AC adapter or line cord from the computer.
3. Open the battery compartment in the unit; it might be secured by a sliding lock or by screws.
4. If the battery is under a removable cover, remove the battery compartment cover.
5. Open the lock that holds the battery in place.
6. Slide out or lift out the battery (see Figure 3-5). If the battery is a flat assembly, it might be held in place by a clip; push the clip to one side to release the battery.
7. Examine the battery contacts inside the computer for dirt or corrosion, and clean dirty contacts with a soft cloth.

To replace the battery, follow these steps:

1. Examine the battery contacts inside the computer for dirt or corrosion, and clean dirty contacts with a soft cloth.
2. Examine the battery's own contacts for dirt or corrosion, and clean dirty contacts with a soft cloth.
3. Line up the guides on the side of the battery with the corresponding holes in the battery compartment and swing the battery into place.
4. If the battery is under a removable cover, replace the cover.
5. Reconnect the AC adapter or line cord.



1. Releasing the battery catch
2. Rotating the battery up and out of the battery compartment

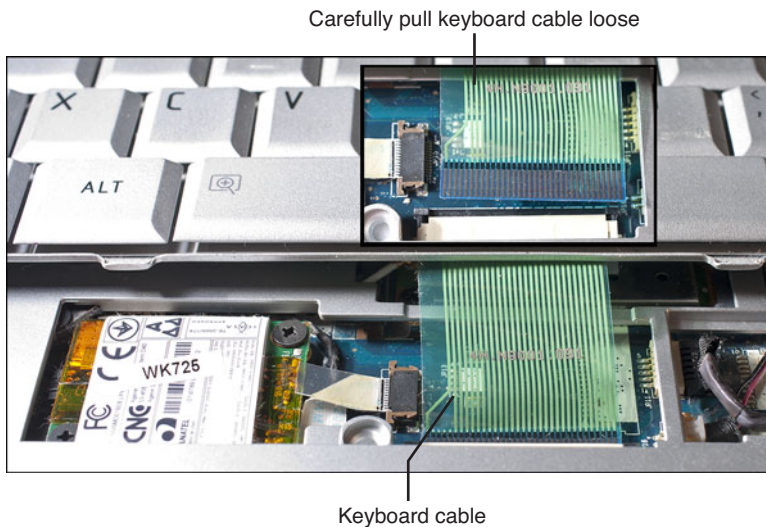
**Figure 3-5** Removing a battery from a typical laptop computer.

## Keyboard Replacement

Follow these steps to replace the keyboard:

1. Position the laptop so the bottom of the unit is facing upwards.
2. Remove the screws that hold the keyboard in place.
3. Turn over the laptop.
4. Open the screen so the keyboard is visible.
5. If necessary, remove the bezel that holds the keyboard in place.
6. Lift up the keyboard to expose the keyboard cable.
7. Remove any hold-down devices used to hold the keyboard cable in place.
8. Disconnect the keyboard cable from the system board (Figure 3-6).
9. Remove the keyboard.

To install the replacement, reverse these steps.



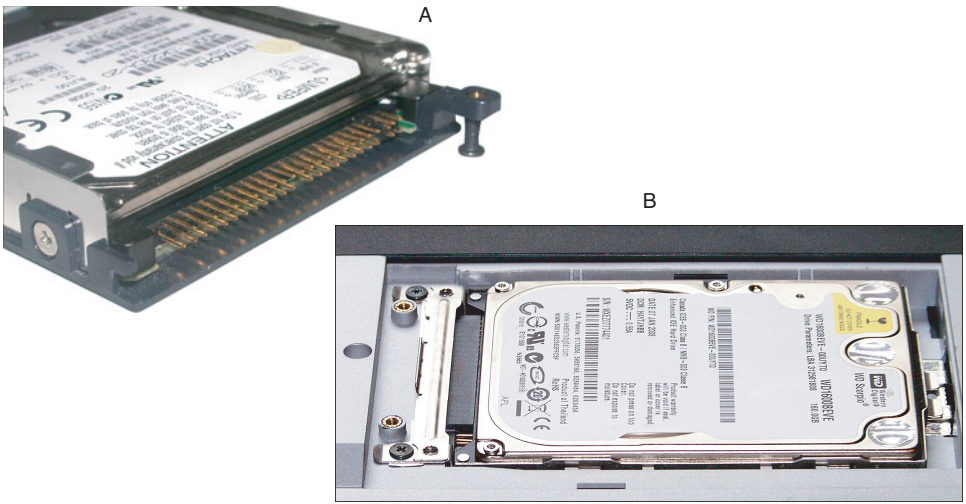
**Figure 3-6** Removing the keyboard cable.

## Hard Drive or SSD

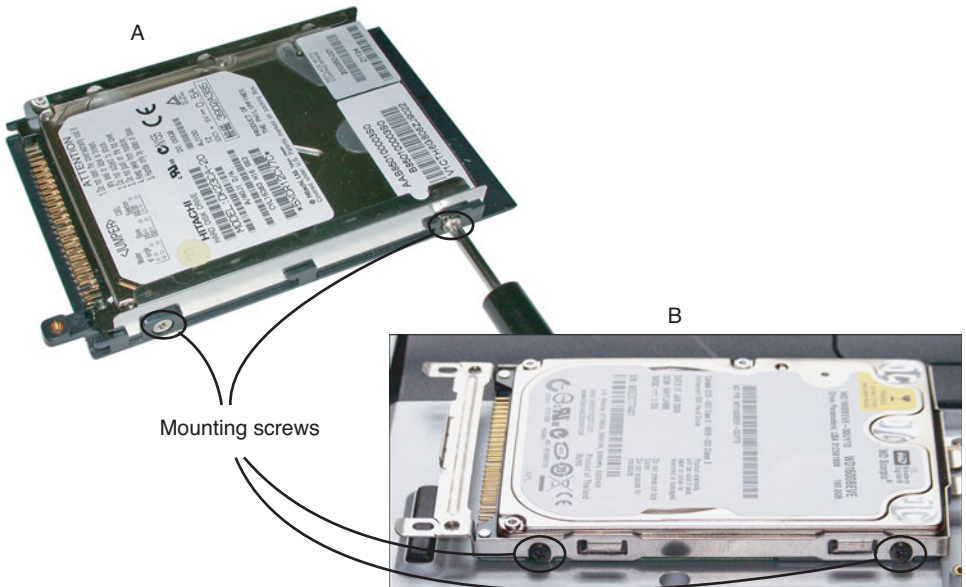
Follow this procedure to remove and replace a 2.5-inch hard disk or solid-state disk (SSD) accessible from the bottom of the laptop (3.5-inch hard disks are used by desktop computers):

1. After disconnecting power sources, turn over the laptop so that the bottom of the laptop faces upward.
2. Loosen or remove the screw or screws used to hold the drive cover in place.
3. Slide the cover away from the retaining lug or clips and remove it. On some systems, the drive might be mounted to the cover (see Figure 3-7a). On other systems, the drive is mounted to the chassis (see Figure 3-7b).
4. If the drive is fastened to the chassis, as in Figure 3-7b, remove the screws holding the drive to the chassis.
5. Slide the drive away from the retaining screw holes and lift it out of the chassis.
6. Remove the screws fastening the drive to the drive cover or frame (see Figure 3-8).
7. Remove the drive from the drive cover or frame.
8. Insert the new hard disk into the drive cover or frame.

Reverse these steps to install the new hard disk. Older systems use a 44-pin portable version of the PATA interface; newer systems use the SATA interface.



**Figure 3-7** A laptop hard disk that fastens to the cover (a) compared to one that fastens to a separate frame inside the chassis (b).



**Figure 3-8** Removing the hard disk mounting screws from the cover (a) or the frame (b).

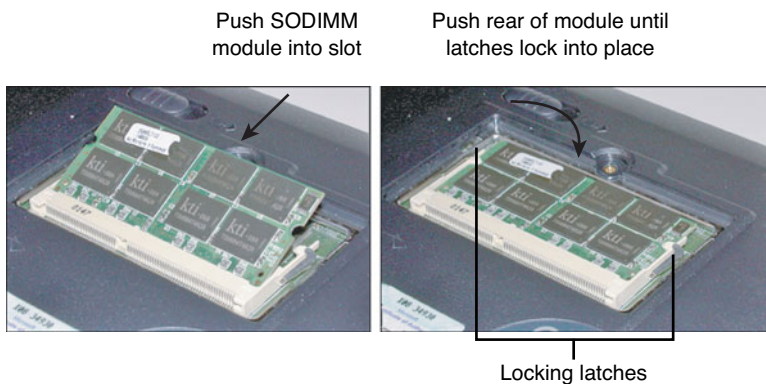
After the system is restarted, enter the BIOS setup program to verify that the new hard disk has been properly recognized by the system.



## Memory

Because most laptops have only two SODIMM memory sockets, it is often necessary to remove one or both memory modules before upgrading to a larger amount of RAM. Here's how to remove and replace SODIMMs:

1. After disconnecting all power sources, remove the cover over the memory upgrade socket on the bottom of the system.
2. Remove any screws or hold-down devices.
3. Remove the old SODIMM memory modules if necessary. To remove a memory module, pull back the clips on both sides and swing the memory up and out.
4. Insert the new memory upgrade, making sure the contacts (on the back side or edge of the module) make a firm connection with the connector.
5. Push the top of the module down until the latches lock into place (see Figure 3-9). Repeat Steps 4 and 5 for each module you install.



**Figure 3-9** Installing an SODIMM module on a typical portable computer.

6. If the memory socket uses screws to secure the memory in place, install them.
7. Close the cover and secure it to complete the upgrade.

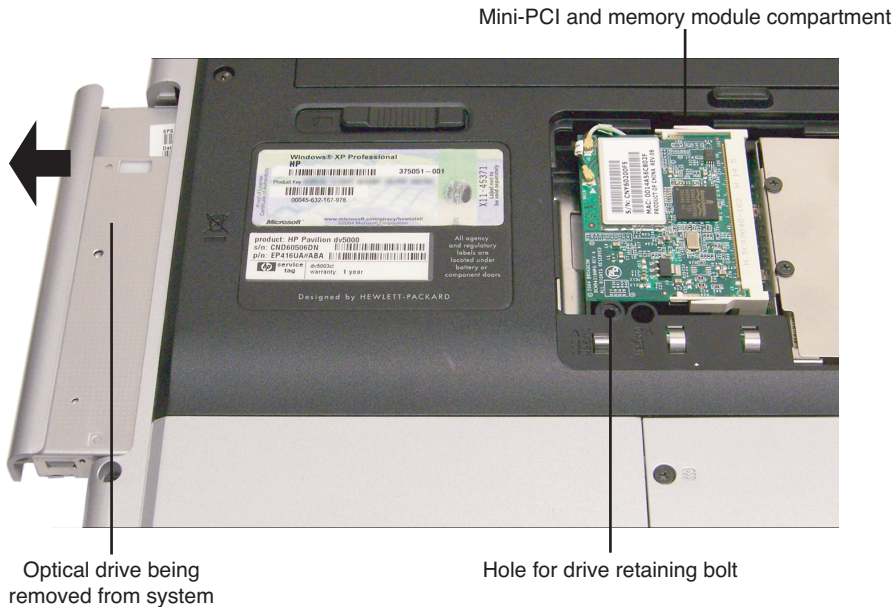
## Optical Drive

If you need to upgrade to an optical drive with more capabilities or you need to replace a defective optical drive, follow this basic procedure:

1. After disconnecting all power sources, turn the laptop over so that the bottom faces upward.
2. Locate the latch that holds the drive in place, or locate the mounting screw that holds the drive in place and unscrew it. It might be located inside the access panel for another component, such as the mini-PCI board or memory modules.

3. Slide open the latch or remove the mounting screw.
4. Slide the drive out of the system. See Figure 3-10 for a typical example.

To reinstall the drive, reverse the preceding steps.



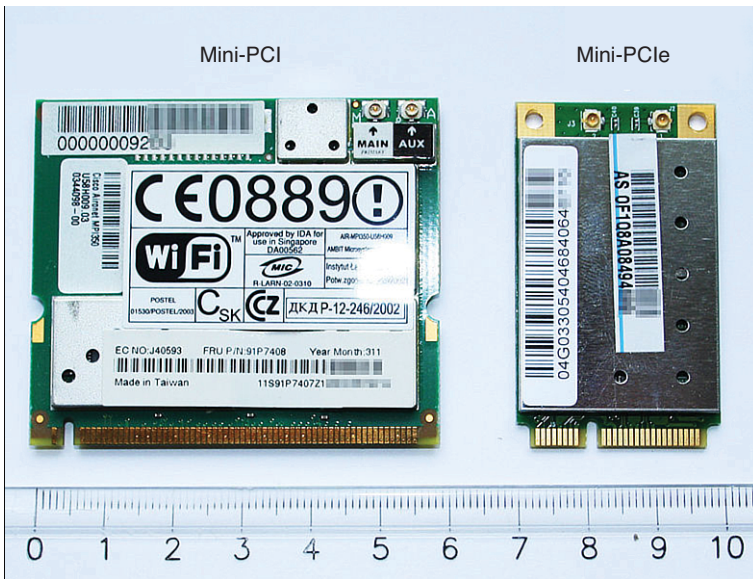
**Figure 3-10** Removing an optical drive from a typical laptop.

## Wireless Card or Mini-PCIe

Most wireless cards use the mini-PCI or newer mini-PCIe form factor shown in Figure 3-11. If the card is damaged or needs to be upgraded, follow this procedure.

To remove a mini-PCI or mini-PCIe card, follow this basic procedure:

1. Verify the location of the card. Some laptops have the card under the keyboard; others have the card located under a removable cover on the bottom of the computer.
2. After disconnecting all power sources, place the computer appropriately for access to the card.
- 3a. If the card is located under the keyboard, remove the keyboard bezel and remove the keyboard.
- 3b. If the card is located under an access panel, remove the screws holding the access panel in place.
4. Disconnect any wires connected to the adapter. They might be screwed into place or snapped into place. Note their position.
5. Push the card out of the connector and remove it from the system.



**Figure 3-11** A typical mini-PCI Type III modem (left) compared to a typical Mini-PCIe card (right). Image source: Wikimedia Commons.

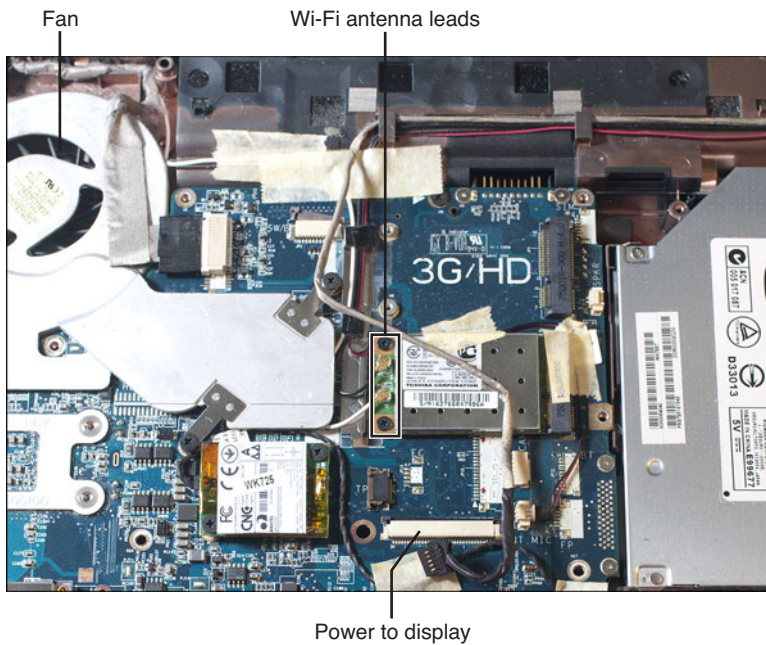
To reinstall the card or replace it with a different card, reverse these steps.

## Screen

The LCD display is the single most expensive component and also one of the easiest to break. Here's how to remove it:

1. After removing power from the system, if the system has an integrated Wi-Fi (wireless Ethernet adapter), disconnect the antenna leads attached to the adapter (usually a mini-PCIe or mini-PCI card).
2. Remove the keyboard frame and keyboard.
3. Disconnect the FPC cable (display cable) from the system board; this cable transmits power and data to the LCD display assembly (see Figure 3-12).
4. If the system has integrated Wi-Fi, remove the antenna leads from the clips in the top cover.
5. Rotate the display assembly to a 90-degree angle to the base unit.
6. Remove the screws that secure the display assembly.
7. Pull the display assembly free from the base unit.

To replace the display, reverse the preceding steps.



**Figure 3-12** Wi-Fi and laptop display power cables must be disconnected during the screen removal process.

## CPU

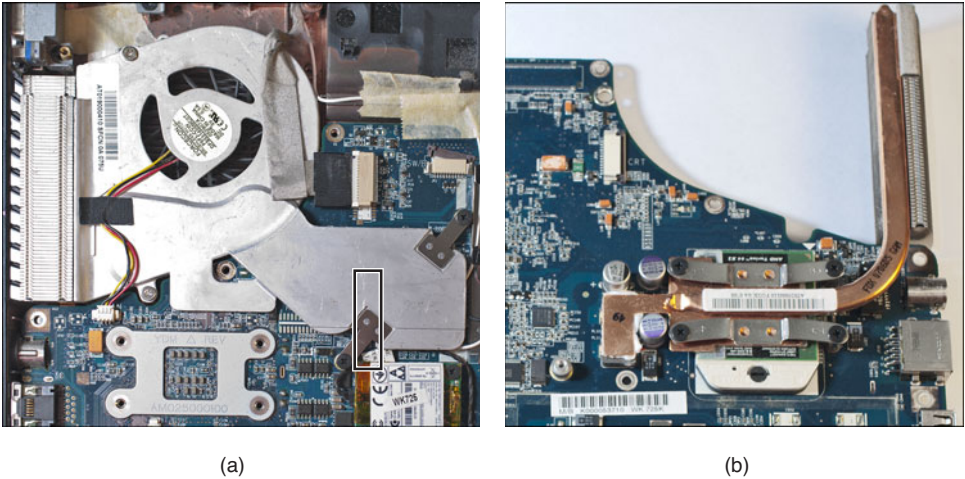
The CPU cannot be replaced without removing the fan and heat sink module. If the fan is separate from the heat sink, follow this procedure:

1. After removing power from the system (including the battery), remove other components as directed. These might include the hard drive, WLAN cover, optical drive, keyboard, keyboard cover, display assembly, and top cover.
2. Depending upon the specific unit, you might need to turn over the system.
3. Remove the screws holding the fan in place.
4. Disconnect the fan's power lead from the motherboard.
5. Lift the fan out of the system. Retain it for reuse.

Laptop heat sinks are typically one-piece or two-piece units that pull heat away from the chipset as well as the processor. Some units incorporate the fan. To remove the heat sink (see Figure 3-13), follow these steps:

1. Remove the screws holding the heat sink in place.
2. If the heat sink incorporates a fan, disconnect the fan power lead from the motherboard.

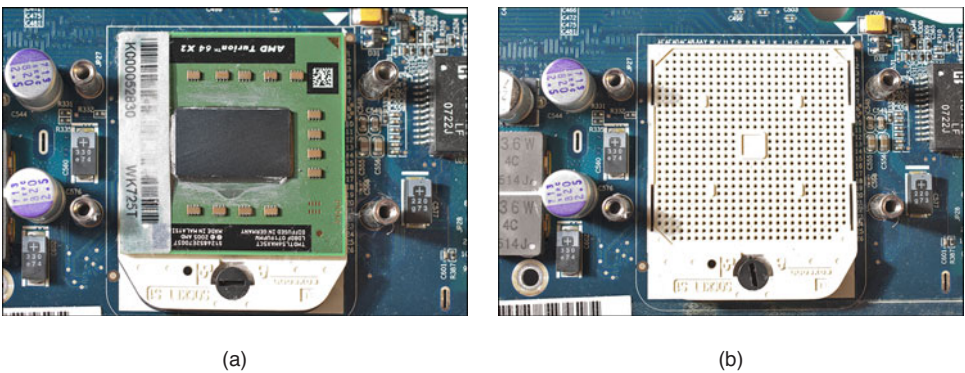
3. Lift up on the heat sink to remove it (move it from side to side if necessary to loosen the thermal material). Retain it for reuse.
4. If some components that use a heat sink are located on the reverse side of the motherboard, turn over the motherboard and repeat steps 1-3. For example, the system shown in Figure 3-13 has a separate heat sink for the graphics chipset (a) and the CPU (b).



**Figure 3-13** Heat sinks for the graphics chipset (a) and CPU (b) on a typical laptop computer.

To remove the CPU, follow these steps:

1. Loosen the processor locking screw. Note the markings on the CPU and the socket. The CPU must be aligned in the same position when installed.
2. Remove the CPU from the socket. Retain it for possible reuse (see Figure 3-14).



**Figure 3-14** A typical laptop processor (a) and its socket (b).

Remove old thermal material from fan or heat sink parts you are reusing. See the instructions with a new CPU for applying thermal material during installation.

## DC Jack

The DC Jack receives DC power from the computer's AC/DC power converter and routes it to the motherboard. It is typically part of a cable assembly that also contains the cable that carries power to the motherboard.

To replace it, follow these steps:

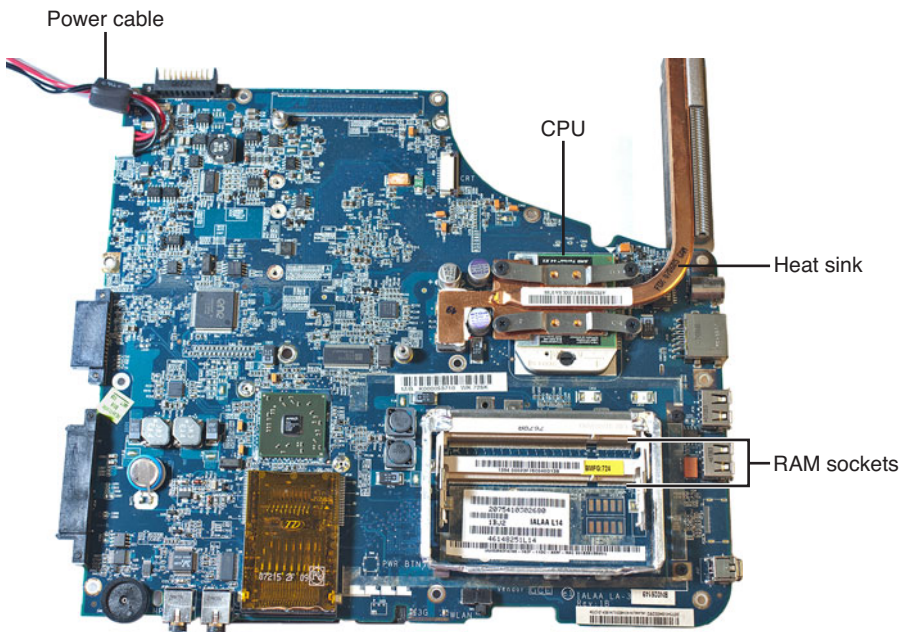
1. After removing power from the system (including the battery), remove other components as directed. These might include the hard disk, WLAN cover, optical drive, keyboard, keyboard cover, display assembly, hinges, and top cover.
2. Unclip the DC jack from the case.
3. Unclip the power cable leading from the DC jack from the case.
4. If the power cable connector is not accessible, remove other components as needed to access it, such as the system board or ExpressCard assembly.
5. If necessary, turn over the system board to access the power connector.
6. Disconnect the power cable connector from the system board.

To install the replacement DC jack, reverse these steps.

## System Board

Accessing the system board (motherboard) requires almost complete disassembly of the computer. Follow this basic procedure:

1. After removing power from the system (including the battery), remove other components as directed. These might include the hard drive, WLAN cover, optical drive, keyboard, keyboard cover, display assembly, hinges, and top cover.
2. Unclip the DC jack from the case.
3. Unclip the power cable leading from the DC jack from the case.
4. If the power cable connector is not accessible, remove other components as needed to access it, such as the system board or ExpressCard assembly.
5. If necessary, turn over the system board to access the power connector (see Figure 3-15).
6. Disconnect the power cable connector from the system board.
7. Remove the old system board.



**Figure 3-15** The underside of a typical laptop motherboard. (Figure 3-12 shows a portion of the top of the same motherboard.)

For reassembly, reverse the preceding steps.

Before reassembling the computer, swap any components on the old system board to the new one. These might include the following:

- CPU and heat sink (Be sure to remove old thermal material and use new thermal material as needed.)
- Fans
- RTC (CMOS) battery
- ExpressCard or PC Card assembly
- Mini-PCI or mini-PCIe module

Other components, such as memory, are reinstalled after the system is reassembled.

## Touch Pad

If you need to replace the touch pad, you need to partially disassemble the portable computer.

1. Check service documents to determine whether the touch pad is a separate component or if it is built in to the top cover. If the touch pad is built in to the top cover, remove the top cover.

2. If the touch pad is a separate component, remove components that block access to the screws that hold the touch pad in place. These might include the hard drive, WLAN cover, optical drive, keyboard, keyboard cover, display assembly, and top cover.
3. Place the system so that the bottom of the system faces up.
4. Disconnect the cable from the pointing devices to the motherboard.
5. Remove the clips or screws holding the touch pad in place.
6. Remove the touch pad assembly.

To replace the touch pad, reverse these steps.

## Plastics

Most of the outer shell of a laptop consists of several plastic subassemblies. However, a typical plastics kit includes the removable covers over components such as the hard drive and memory, and might include items such as the bezel for the optical drive and the rubberized feet for the bottom of the unit.

To replace any of these items, follow these steps:

1. Remove power from the laptop.
2. Turn over the unit.
3. Remove the old component by unscrewing it (covers) or prying it off (bezels or feet).

To replace a component, reverse the previous steps.

## Speaker

To remove speakers, follow this basic procedure:

1. After removing power from the laptop, remove components that block access to the speakers. These might include the hard drive, WLAN cover, optical drive, keyboard, keyboard cover, display assembly, and top cover.
2. If necessary, turn the laptop over.
3. Disconnect the num lock cable or other cables as directed.
4. Remove the screws holding the speakers in place.
5. Lift out the speakers.

To replace the speakers, reverse these steps.



## Laptop Display Components

One of the most important considerations in choosing a laptop is its display. Use the following sections to review the most important features about laptop displays.

### Display Types (LCD, LED, OLED, Plasma)

Most laptops use either LCD (liquid crystal) or LED (light-emitting diode) displays.

A standard LCD display uses a fluorescent backlight, and is often referred to as an LCD-CCFL (cold cathode fluorescent) display.

Many recent systems use LEDs in place of CCFL components for backlighting. These displays are sometimes referred to as LCD-LED displays.

Organic LED (OLED) displays are common in digital cameras and mobile phones, but have been used in only a few prototype laptops so far.

Plasma displays have not been used in laptops for many years because of their high power consumption.

### Other Laptop Display Components

A typical LCD-CCFL laptop display includes an inverter (provides power to the backlight), a backlight, and a Wi-Fi antenna. Figure 3-16 shows the location of the inverter, Wi-Fi antennas and wires, and a webcam in a typical laptop display.

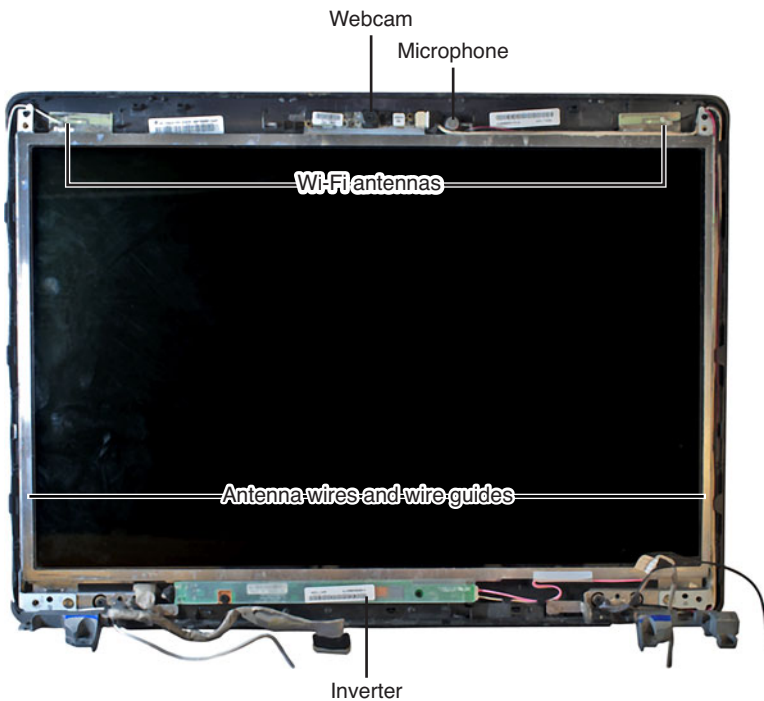
If the inverter fails, there is no power to run the backlight. Inverter failure is the most common cause of LCD display failure. However, inverter replacement is relatively inexpensive, and inverters can be purchased for do-it-yourself (DIY) replacement.

A CCFL backlight failure is much less common than an inverter failure. If the CCFL backlight fails, a complete disassembly of the display down to individual component level is required, or the display assembly should be replaced.

When servicing the inverter on a typical laptop, follow this general procedure:

1. After removing power from the system (including the battery), follow the procedure to remove the screen assembly.
2. Follow the procedure to remove the display panel from the screen assembly.
3. Disconnect the wires from the inverter.
4. Remove any screws or clips used to secure the inverter.
5. Remove the inverter.

To replace the inverter, reverse this process.



**Figure 3-16** Wi-Fi antennas, wires, CCFL inverter, and webcam in a typical LCD-CCFL display.

## Wi-Fi Antenna Components

When servicing the antennas on a typical laptop, follow this general procedure:

1. After removing power from the system (including the battery), turn over the unit and open the cover over the Wi-Fi radio card.
2. Disconnect the wires from the Wi-Fi radio card.
3. Follow the procedure to remove the screen assembly.
4. Follow the procedure to remove the display panel from the screen assembly.
5. Remove the antennas and wires. When reassembling the screen assembly, be sure to replace the wires into the guides located on either side of the display.

## Compare and Contrast Laptop Features

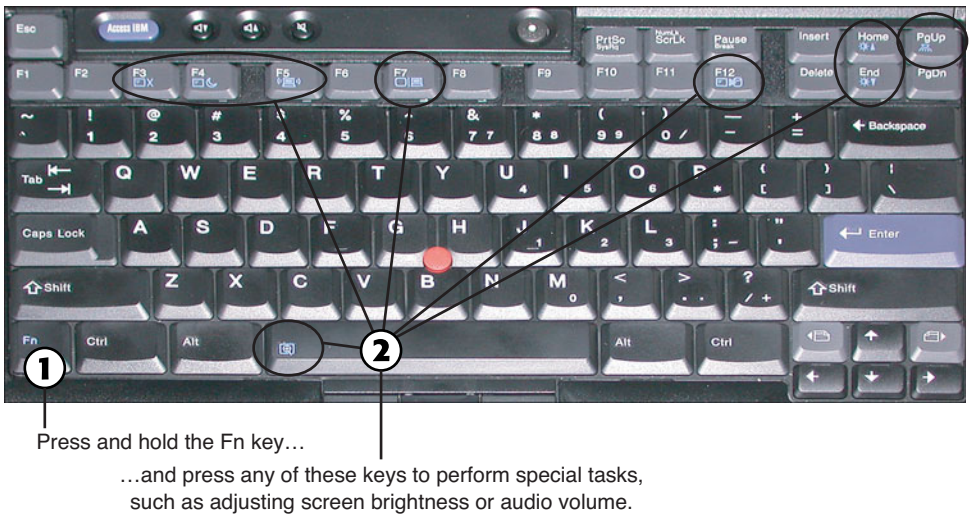
Laptops also use special function (Fn) keys to control various features, might support port replicators or docking stations, and are designed to use cable locks for physical security.

## Special Function (Fn) Keys

Typical Fn+key features include the following:

- Adjust screen brightness/contrast
- Connect to external display
- Enable/disable Bluetooth
- Enable/disable Wi-Fi
- Enable/disable backlit keyboard
- Turn on/turn off embedded keypad

Figure 3-17 shows a typical portable keyboard with the Fn key and some Fn functions highlighted.



**Figure 3-17** A typical laptop keyboard's Fn keys.

---

### Note

There is no standard for Fn key assignments, and available Fn keys on a given laptop depend upon the exact hardware installed.

In addition to Fn keys, some laptops include front-mounted controls for adjusting system volume or enabling/disabling Wi-Fi or Bluetooth. Others include touch-sensitive controls above the keyboard for enabling/disabling Wi-Fi, adjusting audio volume, or muting audio.

---

To connect to an external display, you can also use the Display properties or Personalization properties sheet or, in Windows 7, the Windows Mobility Center. Options include the following:

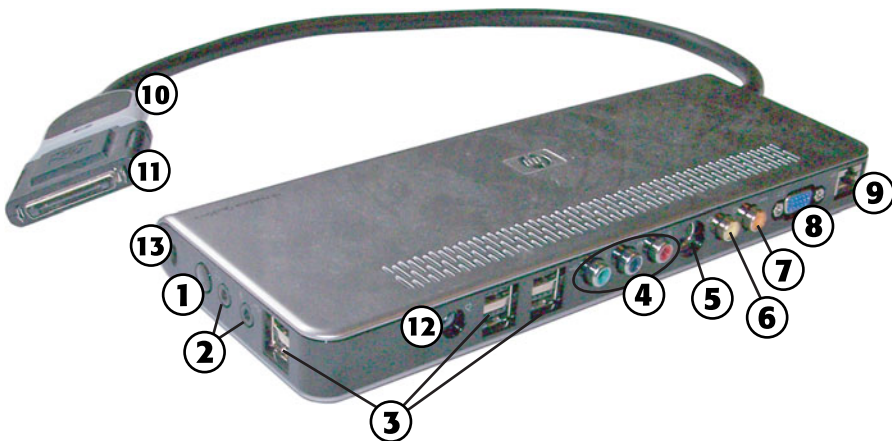
- Clone (mirror)
- Extend desktop

## Docking Station Versus Port Replicator

A docking station expands the capability of a portable computer by adding features such as the following:

- One or more expansion slots
- Additional I/O ports, such as serial, parallel, ExpressCard or PC Card, display output (VGA, DVI, HDMI, component video), SPDIF digital audio, or USB ports
- Additional drive bays
- Power connection for the laptop
- Connectors for a standard keyboard and mouse

Figure 3-18 illustrates the HP QuickDock, which provides additional USB ports, audio ports, and component video ports as well as one-touch power and charging capabilities to supported HP and Compaq laptop computers. It connects to the proprietary connector shown in Figure 3-1.



- |                                     |                         |
|-------------------------------------|-------------------------|
| 1. Power switch                     | 8. VGA port             |
| 2. Audio minijacks                  | 9. 10/100 Ethernet port |
| 3. USB ports (6)                    | 10. Connector to laptop |
| 4. Component video ports for HDTV   | 11. Connector adapter   |
| 5. S-video port                     | 12. Power connector     |
| 6. Composite video port             | 13. Security lock port  |
| 7. SPDIF coaxial digital audio port |                         |

**Figure 3-18** The HP QuickDock docking station supports several series of HP and Compaq laptop computers.

## Physical Laptop Lock and Cable Lock

Laptop locks (see Figure 3-19) use a combination or keyed lock, and are designed to lock the laptop (or other secured device) to a fixed location such as a table.



**Figure 3-19** A combination laptop security lock.

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