

# Chapter 3

## The Visible PC

### Lab Exercises

- 3.01 Exploring the Functions and Components of a PC
- 3.02 Examining User-Accessible Components
- 3.03 Recognizing External Connections
- 3.04 Safeguarding Against Damage from Electrostatic Discharge (ESD)
- 3.05 Disassembling the System Unit and Identifying Internal Components and Connections

Lab Analysis Test

Key Term Quiz

**E**very competent tech knows the PC inside and out. Nothing destroys your credibility in the eyes of a client as quickly as not knowing the basics, like the difference between a graceful shutdown and a forced power down. The word “Oops!” doesn’t always go over well in the real world! This set of labs applies the information you learned in Chapter 3 of *Mike Meyers’ CompTIA A+ Guide to Managing and Troubleshooting PCs*, so you’ll be poking and prodding a PC. You’ll begin by exploring the functions of a PC, and then you’ll examine the typical user-accessible components, as well as the external connectors found on most PCs. After taking a moment to protect both yourself and the PC components from electrical damage, you’ll open up the system unit’s case and take a tour inside. Finally, you’ll finish up with a complete disassembly of the system.



30 MINUTES

## Lab Exercise 3.01: Exploring the Functions and Components of a PC

Everything a computer does falls into one of four categories: input, processing, output, and storage. You need a good understanding of these four processes, and the components that are involved with each one, to troubleshoot PC problems successfully.

### Learning Objectives

At the end of this lab, you’ll be able to

- Define the four functions of computer systems
- Detail common components involved in each of these four functions

### Lab Materials and Setup

The materials you need for this lab are

- A notepad and pencil, to draw a four-column table
- Optional: Access to a working computer with a word processing or spreadsheet application installed, to aid in drawing the table
- The *Mike Meyers’ CompTIA A+ Guide to Managing and Troubleshooting PCs* textbook, for reference

✓ Hint

Get used to taking notes and drawing pictures. Even after many years of repairing computers, from mainframes to PCs, I still use a notepad to keep track of what I see and what I change. I recommend that you save your drawings and notes, as you'll find them useful in subsequent labs.

## Getting Down to Business

In this exercise, you'll review, list, and define the various components involved in the PC's vital functions.

**Step 1** Reread the "How the PC Works" section in Chapter 3 of *Mike Meyers' CompTIA A+ Guide to Managing and Troubleshooting PCs*, paying particular attention to the sections on input, processing, output, and storage.

**Step 2** For each of the following functions of a computer system, write a definition and give a brief example:

Input:

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Processing:

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Output:

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Storage:

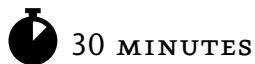
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**Step 3** Using the following table, list the components that operate in each of the four functional categories. Try to include as many components as you can; you might take a peek at some of the later chapters in the textbook to see if you can add any other components. Think about how each of the components contributes to the overall workings of the PC, and include as much detail about the component as possible.

Input	Processing	Output	Storage

**Step 4** If you completed the table right here in the lab book, you'll have it handy throughout the rest of the lessons. If you made a table in your notebook, or created an electronic version, make sure you can get to it easily. As you work on later chapters, you'll want to update the table with additional components and further detail on the components. The information in the table (and in your head) will expand as you develop a better understanding of how the components relate to the PC's "big picture."



## Lab Exercise 3.02: Examining User-Accessible Components

It's been one of those days. You walked into what should have been a simple job interview, only to meet a very frantic IT manager who was dealing with a crisis of epic proportions. She doesn't even bother to interview you—instead she shuttles you out of her office, points down the hall, and says, "Go check Jane's PC, fourth cubicle on the left. She says the PC has locked up on her, and she can't even turn it off! Don't change anything or open it up. Right now I simply need to know if it will shut down, boot properly, and access the drives." Then the IT manager is off to deal with her crisis, and you're on the spot.

This exercise looks at the many PC components that you can access without removing the case. You can use a quick scan to determine whether a PC is functioning properly at the most basic level. Take your time, and jot down notes where you feel the need. Practice each step until you're confident you can do it on the job as a PC tech.

## Learning Objectives

In this lab exercise you will locate and describe the various user controls and built-in user-accessible devices of a PC system. You will not be opening the system case during this lab.

At the end of this lab, you'll be able to

- Recognize and manipulate user controls
- Describe the use of built-in user-accessible devices

## Lab Materials and Setup

The materials you need for this lab are

- One fully functioning desktop computer system unit, with monitor
- A working optical drive (any drive that reads or records CD, DVD, or Blu-ray discs)
- One readable data CD with files
- One keyboard
- One mouse
- A notepad on which to take notes and make sketches of the computer and components
- Optionally, a digital camera to take photos of the computer and components (can be a standalone camera or part of another device, such as a mobile phone)

### ✓ Hint

In Lab Exercise 3.01, I recommended that you get used to taking notes and drawing pictures. Thanks to the wide popularity and availability of digital cameras, you have another excellent way to record the configuration of computer systems and the steps taken during disassembly, repair, and assembly. A digital camera can be a handy tool for supplementing your trusty pencil and paper.

## Getting Down to Business

As a technician, you need to know how everything works on a PC. The best place to begin is with the externally accessible devices.

**Step 1** Before you can do much work with a PC, you need a functioning output device, such as a monitor. Check the monitor to see if it has power. The small *light-emitting diode (LED)* on or near the monitor's power button should be lit: orange if the system is turned off or asleep, or green if the system is fully on. If you determine that the monitor is not plugged into a wall outlet, plug it in now.

**Step 2** Look at the front of your system unit. Locate the power button. Compare your button to the one in Figure 3-1.



**FIGURE 3-1** Recognizing the power button on the front of a PC

Once you have located the power button on your system, make a note of its appearance. Is it in plain sight, or hidden behind a door or lid? Is it round, square, or some odd shape? Pressing the power button to start a PC when the electricity is off is known as a *cold boot* or sometimes a *hard boot*.

Describe your power button here:

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Sometimes software will lock up your system and the only way to shut the system down is to force a *power down*. This requires that you press and hold the power button for four to six seconds.

Notice the two LEDs on the front panel near the power button. One generally lights up green to indicate that the power is on, and the other flashes when the internal hard drive is active.

**✓ Hint**

On older systems, the power button or switch may be located on the back of the system. Many newer systems have a power switch located on the back of the case that controls the flow of electricity to the power supply, and a power button on the front that boots and shuts down the PC. Most systems also have a reset button, which you can use to restart the PC if it becomes unstable or locked up because of some software glitch.

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**Step 3** Locate the floppy drive. You can recognize it by the 3½-inch horizontal slot. Do you see the eject button below the slot on the right side of the drive? Below the slot on the left side is an LED that lights up when the drive is actively reading or writing information on a floppy diskette.

**✓ Hint**

Because floppy diskettes can store only a relatively tiny amount of data, floppy drives are disappearing from PCs. In fact, most new computer systems ship without floppy drives. If your system doesn't have a floppy drive, you may want to explore an older machine to see one in action. As a computer tech, you will most likely still have to deal with floppy drives for at least a few more years.

On the front of your system, you should also see the external face of your system's optical drive. You'll see either the front edge of the tray that opens to accept an optical disc, or a small door that protects the tray when it's retracted. Once you've located this drive, notice that it too has a button in the lower-right corner. When the system is on, you can press that button to open the tray door (if there is one) and slide the tray out to receive your disc (see Figure 3-2). Pressing the button while the tray is out retracts the tray so that the drive can read the disc.

Don't be tempted to force the disc tray to close. Always press the button on the front of the drive to close the tray or to eject a disc. Forcing the tray to close can cause the gears inside to become misaligned, so that the tray no longer closes properly.



**FIGURE 3-2** Can you locate the floppy drive and optical drive on this system unit?

**✓ Hint**

If you forget to remove an optical disc before turning off the system power, you can straighten a strong paper clip and insert one end into the tiny hole on the front of the drive. Pressing directly inward with the paper clip will cause the tray to open.

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Your system may have other devices installed, such as a *USB flash drive* (a solid-state device that plugs into a USB port but acts like a hard drive), a tape drive, a Blu-ray Disc drive, or various media card readers, such as those for CompactFlash or Memory Stick cards. Each of these uses removable media; take care when inserting or removing the media.

**→ Note**

With USB flash drives—or *thumb drives*, as they're often called—the drive is the removable media.

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**Step 4** Now it's time to prepare your system for the scenario outlined in the opening text:

- a. Turn on your system and log on in a normal fashion so that you are viewing the operating system desktop.
- b. Press the eject button on the front of the optical drive. When the tray opens, carefully insert a disc. Press the eject button again to close the tray. If you haven't done this a lot, practice inserting and removing a disc until you feel comfortable with the process. Does the LED on the front of the optical drive flash or stay on continuously at any point?

**✘ Warning**

Don't start any applications yet! Close any open applications or open windows before performing Step 5. You're going to force a "power down," and you do not want to damage any of the software applications.

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**Step 5** Now you're going to simulate a PC that has become nonresponsive and "locked up." Perform a forced power down as follows:

- a. Press *and hold* the power button.
- b. While continuing to hold the power button in, count out loud (one—one thousand, two—one thousand, three—one thousand . . .) until the system powers down and the screen goes blank.



According to your count, how many seconds did it take for the screen to go blank?

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**Step 6** After the system has been powered down for approximately one minute, do the following:

- a. Press the power button and allow the system to boot.

Did the system boot properly? \_\_\_\_\_

- b. Log on in a normal fashion so that you are viewing the operating system desktop.

Were you able to log on as normal? \_\_\_\_\_

- c. Select Start | My Computer or Computer and double-click the icon that represents the optical drive. This should enable you to view the contents of the disc that was inserted prior to the forced power down.

List some of the contents of the disc: \_\_\_\_\_

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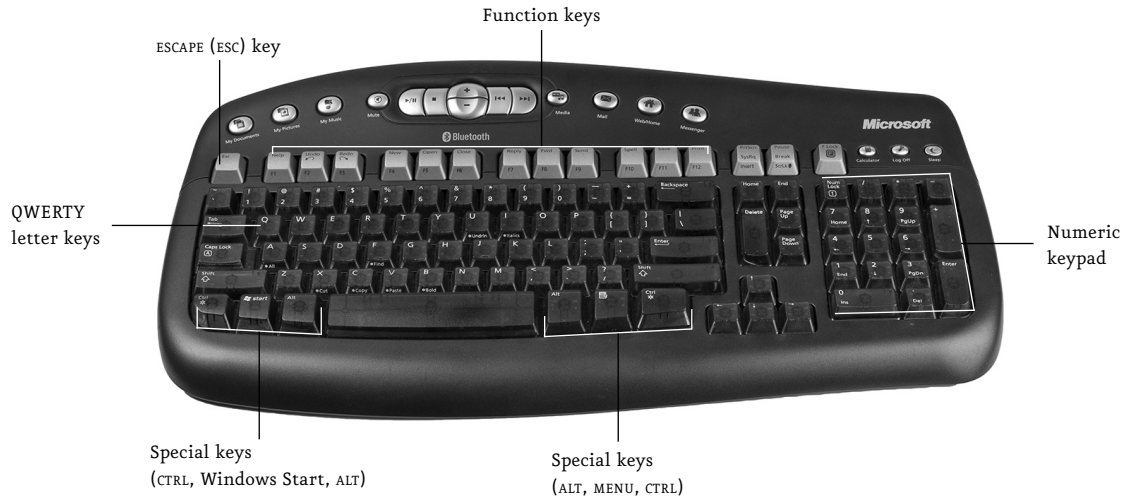
- d. Select Start | Shut Down. If you're using Windows Vista, it goes straight to a shutdown routine. Windows 2000/XP opens the Shut Down Windows dialog box, in which you select Shut down from the drop-down list. This performs a graceful shutdown of the system.

#### ✓ Hint

If all the actions in Step 6 were successful, the system likely is stable and you can report to the IT manager that Jane's machine is back up and running. If any of the actions failed, you should select Start | Restart in Windows Vista or Start | Shut Down in Windows 2000/XP. In the Shut Down Windows dialog box, select Restart from the drop-down list. After the system reboots, you may complete actions b, c, and d once more. Sometimes the forced power down leaves some of the files in a state of flux; restarting shuts the computer down "gracefully," properly closing all open files before powering down. This should clear everything up and enable the computer to function properly.

**Step 7** While the computer is turned off, pretend you lost power and must remove the disc from the optical drive without power. Use a paper clip to remove the disc, as noted earlier in the Lab Hint under Step 3.

**Step 8** As a technician, you need to understand the keyboard, because it is still one of the most important human interfaces connected to a PC. Look at the way your keyboard is laid out: it basically has three main sections, with some extra keys thrown in for good measure (see Figure 3-3).



**FIGURE 3-3** Exploring the QWERTY keyboard

The largest area of the keyboard is the standard *QWERTY* (pronounced “kwerty”) letter key layout, which is familiar to touch typists everywhere. If you never took a typing or keyboarding class, you may be wondering what I mean by *QWERTY*; it’s simply the standard keyboard used in the U.S. and most English-speaking countries, so named for the first six letters in the top row of letter keys.

To the right of the letter keys you’ll usually see a square numeric keypad similar to those found on old adding machines. This feature is popular with people like accountants and merchants, because it makes entering numbers quicker and easier.

Above the letter keys, you’ll find a special row of keys called *function keys*, normally labeled *F1* through *F12*. What these keys do depends on the software you’re using when you press them; pressing the *F1* key, for example, generally calls up a program’s help feature. Function keys are used for various tasks, including accessing basic system settings at startup. You’ll use the function keys a lot when troubleshooting a downed system.

#### → Note

Many modern keyboards include a switch to toggle the purpose of the function keys from performing the standard *F1* through *F12* functions to being some sort of multimedia controls, such as volume up or down or go to the next song. Others offer helpful functions, such as back and next keys for controlling a Web browser. If the function key doesn’t behave as a standard key, look for the function key toggle.

In the keyboard's upper-left corner, next to the function keys, you'll see the Escape key, labeled ESC. In many programs, particularly older ones, pressing this key backs you out of what you're doing, sometimes even causing your current program to close down. In more modern software, pressing ESC is a way to make a program let go of some text or graphic you've selected, or to close the current dialog box without implementing any changes.

To the right of the function keys are the PRINT SCREEN, SCROLL LOCK, and PAUSE/BREAK keys; depending on your keyboard, any or all of these key names may be abbreviated. These specialized keys aren't heavily used these days, although some programs (such as Windows Clipboard) use the PRINT SCREEN key to capture snapshots of the monitor display (known as a screen shot). Screen shots can come in handy when you're troubleshooting program or application problems and need to show someone else what you're seeing (see Figure 3-4).

Along the bottom row of the keyboard, on either side of the SPACEBAR, you'll find the special keys labeled CTRL (for Control) and ALT (for Alternate). On keyboards designed for use with Windows operating systems, you'll also find a key with the Windows logo (which opens the Windows Start menu), and possibly one with a menu symbol as well (which opens a context menu without using the mouse). For the most part, the CTRL and ALT keys don't do anything by themselves, but they are incredibly useful when combined with other keys. In many word processing programs, for example, holding down the CTRL key while pressing the s key has the same effect as selecting File | Save using the mouse—only faster and easier. Techs use these types of key combinations a lot; in this manual you'll see them represented with a hyphen between the keys, for example CTRL-S.

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C:\WINDOWS\system32\cmd.exe
C:\>ipconfig /all

Windows IP Configuration

    Host Name . . . . . : AndyXP
    Primary Dns Suffix . . . . . : totalhome
    Node Type . . . . . : Hybrid
    IP Routing Enabled. . . . . : No
    WINS Proxy Enabled. . . . . : No
    DNS Suffix Search List. . . . . : total

Ethernet adapter Local Area Connection 2:

    Connection-specific DNS Suffix . : 
    Description . . . . . : Realtek RTL8139 Family PCI Fast Eth
    Physical Address. . . . . : 00-40-F4-3A-E6-D0
    Dhcp Enabled. . . . . : Yes
    Autoconfiguration Enabled . . . . : Yes
    IP Address. . . . . : 192.165.4.25
    Subnet Mask . . . . . : 255.255.255.0
    Default Gateway . . . . . : 192.165.4.1
    DHCP Server . . . . . : 192.165.4.11
    DNS Servers . . . . . : 192.165.4.11
    Primary WINS Server . . . . . : 192.165.4.11
    Lease Obtained. . . . . : Tuesday, September 19, 2006 11:57:53
    Lease Expires . . . . . : Wednesday, September 27, 2006 11:57:
C:\>_
  
```

**FIGURE 3-4** A screen shot showing important information for a networked PC



## Lab Exercise 3.03: Recognizing External Connections

Just as you finish working with Jane's PC, her intercom buzzes. It's the head of IT, and she has a new assignment for you: The new satellite office in Albuquerque has received a delivery of new PCs, but the machines are all in boxes and not one of the salespeople there knows a mouse from a monkey wrench. Your job is to call them up and walk them through the process of connecting a PC, describing each cable and connector, and explaining how they connect to the PC.

### Learning Objectives

In this lab, you will identify, describe, and explain the function of the external connections on a standard PC.

At the end of this lab, you will be able to

- Identify the external connectors on a PC and the related cables
- Explain the function of each external connection

### Lab Materials and Setup

The materials you need for this lab are

- At least one fully functioning PC that's less than two years old (two or more systems is ideal, with one older than and one newer than two years old)
- A notepad on which to take notes and make sketches of the computer, connections, and connectors
- Optionally, a digital camera to record the connections and connectors instead of sketching

In addition, a lab partner would be useful.

#### ✓ Cross-Reference

Before you begin this lab, read the sections "External Connections" and "Devices and Their Connectors" in Chapter 3 of *Mike Meyers' CompTIA A+ Guide to Managing and Troubleshooting PCs*.

### Getting Down to Business

Now it's time to learn about all the external things that can be attached to a PC. This lab exercise steps you through identifying and understanding the function of the various connectors. If you have access to the same computer that you used in the previous lab, consult your drawings, notes, and any photos you may have taken to assist you in the completion of the exercise.

**✘ Warning**

Shut off the power to your system and unplug your PC from the wall socket before you start the following exercise.

**Step 1** Look at all those wires coming from the back of your PC! There's a power cable, a telephone or network cable, probably a printer cable, a keyboard cable, a mouse cable, and maybe a few others, depending on your system. Looking at the back of my current system (the one I'm using to write this manual), I count 15 cables directly connected to it. Yowza!

The great thing about PCs is that it's difficult to connect the cables incorrectly. Each one has a unique connector; some are male (connectors with pins), and some are female (connectors with holes). Each connector has a particular shape and a specific number of pins or holes that match those of a specific device connected to the system unit.

Get your notepad ready to take notes and draw pictures.

**✓ Hint**

Cables have conductors. A *conductor* is a wire that can carry electrical signals. You may see a cable described by the number of conductors it has; for example, a telephone cable can be a two- or four-conductor cable. A power cable is a three-conductor cable. A network cable is an eight-conductor cable.

**Step 2** Unplug each of your PC's cables one at a time and practice plugging it back in until you get a feel for how it fits. You should not have to force any of the cables, though they may be firm. How is each cable held in place and prevented from coming loose? Is there a screw, clip, or some other fastener that holds the cable connector tight to the system? Is the connector keyed? What does it connect to? What is the shape of the connector on each end? Is it round, rectangular, D-shaped? How many pins or holes does it have? How many rows of pins or holes are there?

**Step 3** Is it possible to plug any cable into the wrong connector? If so, which one(s)? What do you think would happen if you plugged something into the wrong connector?

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**Step 4** Remove or disconnect any of the following cables from your system and describe its connector. Follow this example:

- Data cable from the monitor to the PC

Type of connector: End 1 (PC) D-sub End 2 D-sub

Male or Female: End 1 (PC) F End 2 M

Number of pins/holes/conductors: 15

✓ **Hint**

Your PC may not have all of these cables; just document the ones you do have.

Now it's your turn!

- Data cable from the printer to the PC (both ends)

Type of connector: End 1 (PC) \_\_\_\_\_ End 2 (printer) \_\_\_\_\_

Male or Female: End 1 (PC) \_\_\_\_\_ End 2 (printer) \_\_\_\_\_

Number of pins/holes/conductors: End 1 (PC) \_\_\_\_\_ End 2 (printer) \_\_\_\_\_

- Data cable from the keyboard to the PC

Type of connector: \_\_\_\_\_

Male or Female: \_\_\_\_\_

Number of pins/holes/conductors: \_\_\_\_\_

- Data cable from the mouse to the PC

Type of connector: \_\_\_\_\_

Male or Female: \_\_\_\_\_

Number of pins/holes/conductors: \_\_\_\_\_

- Data cable from the network (cable modem/DSL modem) to the PC (both ends)

Type of connector: \_\_\_\_\_

Male or Female: \_\_\_\_\_

Number of pins/holes/conductors: \_\_\_\_\_

- Data cable (telephone wire) from the internal modem to the telephone jack (both ends)

Type of connector: \_\_\_\_\_

Male or Female: \_\_\_\_\_

Number of pins/holes/conductors: \_\_\_\_\_

**Step 5** If you're working with someone else, play "Flash Cords." Have your partner hold up various cables, and try to guess what they connect to by the connectors on the ends. Then switch roles and quiz your partner. Another really good way to learn the connector names is to have your partner sit behind the computer, while you reach around from the front, feel the various ports with your fingers, and call them out by name. Switch back and forth with each other until you both can easily identify all the ports by touch.

**Step 6** Properly reconnect all the cables that you removed and prepare to turn on the system. If you have an On/Off button on the back of the system, be sure it is set to the on position. Make sure the monitor is turned on as well.

**Step 7** Examine other computers to see if they have different connectors from the ones you've already documented. See if you can identify the peripherals that connect to those sockets and plugs.

**Step 8** The two system units in Figure 3-5 look different, but they have many connectors in common. Try to find the following connectors on each system unit:

- Power
- Keyboard
- Monitor
- Printer
- Mouse
- Network



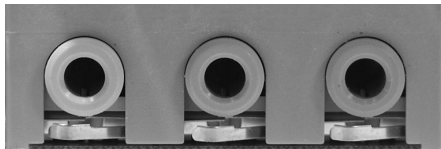
**FIGURE 3-5** Can you match the connectors on these two system units?

**Step 9** Describe the connector that matches each type of cable in the list. Use Chapter 3 of *Mike Meyers' CompTIA A+ Guide to Managing and Troubleshooting PCs* or your notes (photos) for reference.

Cable Type	Connector Type(s)
Keyboard cable	
Mouse cable	
Speaker cable	
Monitor data cable	
Printer data cable (printer end)	
Printer data cable (PC end)	
Network data cable	
Modem/telephone wire	

**Step 10** Identify the connectors pictured next. What is the name of each connector and what does it connect to?

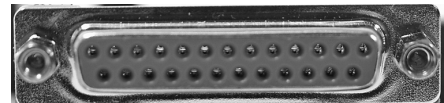
A. \_\_\_\_\_



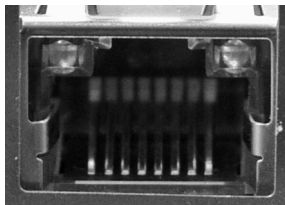
B. \_\_\_\_\_



C. \_\_\_\_\_



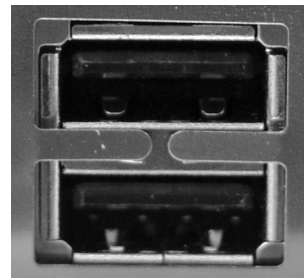
D. \_\_\_\_\_



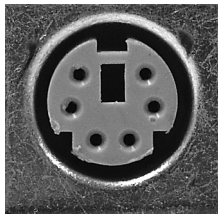
E. \_\_\_\_\_



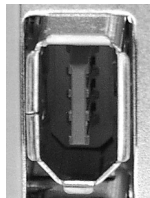
F. \_\_\_\_\_



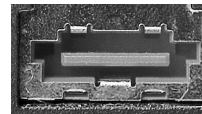
G. \_\_\_\_\_



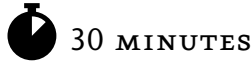
H. \_\_\_\_\_



I. \_\_\_\_\_







## Lab Exercise 3.04: Safeguarding Against Damage from Electrostatic Discharge (ESD)

So far, everything that you've explored has been accessible without removing the cover of the PC. In the next few labs, you'll be opening up the case to explore the components inside. As discussed in *Mike Meyers' CompTIA A+ Guide to Managing and Troubleshooting PCs*, good techs always protect themselves and the systems they work on from damage caused by electricity and *electrostatic discharge (ESD)*, the movement of a static charge from you to something you touch that can cause damage to sensitive electronic components. Protecting yourself is fairly easy at this point: unplug the power cord from the electrical outlet and from the power supply on the PC (see Figure 3-6).

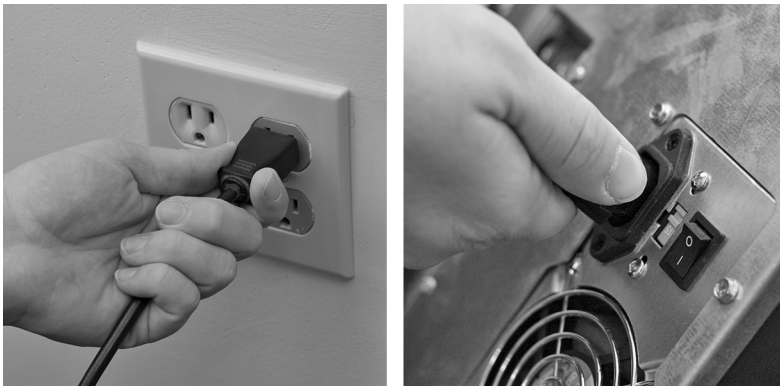
To protect the system unit's sensitive components, you can use the following tools:

- Anti-static wrist strap
- Anti-static mat or anti-static wrist strap and mat combination
- Anti-static bag

Proper use of these tools will help safeguard the components of the system unit against ESD damage—just as removing the power cord from the PC and the wall will help ensure that you are around to work on PCs for many years to come!

### Learning Objectives

In this lab you will learn the techniques to protect both yourself and the sensitive components of the computer system from damage caused by electricity and ESD.



**FIGURE 3-6** Unplug the power cords to protect yourself.

After completing this lab, you'll be able to

- Disconnect the power cord from the PC and the wall outlet, protecting yourself from electrocution
- Properly connect an anti-static wrist strap or anti-static wrist strap/mat combination
- Properly store unused components in an anti-static bag

## Lab Materials and Setup

The materials you need for this lab are

- At least one PC that isn't vital to your (or anyone else's) home or business, not necessarily in working order but preferably less than a few years old
- An anti-static wrist strap
- Optional: anti-static mat
- Twelve anti-static bags of various sizes
- A clean, well-lit workspace of about 3' × 4' (a kitchen table with some newspaper spread about usually makes a fairly decent ad hoc lab bench)

In addition, a lab partner would be useful.

## Getting Down to Business

The key to working on PCs without damaging their delicate components is caution. In this exercise, you'll prepare for a cautious (and if done properly, harmless) exploration of the system's internal organs.

### ✘ Warning

*Shut off the power to your system and unplug the power cord from your PC and from the wall socket before you do the following exercise.*

**Step 1** Disconnect all the external cables (monitor, keyboard, mouse, printer, etc.) from the PC you are going to use and place it on a flat, stable surface (preferably on an anti-static mat) near which you can sit or stand comfortably to inspect the insides.

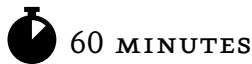
**Step 2** Using whichever method applies to your case (thumbscrews, Phillips-head screws, locking tabs, or Torx screws), remove the cover of your system unit. Don't get frustrated if the cover-removal method isn't obvious at first. Even seasoned techs can have a hard time figuring out how an unfamiliar case opens.

**Step 3** Locate a place on the chassis (the metal frame inside the case) to which you can attach the alligator clip of the anti-static wrist strap or anti-static mat (whichever one you decided to purchase). Be prepared to wear the anti-static wrist strap in later labs (see Figure 3-7).



**FIGURE 3-7** Proper use of an anti-static wrist strap

**Step 4** Locate and place the anti-static bags on your workspace. These will be used in later labs to store components safely after removal. This machine may be disassembled for a few days, so you'll need to protect the components from any ESD exposure during that time. Anti-static bags do a great job of preventing ESD.



60 MINUTES

## Lab Exercise 3.05: Disassembling the System Unit and Identifying Internal Components and Connections

As promised, it's finally time to go under the hood!

You're now going to walk through the complete disassembly of the system unit. You should try to do this in the sequence presented in this lab exercise, but, depending on the configuration of the machine you are disassembling, you may have to perform one or two of the steps out of sequence. For example, you may have to remove an optical drive before you can gain access to remove the power supply.

When you're on the job, you'll encounter different models of personal computers manufactured by different companies. Along with learning the slightly different methods of component removal and installation, you should also learn how to identify the major internal parts of the PC system, regardless of the manufacturer. This lab exercise will help you practice doing that.

### Learning Objectives

In this lab exercise you will locate, remove, and describe the various internal components and connectors of a standard PC system.

At the end of this lab, you'll be able to

- Remove all major components of a PC
- Recognize all major components inside a PC
- Describe the function of each component
- Define the relationship of internal components to external connections

## Lab Materials and Setup

The materials you need for this lab are

- At least one PC that isn't vital to your (or anyone else's) home or business, not necessarily in working order but preferably less than a few years old
- An anti-static wrist strap
- Optional: an anti-static mat
- Twelve anti-static bags of various sizes
- A simple technician's toolkit
- A plastic cup or box to organize the various screws, nuts, and bolts that you'll remove
- A clean, well-lit workspace of about 3' × 4' (a kitchen table with some newspaper spread about usually makes a fairly decent ad hoc lab bench)
- A notepad on which to take notes and make sketches of the computer and components
- Optionally, a digital camera to record the placement, configuration, connections, and connectors associated with the components you'll be removing from the system unit

In addition, a lab partner would be useful.

## Getting Down to Business

This lab exercise might remind you of the biology labs in which students dissect animal specimens. You'll be going inside to examine and remove various parts—but unlike in those biology labs, your specimen has a good chance of leading a perfectly normal life afterward!

### ✘ Warning

Shut off the power to your system and *unplug* the power cord from your PC and from the wall socket before you do the following exercise.

---

**Step 1** Disconnect all the external cables (monitor, keyboard, mouse, printer, etc.) from the PC you are going to use and place it on a flat, stable surface (preferably on an anti-static mat) near which you can sit or stand comfortably to inspect the insides.

**Step 2** Use proper anti-static procedures while opening the case and during this entire exercise (see Lab Exercise 3.04). Using whichever method applies to your case (thumbscrews, Phillips-head screws, locking tabs, or Torx screws), remove the cover of your system unit and then lay the system down so that the open side faces the ceiling.

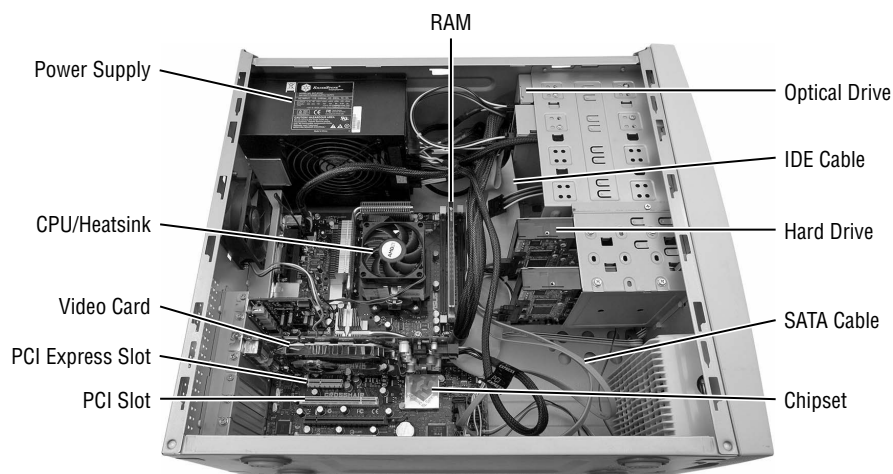
### ✓ Cross-Reference

Review Chapter 3 of *Mike Meyers' CompTIA A+ Guide to Managing and Troubleshooting PCs* to confirm your understanding of proper ESD procedures, and how to open a PC system case.

Look inside your system case. What do you see? To begin with, you'll see lots of cables and wires. Some appear to be single-colored wires, while others seem to be multiple gray-colored wires in the shape of wide ribbons. Most colored wires originate at the power supply and end at the various devices to supply the needed direct current (DC) power to run the PC. The wide ribbon cables attach at various points and are used to transfer data. These are sometimes referred to as *logic cables* or *data cables*.

See if you can locate in your system case the major components labeled in Figure 3-8. You may have to move some of the fan shrouds, wires, and cables in order to find them, especially components on the motherboard—but remember your anti-static procedures and be gentle. Sometimes the slightest bump is enough to unseat a connection.

**Step 3** Now it's time to take some notes, draw some sketches, or take a few pictures. Before you start disassembling this machine, document where the components belong and what wires and cables are connected to the different components. Be prepared to take a few notes on how you actually removed the component. Include as much detail as possible; it will help you tremendously when you're putting the system unit back together.



**FIGURE 3-8** Inside a typical PC

**Step 4** To start, you'll need to clear the way—a bit like peeling an onion, layer by layer—by removing the easily accessible components and cables first.

Look inside the PC and find the expansion slots. How many total expansion cards can be plugged into your system? \_\_\_\_\_

Some of the expansion slots may have cards in them. These may be modem cards, sound cards, network cards, or video cards. Since expansion cards are designed to “expand” the capability of the computer system, they are designed to be installed after the system unit is assembled. For this reason, the expansion cards are a great place to begin your disassembly.

Look at the expansion cards installed in your PC, and then look at the external connectors on each. Can you match the cable to the expansion card?

Remove all installed expansion cards from your system unit. Place each card into an anti-static bag to protect it from ESD damage.

**Step 5** If the machine you are disassembling is only a few years old, it will probably have multiple fan shrouds to make sure the airflow is getting to the main components to keep them cool.

Remove any fan shrouds from your system unit and place them out of the way on your work space.

✓ **Hint**

After you remove each item, especially the bulky items such as fan shrouds, wiring, and cables, it would be good to take a few more notes or pictures. Now that you have a better view of the components underneath, you will be able to consult these notes or pictures during reassembly.

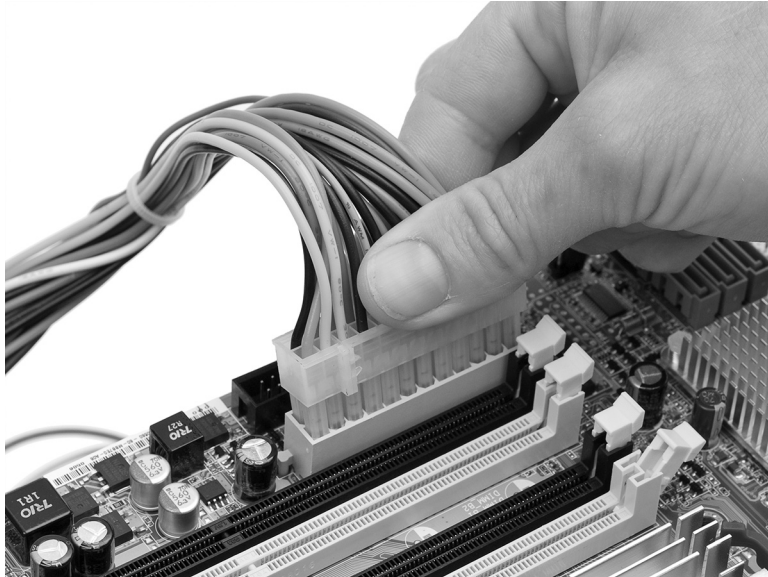
You can complete the next three steps in the order written, or out of order if that works best for your system unit. You'll be removing the power supply wires, the power supply, and the data cables from the components and motherboard. If one of the data cables is in the way of one of the wires, it's okay to remove the data cable first. Please remember to keep good records (notes or photos) of your configuration.

**Step 6** Locate the power supply, which is a large silver or black box in one corner of the system unit case. Trace the colored wires leading out of it. Remember to be gentle!

Find the power plug(s) for the motherboard. If you have a newer PC, it will probably look like the one shown in Figure 3-9.

Find the power connectors for the floppy drive, optical drive, and hard drives. Do they look like one of the connectors shown in Figure 3-10? They should!

Remove all the power connectors from the motherboard and all data drives. Place them to the side as best as you can until you remove the power supply itself.

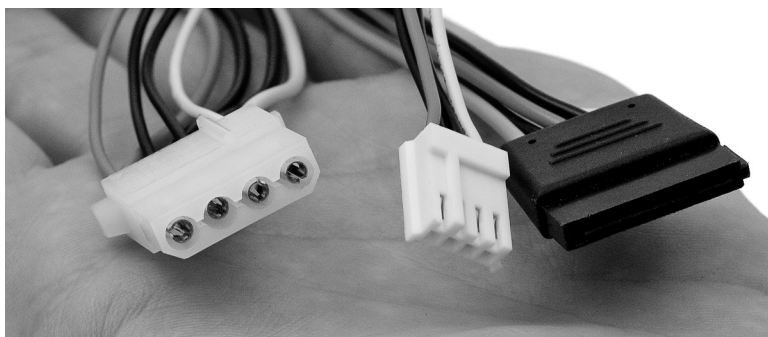


**FIGURE 3-9** Power plug for the motherboard

**Step 7** If possible, remove the power supply at this point. If there are still many cables and components in the way, you can perform this step later in the lab.

**Step 8** Look at the floppy drive, which should be attached to a flat ribbon cable. (Don't worry if your system doesn't have a floppy drive—just move on and explore your other data drives.) Trace the ribbon cable to the motherboard. Do the same for all your other data drives, both hard drives, and optical drives.

These ribbon cables are about 1.5 inches wide, and they are normally gray with a colored stripe on one side. The stripe—usually red—orients the cable properly to the connections on the motherboard and the drive.



**FIGURE 3-10** Power connectors

The cable to the floppy drive has 34 wires (conductors) and in most cases has a twist in the center. Its position relative to this seven-wire twist determines whether a floppy drive is the primary or A: drive for the system (attached to the connector at the end of the cable past the twist), or the secondary B: drive on the system (attached to the center connector).

**✓ Hint**

It's rare to find one floppy drive in a newer system, let alone two. Systems without a floppy drive will also be without a floppy drive cable, though you may still have a 34-pin connector on the motherboard. Systems with only one floppy drive may have a shorter floppy drive cable with no twist and no second drive connector.

Current systems use small, seven-wire data cables for serial ATA (SATA) hard drives and optical drives; these cables have connectors keyed like the letter L. Older systems use wider, 40- or 80-wire flat ribbon cables. Both of these wider cable types still have a colored edge on one side for orientation.

**Step 9** After noting the current state of the data cables, disconnect and reconnect each device's cable in turn. Practice this a few times. Can you plug a cable in backwards? Try it. Plug the cable into the device the wrong way if you can. Older types of cables can be plugged in incorrectly, but newer cables and connectors have built-in keying to prevent this from happening. Make sure that the cables are properly connected when you've finished.

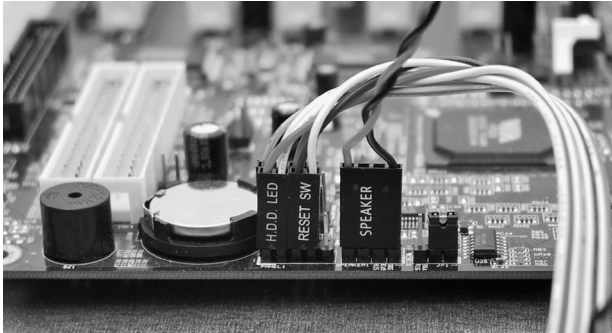
Now look at where the ribbon cables connect to the motherboard. Make note of the proper cable orientation. Practice disconnecting and reconnecting the cables at the motherboard. Is it difficult (or possible) to plug these cables in backwards?

When you feel you have practiced enough, remove the cables and place them safely away from the computer on your work surface. Now would be a great time to make a drawing or take a photograph of the de-cluttered system unit interior.

**Step 10** Most modern systems have a set of small wire and cable runs connecting front panel indicator lights (primarily the power-on and hard drive activity LEDs) and front panel universal serial bus (USB) ports to the motherboard (see Figure 3-11). Look for these individual wire connections (often collectively called *case wires*), which are usually grouped together near one corner of the motherboard. Make careful note of where each tiny connector plugs in—a photo would be incredibly helpful here—and then disconnect them all and tuck the wires out of the way.

**Step 11** Now that all the wires and cables are removed, you should have plenty of room to finish up the disassembly. You're now going to remove all the drives. Drives are usually the most cumbersome to remove because of the drive cages or frames in which they're mounted. Figure 3-12 shows an older system. Depending on the mounting the manufacturer has used, removing a drive may be as simple as pulling out a sliding mechanism, or as complicated as opening up the other side of the system case, removing all the decorative plastic facing, and removing a handful of screws.





**FIGURE 3-11** Various case wires connected to a motherboard

Remove the floppy drive, all optical drives that are present, and the hard drive(s), and set them on your work surface.

**Step 12** Look in your PC and find the random access memory (RAM) modules. RAM comes in thin, wafer-like modules, about three to five inches long by one inch wide. A row of metal contacts running along one of the long edges plugs into a matching socket, three to five inches in length, located on the motherboard. Look for a long wafer standing on its edge; often you'll find two or more RAM modules lined up in a row.



**FIGURE 3-12** Typical drive configuration in a PC tower system case; note the cages or frames used for mounting the various drives

How many RAM modules do you have? \_\_\_\_\_

Do you have dual inline memory modules (DIMMs) or single inline memory modules (SIMMs)?  
\_\_\_\_\_

Making sure to follow proper anti-static procedures, remove the SIMMs or DIMMs from their slots and place them in an anti-static bag for safekeeping.

**Step 13** Look in your PC and see if you can locate the central processing unit (CPU). Running CPUs generate a fair amount of heat, so they need their own dedicated cooling mechanisms. Because of this, when you search the motherboard to try to find the CPU, you'll generally find it hidden under a fan/heat sink unit.

Carefully remove the fan/heat sink unit from the CPU.

#### ✘ Warning

Make sure you fully understand how to remove your particular model of CPU fan before you try it!

If you were able to remove the fan, make a note of the type of CPU chip you have:  
\_\_\_\_\_

If you're in a computer lab with multiple systems, examine a number of different CPU chips. Note where each CPU is located on the motherboard.

Making sure to follow proper anti-static procedures, lift the lever of the zero insertion force (ZIF) socket, remove the CPU, and place it in an anti-static bag for safekeeping.

**Step 14** See if you can locate any jumpers or switches on your motherboard. Resist the temptation to play with them at this point—just make a note of what you find. In particular, look for the identifying labels on the motherboard.

**Step 15** Making sure to follow proper anti-static procedures, remove the screws that secure the motherboard to the chassis or frame of the system case. Place the motherboard in a properly sized anti-static bag and put it aside.

Congratulations! You have just successfully disassembled your first PC! If you have used an area where you can leave the components, wires, cabling, and hardware for a while, you can leave the PC disassembled for later labs. If you really need to clean up the area for now, you can either follow your notes (and lab steps) in reverse order to reassemble the system, or find a large box in which to store the disassembled machine until your next lab session.

Don't worry about the ESD-sensitive components; as long as they are in their anti-static bags, they should be fine.

**Step 16** You have explored and removed nearly all the components of a typical PC system unit. To finish this lab exercise, see if you can correctly match the components in the following list to the items indicated in Figure 3-13.

- |              |       |                  |       |
|--------------|-------|------------------|-------|
| Hard drive   | _____ | Optical drive    | _____ |
| Chipset      | _____ | RAM              | _____ |
| CPU/Heatsink | _____ | PCI Express slot | _____ |
| PCI slot     | _____ | SATA cable       | _____ |
| Power supply | _____ | IDE cable        | _____ |
| Video card   | _____ |                  |       |



**FIGURE 3-13** Do you recognize these components inside your PC?

## Lab Analysis Test

1. Joe has just moved his PC to his new office. After hooking up all the cables, he turns on the system, and when it asks for his password, the keyboard will not respond. What could possibly be wrong?
2. Theresa has just finished the production of a PowerPoint presentation detailing the design of a new office building. She has included some cool 3-D animations in the presentation to show off the design. When she attempts to save the presentation to a floppy diskette, an error occurs. What might have caused the error? Do you have any suggestions that may solve the problem?
3. Cal has purchased a new set of speakers for his PC. The old ones worked just fine, but he wanted more power and a subwoofer. When he plugged in the new speakers, they would not work. Power is on to the speakers. What is the first thing you would check?
4. John had a new modem installed in his computer at a local computer shop, where he watched as the system successfully connected to his AOL account. When he got home and tried, however, he couldn't get a dial tone. He calls you to ask for help. What should you suggest that he check first?
5. Audrey removed the case of her PC to check the type of RAM she has installed. When she put the case back on and tried to start the PC, she got a message that there's a problem with her hard drive. What is a good reason this might have happened?

## Key Term Quiz

Use the following terms to complete the following sentences. Not all of the terms will be used.

ALT key

anti-static bag

anti-static mat

anti-static wrist strap

case wires

cold boot

CTRL key

data cable

electrostatic discharge (ESD)

ESC key

female connector

FireWire

function keys

hard boot

light-emitting diode (LED)

male connector

optical drive

power cable

power down

QWERTY

random access memory (RAM)

ribbon cable

thumb drive

USB flash drive

1. A standard keyboard is referred to as a(n) \_\_\_\_\_ keyboard.
2. The \_\_\_\_\_ are used for various tasks depending on the software you're using when you press them.
3. The movement of a static charge from you to something you touch is called \_\_\_\_\_ and can damage sensitive electronic components.
4. A solid-state device commonly used to store data is called a \_\_\_\_\_.
5. A Blu-ray Disc drive is a type of \_\_\_\_\_.