

Working with Laptops

In this chapter, you'll learn about many of the common features of laptops. Laptops often have special keys on the keyboard that are used to enable and disable hardware. Their displays are similar to regular monitors, but some have additional hardware not included in other monitors. Some hardware is relatively easy to install and replace, but other components can be quite challenging, especially if you don't follow some basic processes for disassembling the laptops. You'll also learn about methods used to conserve power on these systems and some key things to look for when troubleshooting them.

Exam 220-801 objectives in this chapter:

- 3.1 Install and configure laptop hardware and components.
 - Expansion options
 - Express card /34
 - Express card /54
 - PCMCIA
 - SODIMM
 - Flash
 - Hardware/device replacement
 - Keyboard
 - Hard Drive (2.5 vs. 3.5)
 - Memory
 - Optical drive
 - Wireless card
 - Mini-PCIe
 - Screen
 - DC jack
 - Battery
 - Touchpad
 - Plastics

- Speaker
 - System board
 - CPU
- 3.2 Compare and contrast the components within the display of a laptop.
 - Types
 - LCD
 - LED
 - OLED
 - Plasma
 - Wi-Fi antenna connector/placement
 - Inverter and its function
 - Backlight
- 3.3 Compare and contrast laptop features.
 - Special function keys
 - Dual displays
 - Wireless (on/off)
 - Volume settings
 - Screen brightness
 - Bluetooth (on/off)
 - Keyboard backlight
 - Docking station vs. port replicator
 - Physical laptop lock and cable lock

Exam 220-802 objectives in this chapter:

- 1.5 Given a scenario, use Control Panel utilities (the items are organized by “classic view/large icons” in Windows).
- Common to all Microsoft Operating Systems
 - System
 - Hardware Profiles
 - Power options
 - Hibernate
 - Power plans
 - Sleep/suspend
 - Standby

- 4.8 Given a scenario, troubleshoot, and repair common laptop issues while adhering to the appropriate procedures.
 - Common symptoms
 - No display
 - Dim display
 - Flickering display
 - Sticking keys
 - Intermittent wireless
 - Battery not charging
 - Ghost cursor
 - No power
 - Num lock indicator lights
 - No wireless connectivity
 - No Bluetooth connectivity
 - Cannot display to external monitor
 - Disassembling processes for proper re-assembly
 - Document and label cable and screw locations
 - Organize parts
 - Refer to manufacturer documentation
 - Use appropriate hand tools

Common Laptop Features



Laptops are mobile computers, and there are many different types. You can find high-performance laptops with screens of over 17 inches and as much power as a desktop computer. Stripped-down netbooks have screens of about 10 inches and are used to surf the Internet and check email but can't do much more. And of course, there are a multitude of laptop types between these two. Despite their differences in size and performance characteristics, laptops have many common features.

MORE INFO CHAPTER 9, "UNDERSTANDING MOBILE DEVICES"

Tablets are in a different category and are covered in Chapter 9.

Special Function Keys



Keyboards commonly have *function keys*, labeled F1 to F12, that you can use when working with any computer. For example, you can press the F1 key to open help. Similarly, you can press the F5 key in just about any application to refresh the display.

On laptop computers, you'll often find that the function keys have more than one purpose, which you can access by pressing the *Fn* key at the same time that you press the given function key. This is similar to how regular letter keys have two purposes. You can press the A key to get a lowercase *a*, or you can press the Shift key with the A key to get an uppercase A.

Figure 8-1 shows part of a laptop keyboard with some keys highlighted. The function keys are across the top, and the special Fn key is on the bottom. The following sections describe the purpose of special function keys found on many laptops.



FIGURE 8-1 Laptop keyboard with Fn and function keys.

NOTE SPECIAL KEYS AREN'T ALWAYS THE SAME

Figure 8-1 shows how one laptop manufacturer is using the function keys, but there isn't a standard. Another laptop manufacturer might be using these keys for different purposes.

Dual Displays

The dual-display key is useful when you have a second monitor connected to the laptop or when the laptop is connected to a projector during a presentation. In Figure 8-1, the F1 key has an icon of two monitors and is used for dual displays. If you press this key, you'll usually see four choices, with one selected. Press it again and the next choice is selected. The four choices are as follows:

- **Computer Only.** The video is displayed on the laptop's monitor but not on external devices.

- **Duplicate.** The same data is displayed on the computer and on an external monitor. Speakers use this so that they can see the same display on the laptop as the audience sees.
- **Extend.** This selection allows you to extend the desktop and move windows between the displays.
- **Projector Only.** The laptop display is disabled, and only the projector display is used.



EXAM TIP

If the display on the laptop is not functioning, toggle the dual-display key by pressing it repeatedly to see if the display changes. The user might have accidentally set it to Projector Only. Similarly, if you need to send the display to the projector, use this key.

Wireless (On/Off)

Most systems also have a key that can be used to enable or disable the wireless card. In Figure 8-1, the F2 key has an icon of a radio transmitting tower and is used for wireless. By toggling this key, wireless can be turned on or off.

You might see the wireless control in different locations. Some HP laptops have a touch panel above the keyboard that can control some features. One LED looks like a transmitting antenna, and it is blue when wireless is enabled. If you touch it, it changes to orange and disables wireless. Some laptops have a switch on the side.



EXAM TIP

If a user is unable to connect to wireless networks, toggle the Wireless key on the keyboard to see whether the symptoms change. Chapter 23, “Exploring Wireless Networking,” covers wireless technologies in more depth.

REAL WORLD SOME PROBLEMS CAN BE SOLVED BY PRESSING A KEY

Sometimes problems have amazingly simple solutions. Not too long ago, I was out at a coffee shop and noticed another customer working with his laptop. Well, actually, he was banging his mouse on the table out of frustration because his laptop wasn't working with him. I mentioned I knew a little about computers and offered to help.

He said he was answering an email when the wireless connection from the coffee shop stopped working, but we could see that it was still working for others in the coffee shop. I pointed to a key on his keyboard and said, “Press that once.” He did, and a moment later, his connection was restored. Everything is simple when you know how things work.

Volume Settings

Some function keys can be used for volume controls. The keyboard in Figure 8-1 uses F7 to mute the sound, F8 to decrease the volume, and F9 to increase it. Volume settings commonly use a speaker icon with another indicator. The mute icon often shows a speaker with an X. A speaker with a single sound wave is used to indicate it will decrease the volume, and multiple sound waves increase the volume.

Screen Brightness

Keyboards will often have keys to increase or decrease the brightness. The keyboard in Figure 8-1 uses F4 to decrease the brightness and F5 to increase it. The brightness controls commonly use a circular icon resembling the sun, with a down arrow to decrease the brightness and an up arrow to increase the brightness.

NOTE SCREENS ARE DIM WHEN USING BATTERIES

Laptops often switch to a low power plan when on battery power. When using a low power plan, the screen brightness keys might be disabled. Pressing them won't change the display.

Bluetooth (On/Off)

Some systems with Bluetooth capability include a key to enable or disable Bluetooth. It is usually indicated by an icon resembling an uppercase *B*. It works similarly to the wireless switch.

Keyboard Backlight

Some keyboards have backlights illuminating the keys so that they can easily be viewed at night. The keys are often laser-etched, and white, red, yellow, or blue light-emitting diodes (LEDs) shine through them so that they can be easily identified.

These are sometimes popular with gamers, but there isn't much use for the backlight when the sun comes up. A key with an icon of a light is usually available to toggle the backlight on or off.

Lock and F-Lock Keys

Many keyboards also have Lock and F-Lock keys that are important to understand. They sound the same, but the usage is different.

The Lock key often has a lock icon, and it locks the operating system when you press it. This is similar to pressing the Ctrl+Alt+Del keys on Windows Vista and Windows 7 and selecting Lock This Computer.

When an F-Lock key is present, it often has the *F* in a box and the word *Lock*. Toggling this key locks the function keys to be used as F1 to F12, using the alternate purpose of the key.

Using the F-Lock key is similar to using the Caps Lock key to force letters to always be typed as lowercase or uppercase.

Num Lock Indicator

The number pad on a computer usually has a dual purpose of typing numbers or moving the cursor around. You can press the Num Lock key to use the numbers and press it again to use the navigation keys.

Most desktop keyboards include an LED that turns on or off when you press the Num Lock key. However, many laptops don't include an LED. Instead, when you press the Num Lock key, you'll see an indication on the screen that the Num Lock is on or off. Similarly, you'll see the same type of display for the Caps Lock and the F-Lock keys. Figure 8-2 shows how these appear on one computer.

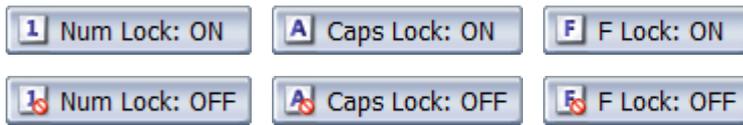


FIGURE 8-2 Lock indicator examples.

Default Usage of Fn Key

The default usage of the Fn key isn't the same on all laptops. For example, think of the F1 key used to open help, which can also be used to enable or disable wireless.

- On one computer, pressing only the F1 key will start help. If you want to toggle wireless, you need to press the Fn and F1 keys at the same time.
- On a different computer, pressing only the F1 key will toggle wireless, turning it on or off. If you want to start help, you need to press the Fn and F1 keys at the same time.

Troubleshooting Keyboard Issues

When you understand how the keys work, most problems with keyboards are relatively easy to resolve. They usually require just a little effort on your part to educate the user, or in some cases you can break out your trusted can of compressed air.

Num Lock Indicator Lights

If you've been using a computer for a while, you probably understand how the Num Lock and Caps Lock keys work. However, this is often misunderstood by many new users. They might complain that numbers no longer type from the number pad.

In this case, there probably isn't anything wrong with the user's computer—the user just doesn't understand how it's displayed or how to change it. Take a minute to demonstrate.

Sticking Keys

This is often a food issue. People often eat or snack at their desks, and food and liquid can drop into the keyboard. The solution is to clean the keyboard with compressed air. In extreme cases, you can remove all the keys and clean them individually with alcohol.

Educating the user about the source of the problem can help, or at least reduce how often the keyboard needs to be cleaned. Another option is to use a plastic keyboard cover. Users can type normally through the cover, and it protects the keyboard from collecting food.

✓ Quick Check

1. How can a user easily get a laptop to send the display to an external monitor?
2. What should you check if wireless suddenly stops working on a laptop?

Quick Check Answers

1. Toggle the function key for the display.
2. Press the function key to enable or disable wireless.

Docking Station vs. Port Replicator

Laptops are very useful when users are traveling. However, compared to the full features available with a desktop computer, laptops look and feel rather small, and users often want more capabilities when they're back at the office.

Docking stations and port replicators are often used with laptops to extend their capabilities. Figure 8-3 compares the two.

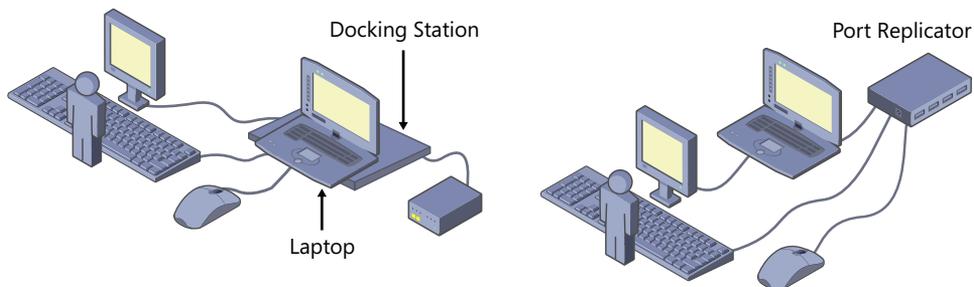


FIGURE 8-3 Docking station and port replicator.



A *docking station* is a case or a cabinet that the laptop plugs into to give the laptop additional capabilities. When you plug the laptop into the docking station, the laptop is connected to other peripherals, such as a standard-sized monitor, keyboard, and mouse. It has additional ports you can use to hook up other devices, such as external drives, and sometimes has expansion slots you can use. It's common for a docking station to be directly connected to a network.



Port replicators are simpler devices. You can usually plug a port replicator into a single USB port on the laptop, and it provides additional ports. Port replicators often include additional USB ports, sound ports, and network connections. If you want to use a full-sized monitor, you would plug it directly into the laptop.

A docking station must be specifically designed for the laptop because the laptop plugs directly into it. Because of this, docking stations are more expensive than port replicators.



EXAM TIP

Docking stations usually provide power to the laptop. If the laptop is on battery power while it's in the docking station, it indicates that it isn't connected. You can usually just remove the laptop and plug it back in to reset it.

Hardware Profiles

Hardware profiles are used in Windows XP but not in Windows Vista or Windows 7. They allow a user to select the set of hardware to which the laptop is hooked up when the system boots.

For example, the user might want to use the wireless network interface card (NIC) while traveling or at home but prefer to use the wired NIC in the office. You can set up two hardware profiles and name them Office and Traveling.

You could disable the wireless NIC in the Office profile and enable the wired NIC. Similarly, you can disable the wired NIC in the Traveling profile and enable the wireless NIC.

In Figure 8-4, in the screen shot on the left, you can see the Hardware Profiles page of a Windows XP system with these two profiles. The system is currently booted into the Office profile, and the hardware has been configured in this profile to use a docking station. The traveling profile has been configured with only the laptop's hardware.

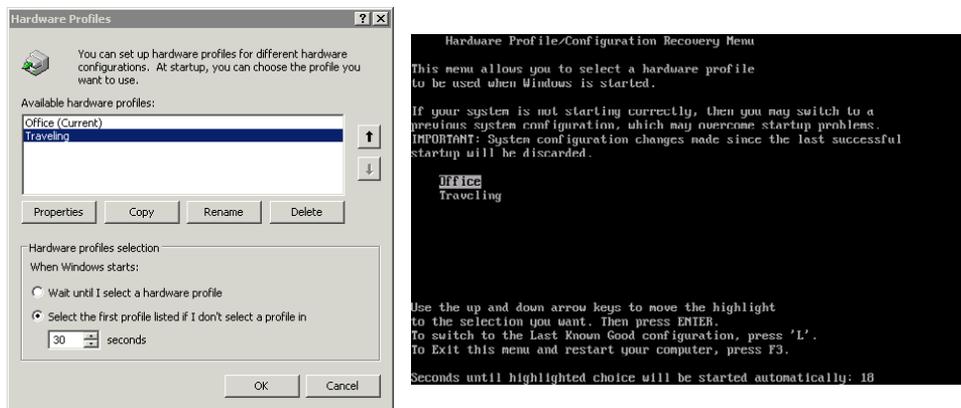


FIGURE 8-4 Setting up hardware profiles.

When you reboot the system, you will see a menu choice similar to the screen shown on the right in Figure 8-4. This is configured to give the user 30 seconds to choose a different hardware profile or boot into the Microsoft Office profile.

To access the Hardware Profiles page, use the following steps:

1. Click Start, Control Panel. If necessary, change the display to Classic View.
2. Double-click System to open the System applet.
3. Click the Hardware tab.
4. Click the Hardware Profiles button. You can select any profile and use the Copy, Rename, and Delete buttons to copy, rename, or delete the profile.

Locks

Laptops disappear quite easily. It's very easy for someone to simply put a laptop under their arm and walk away. I've heard many stories of people returning to a conference after lunch to find their laptops missing. I know of one conference speaker who returned from a 15-minute break to find that the laptop he was using for his presentation had disappeared.



Simple physical security measures can prevent these thefts. For example, Figure 8-5 shows an example of a *cable lock* connected to a laptop computer. It's similar to a cable lock used to secure a bicycle to a bike stand.



FIGURE 8-5 Cable lock for a laptop.

The cable has a combination lock. When set at the correct combination, you can plug it into a port on the laptop. You first wrap it around something stable such as a desk, and then plug the cable into the laptop. Spin the combination and the laptop is secure.

This isn't perfect, but it is enough to deter most thefts. A thief might be able to hammer the lock off, but that risks damage to the laptop. A thief could use large bolt cutters to cut the cable, but someone carrying around bolt cutters looks suspicious.



Quick Check

1. What provides additional features for a laptop while working in an office?
2. What provides physical security for a laptop?

Quick Check Answers

1. Docking station or, to a lesser degree, a port replicator.
2. Cable lock.

Laptop Displays

As with any computer, laptops have a display. The primary difference is that the display is attached to laptops whereas it's a separate piece of hardware in desktop computers. The section covers the different types of displays you'll run across with laptops, along with some specific concerns.

Display Types

The primary display types you'll find in laptop computers are liquid crystal display (LCD) and light emitting diode (LED) monitors. Organic light emitting diode (OLED) and plasma are available but less common. Chapter 6, "Exploring Video and Display Devices," provides information about these types of monitors, and the underlying technology is the same whether it's on the laptop or as a stand-alone monitor.

NOTE CLEANING THE DISPLAY

Use the same method of cleaning a laptop display as you do with other LCD monitors. A dry lint-free cloth works for most situations. You can also use a cleaner that is specially designed for the screen. Spray the cleaner on the cloth and then wipe the display.

Backlight

Backlights are used in LCD and LED display monitors because the crystals in these monitors do not emit light. The backlight shines light from the back of the display to the front, going through these crystals. You can see different colors based on how the crystals are oriented.

Traditional LCD monitors use a cold cathode fluorescent lamp (CCFL) as a backlight, and the CCFL requires alternating current (AC) voltage. This isn't a problem for stand-alone monitors because the monitor is plugged into an AC outlet.

In laptops, the display is attached to the computer and the computer runs on direct current (DC) voltage. When you plug a laptop computer into an AC outlet, you use a power adapter that converts the AC voltage to DC voltage. If it's running on battery power, it's also using DC voltage. This DC voltage must be converted to AC voltage to power the CCFL. Laptops use an inverter for this purpose.

Inverter



Laptops that include a CCFL use an *inverter* to convert the DC voltage provided from the motherboard to the AC voltage needed by the CCFL. An inverter is a small circuit board connected with just a couple of screws and two plug-in connectors. One receives the DC voltage from the motherboard, and the other sends the AC voltage to the CCFL.

Unfortunately, inverters often fail. They sometimes include a fuse you can replace, but typically, you have to replace the entire circuit board when it fails. Figure 8-6 shows a picture of an inverter held by technician José Vargas to give you an idea of its size.



FIGURE 8-6 Inverter inside a laptop computer.

IMPORTANT RISK OF SERIOUS ELECTRICAL SHOCK

Dangerous voltages exist on the inverter when the system is turned on. You should not open a laptop or handle the inverter when the system is turned on, and you should remove the battery before opening a laptop. When handling any printed circuit cards, you should also use an Electrostatic Discharge (ESD) wrist strap.

LCD

LCD displays used with laptop computers work like any regular LCD display. The biggest difference is that they require an inverter to power the CCFL backlight, while stand-alone monitors don't need an inverter. If either the inverter or the CCFL fails, the display will go dark and you'll need to replace the failed component.



EXAM TIP

When an inverter fails, the CCFL backlight doesn't work. The result is that the display will be dim or, possibly, completely dark.

LED

LED monitors are LCD monitors that use LEDs as backlights. Because the LEDs do not require AC voltages, the LED monitors do not require an inverter. Most laptops are now shipping with LED display monitors instead of the LCD monitors.

This provides two important benefits. First, the manufacturer saves money by not requiring the inverter. Second, technicians have one less component to worry about checking for failure. Inverters often fail, but this isn't a concern for LED monitors.



EXAM TIP

LED monitors (LCD monitors using LED backlights) do not use CCFLs. When used on laptop computers, LED monitors do not require inverters.

OLED

OLED devices do not require a backlight at all. They are thinner and lighter, and they provide exceptional graphics. Unfortunately, they are still quite expensive when compared to LED or LCD monitors. You might see them in small mobile devices such as smartphones, but they are rarely used in laptops.

Plasma

Plasma displays also don't require a backlight. They use very small gas-filled tubes that can emit lights. Each pixel includes a red, green, and blue tube that are used to produce different colors.

While a plasma display can provide vibrant images, it has two problems. Most important for a laptop computer is that a plasma display requires more power than an LCD or LED monitor. The result is that a laptop with a plasma display won't stay powered on as long when using a battery. Second, a plasma display is susceptible to burn-in if the same image is left on the monitor for a long period of time.

Wi-Fi Antenna

Most laptops have built-in wireless (often called Wi-Fi) capabilities. To connect with the wireless access point, they need to have an antenna. The antenna is commonly located inside the display, either at the top, when the display is opened, or on one or more edges. Wires run from the antenna to a wireless card inside the laptop.

Troubleshooting Display Issues

You might need to troubleshoot problems with a monitor's display. The following sections identify some common problems.

No Display

If your monitor has no display at all, the LCD screen has likely failed. However, always check the easy fixes first:

- Ensure that the laptop is on. You'll usually have some type of power indicator that verifies power is on.
- Ensure that the monitor hasn't been disabled by using a function key. An easy check is to toggle the function key and look for a change.

Another check is to plug in a second monitor and view the display. You might need to toggle the display function key to enable output to this second monitor. If you can't see a display on either monitor, the video card or the motherboard's video capability has likely failed. If you can view the display on the second monitor but not the laptop's display, it's very likely the LCD screen has failed.

You'll need to replace the LCD screen if it's failed, but before replacing the entire display, you should check to verify that it is not displaying anything at all. It's possible that it's just a dim display.

Dim Display

A dim display indicates a failed backlight. On traditional LCD displays, the problem might be due to a failed inverter. The solution is to replace the backlight and/or inverter. Sometimes a dim display looks dark, but if you shine a flashlight into the monitor you can see data displayed. This is also a clear indication that the problem is the backlight or the inverter.

LED displays don't use inverters, but the backlight can fail, resulting in a dim display. The solution is to replace the backlight.

Flickering Display

One of the symptoms you might see with laptop displays is a flickering display. It could be due to a problem with the backlight, the inverter powering the CCFL, or the LCD panel itself.

More often than not, this is caused by a loose connection within the laptop. Laptops are moved, jostled, and tossed around a lot more than desktop computers. All this activity

can jiggle something loose. If you can reproduce the symptom by moving the display, it is most likely due to a loose connector. The solution is to take it apart and reseat the display's connectors.

If this doesn't resolve the issue, the next best choice is the CCFL. Just as a fluorescent light can flicker when it ages, the CCFL can flicker. Similarly, the inverter can become more sensitive to heat as it ages. When the computer first turns it on, it will work fine. As the computer is used and heats up, the inverter can start failing, causing the flicker. Less common is flickering due to a problem with the LCD display itself, but it is possible.

Cannot Display to External Monitor

The most common reason a laptop cannot send the output to the display monitor is that the function key is set to send it to the primary display only. This should be your first check.

Another item to check is the dual-monitor display settings from within the operating system. Chapter 6 includes information about using multiple displays and how to configure them.

Ghost Cursor

Occasionally users complain of a ghost cursor. This means different things based on the symptoms. The three things to consider are the touchpad, the pointing stick, and settings for the mouse.

Figure 8-7 shows a laptop with a touchpad and the common location for a pointing stick. Instead of using a mouse, users can use gestures on the *touchpad* to mimic mouse movements. The pointing stick is a small pointing device that can be manipulated with your finger to move the mouse.



FIGURE 8-7 Laptop keyboard with touchpad.

When the touchpad or pointing stick is enabled, users sometimes inadvertently touch it, causing the cursor to jump around. If users are using an external mouse and not using these controls, the easiest solution is to just disable them.

The other option is to manipulate their sensitivity. Manufacturers often modify the Control Panel's Mouse applet so that it includes properties for these devices. You can use these settings to reduce the sensitivity of the touchpad or pointing stick.



EXAM TIP

If users are not using the touchpad, it's best to disable the touchpad. This will prevent the user from accidentally causing the mouse pointer to jump around the screen.

Apple users sometimes complain about this, and Apple has published a support article to address it (<http://support.apple.com/kb/TS2302>). On Apple systems, the solution is to enable the Trackpad setting to Ignore Accidental Trackpad Input.

Another possibility that might cause users to complain of a ghost cursor is a setting in the Windows Mouse applet. The Pointer Options tab in the Mouse applet includes a setting labeled Display Pointer Trails. When it is enabled, the mouse pointer includes ghost images or trails of the mouse as it's moved.

Installing and Configuring Laptop Hardware

When you work as a PC technician, there will likely be times when you need to install or swap out hardware. Some items can be incredibly easy to replace, while others will take a significant amount of time.

Disassembling Processes

Laptops are made by different manufacturers, and you'll find that there are multiple differences in how they are assembled. With that in mind, there isn't a specific set of hardware replacement steps you can follow that will work for any laptop. However, there are some basic disassembling processes you can follow.

Turn System Off

Ensure the laptop is turned off and that the battery is removed before starting. Some components, such as the inverter, have dangerous voltages that can harm you. Other components can be damaged if the system is opened with the power on.

Document and Label Cable and Screw Locations

A lot can happen between the time that you disassemble a laptop and when you put it back together. It's worth your time to document and label everything as you go along. One method of labeling wires is with small pieces of tape and a pen. Put the tape on the wire and

mark it so that you'll know where it goes. If you have a camera phone, you can also take some pictures to help you remember.

Organize Parts

As you're removing screws and parts, it's best to organize them as you're proceeding. For example, put the screws holding the case in one container and put screws holding specific components within the laptop in separate containers.

Some screws are close in size but can be just a little longer or larger, and if you put a screw into the wrong location, you can damage the laptop. Organizing the screws in separate containers helps avoid this problem.

NOTE CONTAINERS

Blank CDs and DVDs come on spindles covered with a plastic case. I have several of these that I use as containers when I'm working on a system. It makes it easy to keep the screws and other parts separate. I often include notes (such as "external screws" or "hard drive screws") that I add to the container to help me remember.

Refer to Manufacturer Documentation

This is extremely important. The disassembling steps are usually different from one laptop to another, but the manufacturer's documentation shows the specific steps for your laptop. Without this documentation, it's very easy to destroy the laptop, especially when you start removing items such as the keyboard or display screen.

You can often find documentation for systems on the web. For example, I used an HP Pavilion dv7 laptop for many of the pictures in this chapter. I used Bing to search for "dv7 manual" and quickly found and downloaded the manual.

Use Appropriate Hand Tools

You'll find that a few different size screw drivers (flat-blade and Phillips) are the primary tools that you'll need when taking a laptop apart. Another valuable tool is a plastic wedge or plastic shim, which you can use to pry open the case. This can be any piece of plastic strong enough to give a little leverage but thin enough to fit into tight spots. You can use something as simple as a guitar pick.

If you'll be handling the circuit boards, it's also very important to prevent electrostatic discharge (ESD) damage. At the very least, ensure that you're using an ESD wrist strap. Connecting the wrist strap to yourself and a metal part of the laptop ensures that you have the same electrical potential as the laptop and thus prevents ESD damage.

Hardware and Device Replacement

The majority of hardware that you'll replace is accessible from the rear panel. You usually have only a few screws that you need to remove to access removable components. Some laptops have multiple panels, and others have a single panel.

IMPORTANT AVOID SERIOUS ELECTRICAL SHOCK

Always disconnect power and remove the battery before adding or replacing any hardware in a laptop computer. The exceptions are hot-swappable devices, such as USB flash drives.

Figure 8-8 shows the rear of a laptop with the case closed and opened. The case on the left has arrows pointing to the screws. When these screws are removed, you can remove the panel and access the internal components as shown on the right.

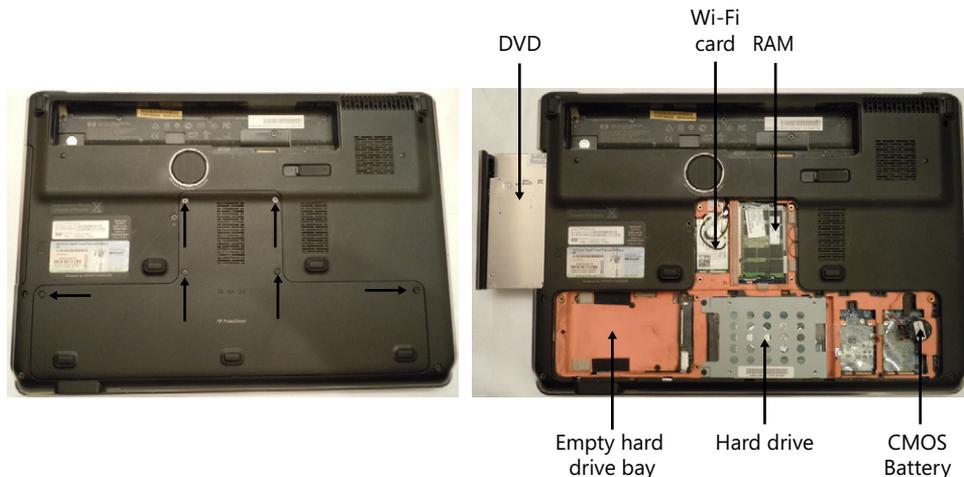


FIGURE 8-8 Rear of laptop with access panel on (left) and removed (right).

Plastics

Laptop computers commonly have plastic cases and covers that you need to remove to gain access to internal components. They are normally secured with screws and often with clips or latches. Even after removing the screws, you often need to pry the plastic cover off with a wedge.

The size and location of these covers varies widely from computer to computer. This chapter has pictures of cases from one computer, but there is no standard, so you'll see different covers.



EXAM TIP

A plastic wedge is useful when removing plastic covers or opening cases. If you use a metal screwdriver you might scratch the case, but a plastic wedge will not cause damage.

Battery

A core component of a laptop is the battery. It allows the system to run even when it's disconnected from an AC power source. Most batteries are very easy to remove and replace.

Figure 8-9 shows a battery removed from the underside of a laptop computer. Batteries are typically held in place with a latch that you can slide to one side to release it. These often fit snugly in the laptop, but gravity can help you remove it. Turn the laptop over and release the latch, and the battery will fall into your hand.

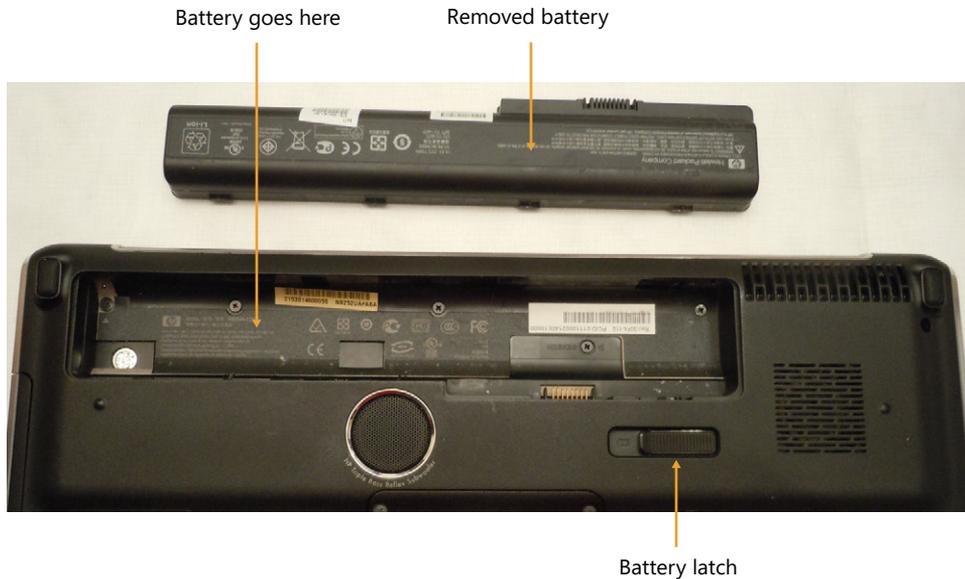


FIGURE 8-9 Removing a battery.

All laptop batteries aren't the same. You'll see them in many different shapes, sizes, and even types.



The most common type of battery used in laptop computers is the *lithium-ion (Li-ion)* battery. It will typically last between one to three years or between 300 and 800 charge and recharge cycles, depending on the quality of the battery. As it ages, it will gradually lose its ability to hold a charge.

NOTE TWO-WEEK RULE FOR PROLONGING BATTERY LIFE

Batteries age quicker if they stay fully charged or if they're allowed to remain discharged. If the laptop will not be used for two weeks or more or if it will remain plugged into an AC outlet for two weeks or more, remove the battery. It doesn't need to be stored in a refrigerator, but if you do store it there, you need to let it warm up to room temperature before using it.

Li-ion batteries are environmentally friendly, but you should observe local regulations when disposing of them or recycling them. They should not be incinerated because they can explode.



Older batteries such as *nickel cadmium (NiCd)* and *nickel metal hydride (NiMH)* were common but are used much less in laptops today. NiCd batteries include cadmium, which is toxic to the environment. NiMH batteries are environmentally friendly but cannot be recharged as many times as a Li-ion battery.

Hard Drive (2.5 vs. 3.5)

Most hard drives in laptop computers use a Serial ATA (SATA) interface, and they are very easy to replace. If you need to purchase a laptop hard drive, ensure that you get one 2.5 inches in size. Standard disk drives are 3.5 inches in size.

Figure 8-10 shows a laptop with two drive bays and with one drive removed. When you're removing the drive, you first need to remove the screws holding it in, and then you can slide it away from the connector. Most drives have a little plastic tab that you can use to pull them away and then out.

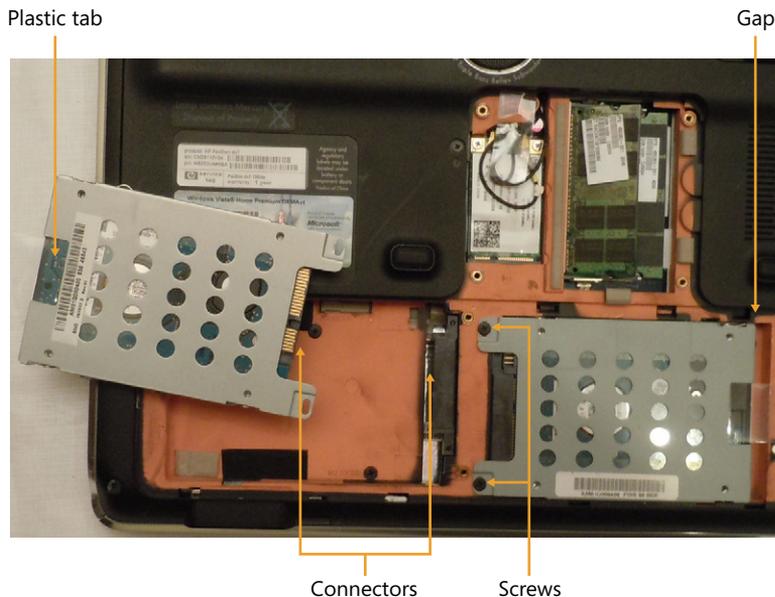


FIGURE 8-10 Removing a hard drive.

The hard drives fit into the drive bay with a little gap, as you can see on the drive shown on the right in Figure 8-10. When you're putting a drive in, this gap allows you to place it flat in the bay and then push it into the connector. Replace the screws, and you're done.



EXAM TIP

If you need to turn in a laptop computer for hardware servicing, remove the hard drive first to retain user data. If a laptop fails but the hard drive works, you can move the drive to another system of the same make and model. It will usually boot without any problems.

Flash

A popular trend with many hobbyists is to replace the primary hard drive with a solid state drive (SSD) in laptop computers. These use flash memory and are available in 2.5-inch SATA versions. They don't have any moving parts, consume less power, and are extremely fast when compared with a standard hard drive.

In systems with two hard drive bays, you can use something like a 256-GB flash drive for the operating system to get super-fast boot times. If the user needs more space for data, the other hard drive can be a 1-TB traditional hard drive to provide ample space for storage. Of course, you can also use two flash drives.

Memory

Memory is another item that is usually easy to replace on laptop computers. If you have an open slot, you can add additional memory to increase the system's performance, or you can replace the existing memory with higher-capacity RAM. For example, if a system has two 1-GB memory sticks, you might be able to replace them with two 2-GB sticks to double the capacity.

Two primary concerns when replacing memory is ensuring that you use compatible memory and that you follow ESD practices. Laptop computers use small outline dual in-line memory modules (SODIMMs), which are smaller than dual in-line memory modules (DIMMs) that are used in desktops.

MORE INFO CHAPTER 3, "UNDERSTANDING RAM AND CPUS"

Chapter 3 covers different types of DIMM and SODIMMs.

Figure 8-11 shows a laptop with one SODIMM installed and one removed. They are held in place with latches that fit into the round slot on each side of the SODIMM. When secured, the SODIMM lays flat, but when you release the latches, it rises to about a 30-degree angle and you can easily remove it.

To replace the SODIMM, push it into the slot. When it is plugged in, press it down so that it lays flat. The two latches will snap into place, which will secure it. Put all the covers back into place, plug the computer in, and turn the computer on. The system should recognize the new RAM. If not, you might need to double-check your work and ensure that the SODIMM is seated properly in the slot.

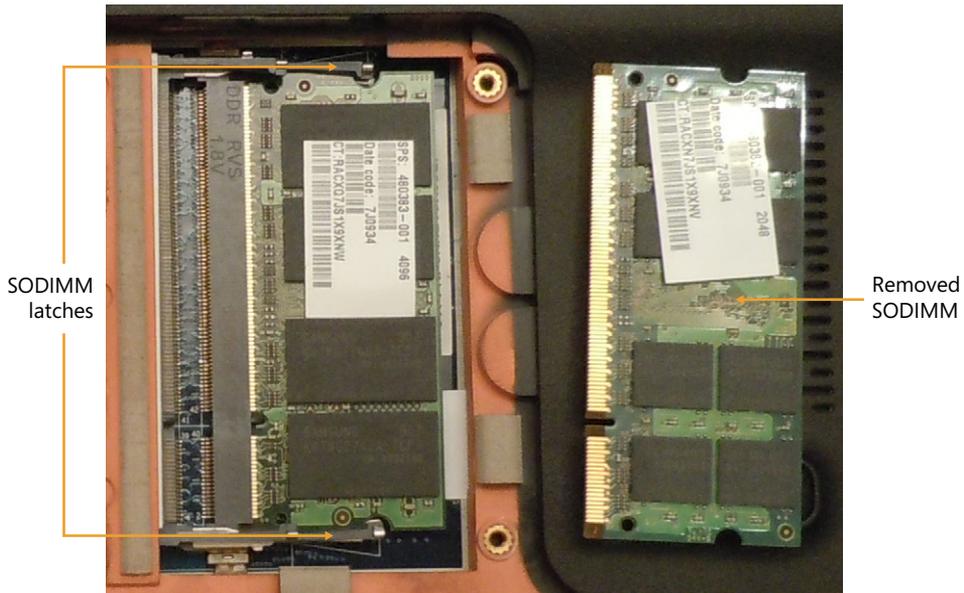


FIGURE 8-11 Replacing a SODIMM.



EXAM TIP

The power-on self-test (POST) will check the memory when the system boots. If you hear an unfamiliar beep after installing RAM, double-check the installation.

Optical Drive

When a laptop computer includes an optical drive such as a CD, DVD, or Blu-Ray drive, you'll find that they are very easy to replace. Most are held in place with a single screw.

Figure 8-12 shows the location of the screw and an optical drive partially removed from a laptop computer. After removing the screw, you can pry the drive away from the case with a plastic wedge.

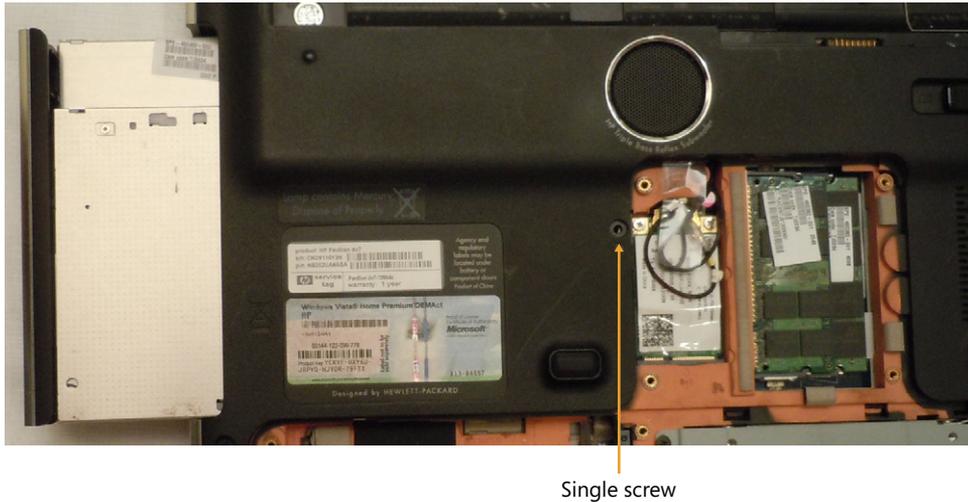


FIGURE 8-12 Removing an optical drive.

Mini-PCIe

Laptop computers commonly include Mini Peripheral Component Interconnect Express (Mini-PCIe) slots for expansion. For example, the wireless card shown in the next section is a Mini-PCIe card.

Mini-PCIe is an upgrade to MiniPCI slots, similar to how PCIe is an upgrade to PCI. Mini-PCIe circuit cards are smaller than typical PCIe cards used in desktop computers.

Wireless Card

The wireless card is another easy component to replace. It's easy to identify because it will have two or three wires attached to it, depending on the type of wireless it supports.

Figure 8-13 shows a wireless card partially removed from a laptop computer. In this system, the wireless card is next to the RAM and is annotated with a wireless icon, shown at the bottom of the figure.

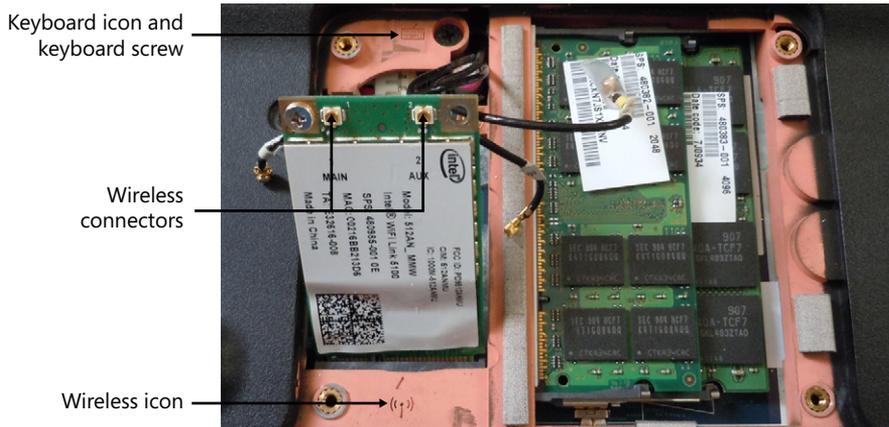


FIGURE 8-13 Removing the wireless card.

This wireless card has two connectors, but the laptop computer has three wires. This provides an excellent example of the importance of labeling wires when you're taking a system apart. One wire must connect to pin 1 (MAIN), and the other wire must connect to pin 2 (AUX). If the wires are not labeled, you should label them. They were already labeled in this system, and the third cable is labeled MIMO, indicating that it is used if the wireless card supports 802.11n.

MORE INFO CHAPTER 23, "EXPLORING WIRELESS NETWORKING"

Chapter 23 covers wireless technologies in more depth, including 802.11n. Multiple input multiple output (MIMO) is used with 802.11n but not with other wireless standards such as 802.11a, 802.11b, and 802.11g.

The cables from the wireless card run to an antenna transceiver normally located on the top of the laptop display. In some cases, the transceiver is located on the sides of the display.

It might not show up in Figure 8-13 very well, but there is also a rectangular keyboard icon next to a screw. This lets you know that this is one of the screws holding the keyboard in place.

Keyboard

You'll often have to remove the keyboard to access the motherboard and some other internal components. There are different methods for different motherboards, so your best bet is to check the manual.

NOTE GIVE YOURSELF PLENTY OF TIME

When you start removing components from the front of the laptop (such as the keyboard, touchpad, and screen), you'll find that the process becomes much more difficult. It's often tedious and time-consuming. Even when you have the manual with detailed directions, it can take you quite a while, so ensure that you have plenty of time before starting.

On some models, you'll first need to remove components from the bottom of the laptop, such as the battery, RAM, DVD player, and the wireless card. With these removed, you'll have access to the screws holding in the keyboard. These often have a small icon of a keyboard.

After removing the screws, you can flip the laptop back over and remove the laptop case or cover. In some cases, you might need to remove additional screws after removing the laptop case, and you'll usually have to pry the case loose with a plastic wedge. When the case is removed, you'll be able to pull the keyboard out. Before removing it completely, carefully remove the connectors.

Touchpad

If you need to remove the touchpad, you can usually access it after removing the keyboard. It is usually held in place with a clip and connected to the motherboard with a cable. Carefully remove the clip and the connector, and you'll be able to remove it.

Speaker

You can usually access the speaker after removing the keyboard. It is often held in place with one or more screws and has a connection to the motherboard. Remove the screws and the connector, and you'll be able to remove the speaker.

Screen

The display typically cannot be removed until you've removed components from the bottom of the laptop to gain access to the screws holding in the keyboard. After removing the keyboard, you'll usually have sufficient access to the display screen.

It's important to remember that the wireless card includes connections to the antenna transceivers and that these transceivers are in the display screen. Therefore, don't try to remove the display screen without first disconnecting these cables from the wireless card. Additionally, many displays include other components, such as a webcam, and you'll need to remove these connections.

With the keyboard removed and the cables removed, you can then locate the screws holding the display to the case. These are normally part of the hinged assembly used to open and close the laptop.

IMPORTANT SUPPORT THE SCREEN

When you remove the screws holding the hinged assembly in place, make sure that you support the display. Without the screws, it can easily fall and break.

Some manufacturers sell replacements of the entire display assembly. In other models, you'll need to take the display apart to access the LCD display panel. This can be relatively simple or extremely complex, depending on the model and the additional components included in the display screen.

DC Jack

Laptop computers run on DC power. They use a power adapter that plugs into an AC outlet and converts the AC voltage to DC voltage. The other side of this adapter plugs into the DC jack.

Occasionally, the DC jack connection becomes loose and needs to be replaced. This is rarely an easy endeavor because you often need to remove the system board to gain access to the DC jack. As with other components, follow the procedures in the manual.

System

If you need to remove the system board (often called the motherboard), you usually have to remove all the other components in the system. This includes removing all the components accessible from the bottom of the laptop and then removing the keyboard and other components from the top.

One important step you'll need to add is to remove the clock battery. In laptops, this might be called the RTC (real-time clock) battery or the complementary metal oxide semiconductor (CMOS) battery. It is providing power to the system board to keep the clock running and should be removed before removing the system board.

Unless you do this regularly, expect it to take you quite a while to remove all the components from the laptop computer and then remove the system board. Instead of reinstalling the board the same day, you might postpone the job for another day. With that in mind, it becomes especially important to document the screw and cable locations.

CPU

The CPU is often soldered into the motherboard so you will rarely replace it individually. However, if the CPU can be replaced on a laptop, refer to the manufacturer's manual for detailed instructions.

Expansion Options

In addition to allowing you to add or replace hardware internally, many laptops also include expansion slots that you can use without taking them apart. Laptops commonly have USB ports, just as regular desktop computers do, but they will often have extra slots found only on laptops.

MORE INFO CHAPTER 5, "EXPLORING PERIPHERALS AND EXPANSION CARDS"

Chapter 5 covers USB connections, which you'll find on almost every laptop computer. Chapter 4, "Comparing Storage Devices," covers external Serial ATA powered (eSATAp) ports, which are also found on many laptop computers. An eSATAp port can be used as an external SATA (eSATA) port or as a USB port.

PCMCIA

PC Cards were often used with laptop computers before the release of the ExpressCard, but they are very rare today. They were created by the *Personal Computer Memory Card International Association (PCMCIA)* and were previously called PCMCIA cards. They came in three types with three different thicknesses, as follows:

- Type I cards are the thinnest at 3.3 mm. A Type I card can plug into a Type II, Type II, or Type III slot.
- Type II cards are a little thicker at 5.0 mm. A Type II card can plug into a Type II or Type III slot.
- Type III cards are 10.5 mm and are often used for hard drives. A Type III card can plug into a Type III slot only.

ExpressCards

Most laptops manufactured since 2007 include *ExpressCard* slots, and there are a wide variety of ExpressCards available. They are available as adapters to add additional USB, eSATA, network, or FireWire ports. Some provide you with additional memory card slots, including SecureDigital (SD) or CompactFlash memory slots. They are also available as wireless network cards, sound cards, and much more.

ExpressCards come in the following two versions:

- **ExpressCard/34.** This card is 34 mm wide and has 26 pins.
- **ExpressCard/54.** This card is 54 mm wide and has 26 pins.

Figure 8-14 compares the size of these cards with the legacy PC Card. Notice that /34 and /54 refer to the overall width of the cards but that each ExpressCard has 26 pins and fits into the same type of slot. That is, there are two types of ExpressCards but only one type of ExpressCard slot. Both ExpressCard versions are 5.0 mm thick, the same thickness as a Type II PC Card.

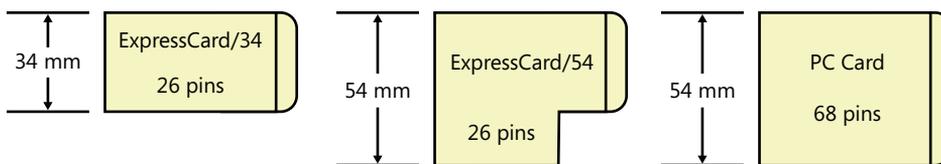


FIGURE 8-14 Comparing an ExpressCard/34, an ExpressCard/54, and a PC Card.

A logical question is, “Why are there two versions of ExpressCard?” There are two reasons:

- **More space.** The ExpressCard/54 provides manufacturers with more space to house the components. For example, a hard drive with a 1.8-inch platter can fit on an ExpressCard/54 but not on the smaller ExpressCard/34.
- **Better heat dissipation.** Some cards include components that tend to get hotter than others. By using a larger card, it has more surface space to dissipate the heat.

NOTE NO PERFORMANCE DIFFERENCES BETWEEN EXPRESSCARD VERSIONS

There are no performance differences between ExpressCard/34 and ExpressCard/54. They both fit into the same slot and use the same technology.

Conserving Power

One of the great benefits of a laptop computer is that you can still run it even if you’re disconnected from a primary power source. Laptops have batteries that will continue to power the system, but these batteries don’t last forever.

Most users don’t want to lug around a 50-pound battery with their laptop, but they also want the laptop to stay powered as long as possible. Manufacturers try to strike a balance between how long a battery will last and how heavy it is. You can also take steps to conserve power and keep systems running longer.



EXAM TIP

Conserving power isn’t limited only to laptop computers. Most of the concepts in this section apply both to desktop computers and to laptops.

ACPI



An open standard supported by Windows operating systems and most hardware devices is *advanced configuration power interface (ACPI)*. This is an update to an earlier standard called *advanced power management (APM)*.

Systems that support ACPI allow the operating system to send signals to devices to change their power state. For example, ACPI can be used to turn off a display monitor after 10 minutes of inactivity.

ACPI defines many power states for systems and hardware, such as global power states that apply to the entire computer, device power states that apply to individual devices, and processor states that apply to the central processing unit (CPU).

The following four global states identify the level of computer operation for the system:

- **G0.** The system has full power and is working normally.
- **G1.** The system is in one of four low-power states.
- **G2.** The system is off but still has power available.
- **G3.** The system is completely disconnected from power.



EXAM TIP

If you are going to perform hardware maintenance on a computer, it should be in the G3 power state. The G2 state supports soft power. It can be turned on from the front panel power switch or from signals sent over a network. For example, administrators can send Wake-on-LAN “magic packets” to a system in the G2 state to wake it up.

G1 is divided into four separate sleep or low-power states. The S1 and S2 states define levels of sleep for the processor, but for a PC technician, the most important states are S3 and S4:

- **S3.** This is commonly called *sleep*, *suspend*, or *standby*.
- **S4.** This is known as *hibernation* or sometimes *suspend to disk*.

Sleep/Suspend/Standby (G1 S3)

Sleep mode is a low-power state that allows the computer to quickly return to full power. It’s also known as *suspend* mode or *standby* mode and is defined in the S3 sleeping state within the G1 global state.

It provides trickle power to maintain the contents of the RAM and low power to the CPU. The CPU periodically checks to see whether you’ve taken any action indicating that it should wake the system. Other components, such as the disk drive and display, are powered off.

When a user takes an action, such as pressing a key, the system wakes up and returns power to normal for all the components. A system can return to normal from sleep mode very quickly.

Hibernate (G1 S4)



Hibernate mode saves the most power. It’s also known as *suspend to disk* and is defined in the S4 sleeping state within the G1 global state.

The computer takes a snapshot of the entire contents of random access memory (RAM) and stores it on the hard drive. It then completely shuts down the computer. When you turn the computer back on, it copies the snapshot from the hard drive and restores it into RAM. Many laptops are configured to go into hibernation mode when you close the lid.

For example, if you were taking notes on a laptop computer and then realized you needed to leave for an appointment, you could close the lid of your laptop. The system would copy

the contents of RAM to the hard drive and turn itself off. When you open the lid and turn the system back on, your session will be restored just as it was when you closed the lid.



EXAM TIP

Hibernate saves the most power because the computer is turned completely off, but it takes longer for the system to turn back on. Standby or sleep modes still use power and will consume battery power, but the system can return to full operation much quicker.

Hybrid Sleep

Many systems support a hybrid sleep mode. It copies the contents of RAM to the disk as if it were hibernating. However, instead of shutting down, it goes into a low-power sleep mode. It can wake up quickly when it's needed. Additionally, if the system loses power, it can return to operation from the hibernation mode.

Power Options

Windows XP, Windows Vista, and Windows 7 all include an applet called Power Options in the Control Panel. You can use this to configure different power plans for a system.

You can access the Power Options applet by clicking Start, Control Panel. On Windows XP and Windows Vista, change the view to Classic View. On Windows 7, change the view to Large Icons. You can then double-click the Power Options applet to start it.

It looks a little different in Windows XP than it does in Windows Vista and Windows 7. Windows XP uses power schemes, but Windows Vista and Windows 7 use power plans providing you with more control.

Power Plans

When you open the Power Options applet in Windows 7, you'll see the following available *power plans*:

- **Balanced (recommended).** This plan attempts to balance the performance of the system with how much power is used. It's recommended for most uses, including on desktop computers.
- **Power saver.** This reduces energy consumption and can help a system stay on battery power longer. Laptops often switch to this automatically when they are on battery power.
- **High performance.** This favors performance over saving energy. It is hidden by default.



EXAM TIP

The power saver plan dims the display so that it uses less power. This plan often ignores the special keyboard keys to increase the brightness. If the display is dimmed and it can't be adjusted, ensure that the system is connected to AC power.

If you click one of the plans, you can configure some basic settings, and if you click Change Advanced Power Settings, you can view the advanced settings. Figure 8-15 shows the advanced settings page for the Balanced (Active) plan that is active on this system. Notice that the display is set to turn off after 10 minutes of inactivity and that the hard drive will turn off after 20 minutes. Also, you can see that Allow Wake Timers is enabled for Sleep. This allows the system to wake up to perform a scheduled task.

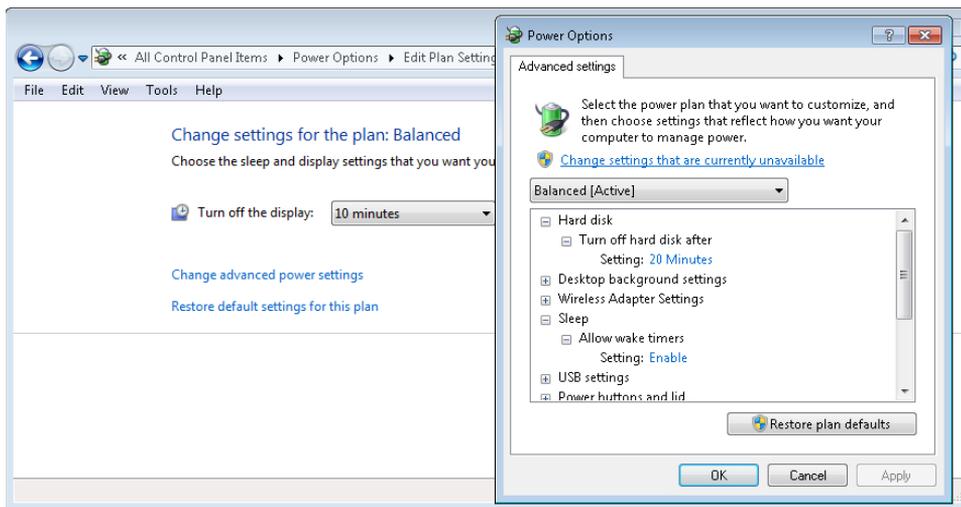


FIGURE 8-15 Viewing the balanced plan settings.

Troubleshooting Power Issues

Power issues on laptop computers are normally limited to either the power adapter or the battery. The following sections describe the two common symptoms that you'll likely encounter.

No Power

If the system has no power, there could be several reasons. The obvious reason is that it isn't plugged in. Laptops use special power adapters that convert AC power to DC. The adapter plugs into an AC outlet, and the other end plugs into the laptop's DC jack.

You can usually check two indicators to determine whether the adapter is providing power to the system. First, most adapters have a small LED as a power indicator that illuminates

when it is plugged in. Second, most laptops have an LED at the DC jack that illuminates when it is receiving power from the adapter.

If an LED isn't lit, double-check the connections. You might need to reseat the cables into the different jacks. After reseating the connections, check the LEDs again. If the adapter LED isn't lit, you might need to replace it. If the LED at the DC jack isn't lit but the adapter is working, you might need to replace the DC jack.

Battery Not Charging

If the battery is not charging, check to ensure that the system is receiving power. Without power, it won't charge. In some cases, the battery will fail and just won't be able to accept a charge anymore. The system will work with AC power without any problem but won't work while on battery power. The solution is to replace the battery.

Stay Cool

Heat is the enemy of any type of electronics, and this includes laptops and batteries. Many laptops don't include any internal fans, so they have a tendency to get hot. Laptop pads are available that include fans. These often plug into a USB port, and the fans spin to keep the system cool when it's turned on.

Troubleshooting Connectivity Issues

This chapter covered many troubleshooting issues, but you might also experience some issues with connectivity for wireless or Bluetooth connections. The primary user complaints you'll hear are related to intermittent connections or no connection at all.

Intermittent Wireless

An intermittent wireless connection often indicates that there is interference with the signal. You can either identify the source of the interference to eliminate it or find a way avoid it. Chapter 23 includes information about common types of interference and how to change wireless channels to avoid it.

Intermittent connection can also occur when the laptop computer is too far away from the wireless access point (WAP). The simple solution is to move the laptop closer to the WAP. If this isn't possible, you might be able to boost the power output of the wireless access point, adjust the antenna position, or move the WAP.

Last, if the system has been worked on recently, it's possible that the connections to the wireless card are loose. You can open the system to verify that the wires are secured to the wireless card.

No Wireless Connectivity

A good question to ask when a user complains about wireless connectivity is something like, “Did it stop working recently?” If a system had wireless but it just stopped, check the function key or wireless switch on the keyboard. It’s very possible that the user accidentally turned the wireless off. This is almost always the case if other users can connect but one user cannot.

If it hasn’t worked at all, you might need to configure the wireless connection from scratch. Check out Chapter 23 for steps to take. It’s also possible that the wireless card has failed. If so, you’ll need to replace it by using procedures mentioned earlier in the chapter. Alternatively, you can purchase a USB wireless dongle. These plug into a USB port and can be used to connect to a wireless network.

No Bluetooth Connectivity

If a user doesn’t have any Bluetooth connectivity, you can follow the same procedures you used for no wireless connectivity. Find out if it recently stopped, and if so, look for the function key to enable or disable it. If it hasn’t worked at all, you might need to pair Bluetooth devices and configure them to work together. Chapter 9 covers details about Bluetooth.

Chapter Summary

- Laptop keyboards typically have special function keys that can control hardware. This includes keys used for dual displays, to enable or disable wireless and Bluetooth, control the volume, and control the screen brightness.
- A docking station extends the capabilities of a laptop when the laptop is plugged into it. A port replicator provides additional ports for a laptop computer.
- Windows XP uses hardware profiles with docking stations, but they are not available in Windows Vista and Windows 7.
- Most laptops include a port used for a physical cable lock.
- Laptops primarily use LCD or LED displays. LCD displays include an inverter to convert DC to AC for the CCFL. The Wi-Fi antenna is normally in the display, and a cable runs to a wireless Mini-PCIe card in the system.
- If the LCD inverter or CCFL fails, the display will be dim or dark. If the display is flickering, it might be due to a loose cable. If you can’t see a display on the laptop monitor or an external monitor, the video card might have failed.
- Use specific steps when replacing components on a laptop, starting with removing all power sources including the battery. Locate and use manufacturer documentation. Document and label cable and screw locations as you’re taking the laptop apart, and organize the parts. Last, make sure that you have the right tools, including a plastic wedge.

- ExpressCard/34 and ExpressCard/54 slots provide expansion capabilities for laptops. They replace older PCMCIA cards. The /34 and /54 specifications refer to the overall width but not the number of pins.
- Sleep modes consume very little power and can return to operation very quickly. Hibernate mode stores the data in RAM onto the disk and turns off the laptop. Hibernate mode does not consume any power but takes longer to start up than sleep mode does.
- Windows-based systems use power plans to conserve energy. Laptops will commonly switch to a power-saving plan when they are switched from AC power to battery power.
- Connectivity issues can be resolved by manipulating the wireless switch on the keyboard. If necessary, you can replace the Wi-Fi card.

Chapter Review

Use the following questions to test your knowledge of the information in this chapter. The answers to these questions, and the explanations of why each answer choice is correct or incorrect, are located in the “Answers” section at the end of this chapter.

1. Which key can often be used with a function key to disable wireless on a laptop computer?
 - A. F1 key
 - B. Num Lock key
 - C. Fn key
 - D. Caps Lock key
2. Which of the following best describes a docking station?
 - A. A device designed to enhance the capabilities of a laptop and allow it to function as a desktop computer
 - B. A device that has one connection and provides additional ports for the laptop
 - C. A component that provides AC power to an LED display
 - D. A component used for laptop physical security
3. A laptop display is dark, but you can see information on the screen when you shine a flashlight into it. Of the following choices, what is the problem? (Choose two.)
 - A. Backlight
 - B. Inverter
 - C. LCD display
 - D. Video card

4. You are preparing to replace the keyboard in a laptop computer. Of the following choices, what should you include in the process? (Choose all that apply.)
 - A. Toggle the Fn key before starting.
 - B. Obtain the manufacturer's documentation for the laptop.
 - C. Remove the LCD display first.
 - D. Remove all power including the battery.
5. A user wants to conserve power on his system when he's not using it. Which of the following saves the most power?
 - A. Turning off the display after inactivity
 - B. Turning off disks after inactivity
 - C. Sleep
 - D. Hibernate
6. Wireless has failed on a laptop computer. Which of the following options would restore the capability? (Choose two.)
 - A. Install a Mini-PCIe card.
 - B. Install a USB wireless adapter.
 - C. Install a PCI wireless card.
 - D. Install an AGP wireless adapter.

Answers

1. Correct Answer: C

- A. Incorrect:** The F1 key by itself is used to open Help.
- B. Incorrect:** The Num Lock key configures the numeric keypad to use numbers or as navigation keys.
- C. Correct:** The Fn key is often used with a function key to disable wireless.
- D. Incorrect:** The Caps Lock key configures letters to be always uppercase or lowercase.

2. Correct Answer: A

- A. Correct:** Docking stations provide additional capabilities to laptops when used in an office.
- B. Incorrect:** Port replicators provide additional ports.
- C. Incorrect:** An inverter provides AC power to LED displays.
- D. Incorrect:** Cable locks are used for physical security.

3. Correct Answers: A, B

- A. Correct:** If the backlight fails, the display will be dark or dim.
- B. Correct:** The inverter powers the backlight on LCD laptop displays, so it can exhibit these symptoms.
- C. Incorrect:** Data can be viewed when the flashlight is shined into the panel, so the LCD display has not failed.
- D. Incorrect:** If the video card failed, you wouldn't see any display.

4. Correct Answers: B, D

- A. Incorrect:** It is not necessary to toggle any keys before starting.
- B. Correct:** The documentation provides the steps you'll use.
- C. Incorrect:** The display usually isn't replaced before the keyboard, but the manual provides the specific steps.
- D. Correct:** All power should be removed before starting.

5. Correct Answer: D

- A. Incorrect:** Turning off just the display is useful, but other components are still consuming power.
- B. Incorrect:** Turning off just the disks is useful, but other components are still consuming power.
- C. Incorrect:** Sleep mode reduces power consumption but not as much as hibernate.
- D. Correct:** A system turns off in Hibernate mode, so this saves the most power.

6. Correct Answers: A, B

- A. Correct:** A Mini-PCIe card can add wireless to a laptop.
- B. Correct:** A USB wireless adapter can add wireless to a laptop.
- C. Incorrect:** PCI cards won't fit in a laptop.
- D. Incorrect:** AGP is a video technology bus.

