

Building a Budget PC Now!

Lesson 2

Before you proceed, make sure you have everything you need. Open each box and verify the contents against the packing list. Once you're sure everything is present and accounted for, it's time to get started.



Figure 3-1. Budget system components, awaiting construction

Task 1 Preparing the Case and Installing Drives

The first step in building any system is always to make sure that the power supply is set to the correct input voltage. Some power supplies, including the Antec EarthWatts 380, set themselves automatically. Others must be set manually using a slide switch to select the proper input voltage. Bundled power supplies are nearly always set properly by default, if applicable, but there are rare exceptions, so it's always a good idea to verify the input voltage setting before you proceed.



If you connect a power supply set for 230V to a 115V receptacle, no harm is done. The PC components will receive only half the voltage they require, and the system won't boot. But if you connect a power supply set for 115V to a 230V receptacle, the PC components will receive twice the voltage they're designed to use. If you plug in the system, that over voltage will destroy it instantly in clouds of smoke and showers of sparks.

Opening the Case

Task 1.1 To begin preparing the case, remove the two thumbscrews that secure the top panel, as shown in Figure 3-2.



Figure 3-2. Remove the two thumbscrews that secure the top panel



Figure 3-3. Slide the top panel to the rear to release it

Task 1.2 After you remove both thumbscrews, slide the top panel slightly toward the rear, as shown in Figure 3-3, and then lift it off.

Task 1.3 With the top panel removed, lift the left side panel straight up and remove it, as shown in Figure 3-4. Remove the right side panel in the same manner. Put the top panel and both side panels safely aside, where they won't be scratched while you are building the system.



Figure 3-4. Remove the side panels and set them safely aside

Mounting the Hard Drive

Task 1.4 Slide your hard drive into the drive bay, with the rear (data and power connector side) of the hard drive toward the rear of the drive bay. Slide the drive forward and backward until two of the screw holes in the hard drive align with the holes in the rubber grommets on the drive bay. When the drive is correctly aligned, the rear of the drive should protrude slightly from the rear of the drive bay, as shown in Figure 3-8.

Task 1.5 The parts bag includes special screws designed to mount hard drives in this bay. These screws (two of them fully visible in Figure 3-8) are threaded for only part of their length. The unthreaded portion is supported by the silicone grommet, which isolates the drives to reduce noise and vibration. Insert four of these screws, two per side, and tighten them finger-tight plus a quarter turn or so. Do not overtighten the screws, or you'll eliminate the benefits of the grommets.

If you have more than one hard drive to install, repeat these steps for the other drives. If you're installing two drives, leave at least one unoccupied mounting slot between them to improve ventilation.

Task 1.6 After you install the hard drive or drives in the bay, slide the drive bay back into position, as shown in Figure 3-9. Make sure the locking tabs and slots on the two drive bays latch into position as you slide the bay into place. Also note the slot on the center-front edge of the drive bay (visible at the bottom of Figure 3-9), which mates with a corresponding metal tab on the chassis.



Sharp Edges

Be careful when removing the metal RF shield, and be careful working in that drive bay later. Snapping the metal RF shield free leaves a sharp burr on the top edge of the remaining RF shield.



Figure 3-8. Slide the hard drive into the internal drive bay and secure it with four hard drive mounting screws

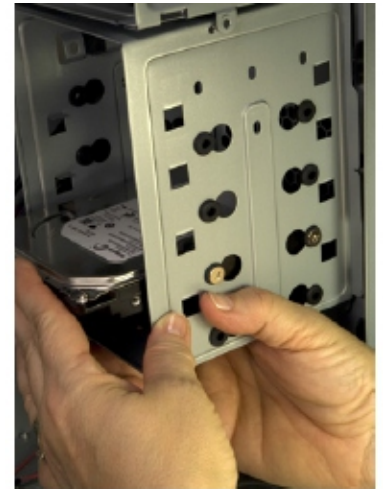


Figure 3-9. Slide the internal drive bay back into place and secure it with the three screws you removed earlier

Snap in the Optical Disc



Figure 3-10. Working from inside the case, press the top plastic drive bay bezel until it snaps out



Figure 3-11. Slide the optical drive into the drive bay until its bezel is flush with the case bezel

Task 1.11 Locate the optical drive mounting screws in the parts bag. These screws are the most finely threaded in the bag. Use at least four screws (two per side) to secure the optical drive to the chassis, as shown in Figure 3-12. Tighten the screws finger-tight plus maybe a quarter turn. (It's difficult to overtighten these screws because their heads are quite shallow. Your screwdriver will lose its grip before you can overtighten them.)

Task 1.7 The next step is to install the optical drive. To begin, use your fingers from inside the case to press outward on the top plastic bezel cover until it snaps free, as shown in Figure 3-10.

Task 1.8 If you have a second 5.25" device to install (such as the Antec Easy SATA hard drive docking station), you'll need to prepare a second 5.25" drive bay. To do so, use a screwdriver to twist the metal RF shield (behind the plastic bezel cover) back and forth until it snaps free.

Task 1.10 Using both thumbs, slide the optical drive into the drive bay, as shown in Figure 3-11. If it binds, pull the drive out slightly and reseal it. Press the drive bezel flush with the case bezel.



Figure 3-12. Use at least four screws (two per side) to secure the optical drive to the chassis

Placing the I/O Shield

Task 1.12 Nearly every case we've ever used, including the Antec NSK-4482, comes with a generic I/O shield. The generic shield never matches the motherboard I/O panel, so you'll need to remove the stock I/O shield and replace it with the one supplied with the motherboard.

Task 1.13 To remove the I/O shield, use a tool handle to press from outside the case until the I/O shield pops loose, as shown in Figure 3-13. Be careful with your fingers: I/O shields are made of thin metal and may have edges sharp enough to cut you. Don't worry about damaging the generic I/O shield supplied with the case. You can discard or recycle it.



Figure 3-13. Remove the I/O shield supplied with the case



Figure 3-14. Install the I/O shield supplied with the motherboard

Like all motherboards, the ASRock K10N78M-PRO comes with a custom I/O shield that matches the motherboard I/O panel. Before you install the custom I/O shield, compare it to the motherboard I/O panel to make sure the holes in the I/O shield correspond to the connectors on the motherboard.

Task 1.14 Once you've done that, press the custom I/O shield into place. Working from inside the case, align the bottom, right, and left edges of the I/O shield with the matching case cutout. When the I/O shield is positioned properly, press gently along the edges to seat it in the cutout, as shown in Figure 3-14. It should snap into place, although getting it to seat properly sometimes requires several attempts. It's often helpful to press gently against the edge of the template with the handle of a screwdriver or nut driver.

Standoffs Mounting

Task 1.15 The ASRock K10N78M-PRO motherboard has six mounting holes. Some cases are shipped with several standoffs already installed, but the Antec NSK-4482 has no standoffs preinstalled. So, we need to install standoffs in all six of the positions required by the motherboard.

Task 1.16 Install brass standoffs for each motherboard mounting hole. Although you can screw in the standoffs using your fingers or needlenose pliers, it's much easier and faster to use a 5 mm nut driver, as shown in Figure 3-16. Tighten the standoffs finger-tight, but do not overtighten them. It's easy to strip the threads by applying too much torque with a nut driver.

Task 1.17 Once you've installed all the standoffs, do a final check to verify that (a) each motherboard mounting hole has a corresponding standoff, and (b) no standoffs are installed that don't correspond to a motherboard mounting hole. As a final check, we usually hold the motherboard in position above the case and look down through each motherboard mounting hole to make sure there's a standoff installed below it.



If your case comes with preinstalled brass standoffs, make absolutely certain that each standoff matches a motherboard mounting hole. If you find one that doesn't, remove it. Leaving an "extra" standoff in place may cause a short circuit that may damage the motherboard and/or other components, or at least cause a boot failure.

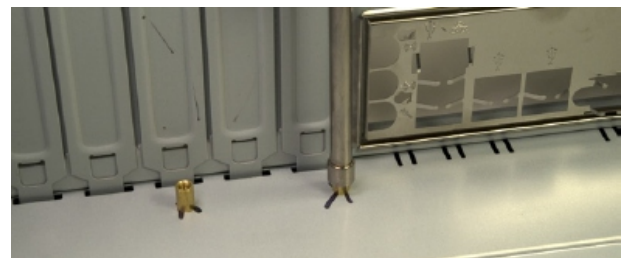
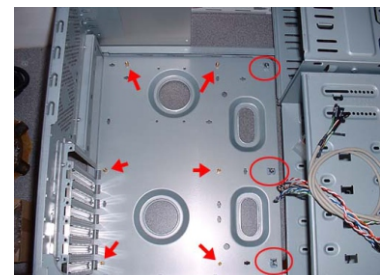


Figure 3-16. Install a brass standoff at each marked position



Standoffs positions

Task 2 Populating the Motherboard & Accessories

Install the Processor

Task 2.1 With the case prepared, the next step is to populate the motherboard by installing the processor, CPU cooler, and memory. To begin, place the motherboard on a firm, flat surface. Place the pink antistatic foam supplied with the motherboard between it and the work surface to protect the motherboard against physical or static electricity damage.

Task 2.2 Locate the metal cam lever on the side of the processor socket. In its closed position, along the edge of the processor socket, this lever applies pressure to lock the processor pins into the socket. In its open position, with the lever vertical relative to the socket, that pressure is released, allowing a processor to be inserted or removed without damaging the pins. Press the cam lever slightly outward (away from the socket) to release it from the plastic latches that secure it, and then lift the lever, as shown in Figure 3-17, to the full vertical position.

Task 2.3 Open the inner package carefully and remove the processor from the antistatic foam bed upon which it rests. Orient and align the processor with the processor socket. The socket has an arrow on one corner that corresponds to an arrow on one corner of the processor. Make sure these arrows are aligned, and then simply drop the processor into the socket, as shown in Figure 3-18.

The processor should seat flush with the socket without any pressure being applied. **Never press down on the processor, or you may bend the processor pins and ruin it.** If the processor doesn't drop into the socket freely, it's not aligned properly. Realign it and try again until it drops easily into the socket and seats completely.

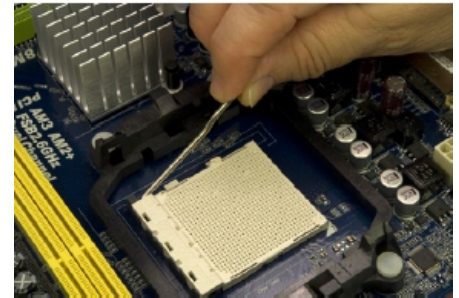


Figure 3-17. Release the cam lever from the processor socket and lift it up



Figure 3-18. Orient and align the processor properly with the socket and then drop it into place



Figure 3-19. Press the cam lever down and snap it into place under the plastic locking tab on the processor socket

Task 2.4 The processor should seat flush with the socket without any pressure being applied. **Never press down on the processor, or you may bend the processor pins and ruin it.** If the processor doesn't drop into the socket freely, it's not aligned properly. Realign it and try again until it drops easily into the socket and seats completely.

Attached CPU Cooler to Processor

Task 2.5 The CPU cooler clamps to the processor socket with two metal brackets that fit over plastic tabs on opposite sides of the processor socket. One of the brackets is free-floating. The other has a latching lever that cams the CPU cooler into tight contact with the processor. You can place either bracket over either tab, but it's easier to use the latching bracket on the tab nearest the edge of the motherboard, where there's more room to maneuver.

Task 2.6 Locate the latching bracket on one side of the CPU cooler. Tilt that side of the CPU cooler slightly up from the processor surface, and hook the free-floating bracket over the black plastic tab on the edge of the processor socket, as shown in Figure 3-20. Make sure the hole in the bracket catches the tab, and then lower the other side of the CPU cooler until its base is in full contact with the processor. (You may have to use your finger to hold the bracket in place.)



Figure 3-20. Hook the free-floating metal bracket over the black plastic tab on the processor socket

Task 2.7 Making sure that the first bracket remains connected and maintaining finger pressure to keep the CPU cooler in position, press the second (cammed) bracket into position over the second tab, as shown in Figure 3-21.



Figure 3-21. Press the latching bracket into position over the second tab

Task 2.8 Verify that both brackets are secured over both tabs, and then press the black plastic cam lever down until it latches to lock the CPU cooler to the processor socket, as shown in Figure 3-22.

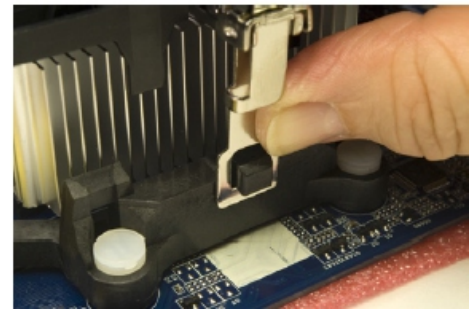


Figure 3-22. Press the black plastic cam lever on the CPU cooler down until it latches to secure the CPU cooler to the processor socket

Task 2.9 Ordinarily, we make a point of connecting the CPU cooler fan to the motherboard fan power header pins immediately after installing the CPU cooler, lest we forget to do so. With this motherboard and CPU cooler, though, there's a slight problem. The length of the CPU fan cable and the location of the CPU fan power connector on the motherboard make it easier to install the memory modules before connecting the fan.

Plugged-in the Memory Modules

Task 2.3 To install the memory modules, open the DIMM locking brackets on both sides of both memory sockets, as shown in Figure 3-23.

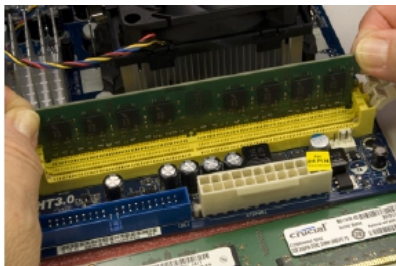


Figure 3-23. Open the DIMM locking tabs on both sides of both memory sockets

Task 2.10 Touch the chassis or power supply to ground yourself before you handle the memory modules. Align one DIMM with the memory slot nearest the processor, as shown in Figure 3-24. Make sure the keying notch on the contact edge of the memory module aligns with the keying tab in the socket and that the two sides of the memory module fit into the slots on the vertical sides of the memory slot.

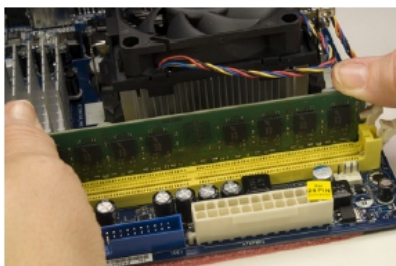


Figure 3-24. Align the memory module with the socket

Task 2.11 Align the memory module and the slot, with the DIMM vertical relative to the slot and both sides of the DIMM aligned with the vertical slots in the socket. Using both thumbs, press straight down on the memory module until it seats, as shown in Figure 3-25.



Figure 3-25. Press straight down on both sides of the memory module until it seats completely in the socket

Task 2.12 Before you install the second memory module, make sure the first module is fully seated and latched. The metal contacts on the base of the memory module should be concealed by the memory socket, and the plastic latching tabs on the memory socket should snap into place to latch the module into position, as shown in Figure 3-26.

Task 2.13 With the memory installed, you can now connect power to the CPU fan. This connector is keyed by plastic tabs on the cable connector and the motherboard header-pin set to prevent it from being connected incorrectly. Align the cable connector with the header pins and press the cable connector onto the header pins, as shown in Figure 3-27.

The motherboard is now prepared. Place it aside for now. Use the antistatic foam under the motherboard to make sure it's not damaged by static electricity.

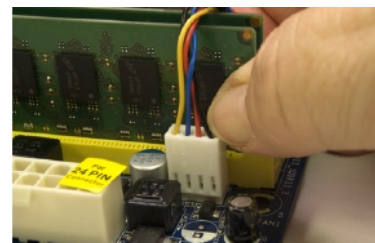


Figure 3-27. Connect the CPU fan power cable to the CPU fan header pins

Installing the Motherboard Securely

Installing the motherboard is the most time-consuming step in building the system because there are so many cables to connect. It's important to get all of them connected right, so take your time and verify each connection before and after you make it.

Task 2.14 To begin, slide the motherboard into the case, as shown in Figure 3-28. Carefully align the back panel I/O connectors with the corresponding holes in the I/O shield, and slide the motherboard toward the rear of the case until the motherboard mounting holes line up with the standoffs you installed earlier.



Figure 3-28. Slide the motherboard into position



Figure 3-29. Verify that the back panel connectors mate cleanly with the I/O shield

Task 2.15 Make sure none of these tabs intrude into a port connector. An errant tab at best blocks the port, rendering it unusable, and at worst may short out the motherboard. Use a flashlight or other bright light to make sure you can see any problem clearly.

Task 2.16 After you position the motherboard and verify that the back panel I/O connectors mate cleanly with the I/O shield, insert a screw through one mounting hole into the corresponding standoff, as shown in Figure 3-30. You may need to apply some pressure to align the motherboard mounting holes with the standoffs until you have inserted two or three screws.



Figure 3-30. Install screws in all six mounting holes to secure the motherboard

Connecting power to the motherboard

Task 2.17 With the motherboard installed and secured, the next step is to connect power to the motherboard. In the bundle of cables coming from the power supply, locate the ATX12V cable. Depending on the power supply, this cable may be labeled ATX12V, CPU Power, or something similar. It uses a four-pin (2x2) keyed connector with two 12VDC wires (yellow) and two ground wires (black) diagonally opposite in the connector body. Connect this to the motherboard as shown in the picture(right).



Figure 3-31. Connect the ATX12V power cable (CPU power) to the motherboard

Task 2.18 The next step is to connect the 24-pin ATX main power connector to the motherboard. Locate the main power cable from the bundle coming out of the power supply and route that cable to the front edge of the motherboard. Like the ATX12V connector, the ATX main power connector is keyed and has a latch. Orient the cable connector properly relative to the motherboard socket and press the connector into place, as shown in Figure 3-32. Make absolutely sure that the connectors mate and latch.



Figure 3-32. Connect the 24-pin ATX main power connector to the motherboard

Connecting front-panel I/O ports

Task 2.19 The next step is to connect the front-panel audio and USB ports. Locate the front-panel audio cable. This cable has two connectors, one labeled HD AUDIO and the other AC'97. This motherboard provides an HD audio connector, so we'll leave the AC'97 connector unused. The audio header pin set is located at the far back corner of the motherboard, colored lime. This connector is keyed with a missing pin on the motherboard header-pin set and a blocked hole on the cable connector. Orient the HD audio cable connector properly, making sure that the missing pin corresponds to the blocked hole, and press the cable connector onto the header-pin set, as shown in Figure 3-33.



Figure 3-33. Connect the front-panel HD audio cable to the motherboard

Task 2.20 The front-panel USB cable supports two front-panel USB ports. This cable connects to either of the two sets of USB header pins (color-coded blue) located in the front corner of the motherboard near the expansion slots. Like the audio connector, the USB connector is keyed with a missing pin on the motherboard header-pin set and a corresponding blocked hole on the cable connector. Align and orient the USB cable connector properly relative to the motherboard USB header-pin set, and press the cable connector onto the header pins, as shown in Figure 3-34.

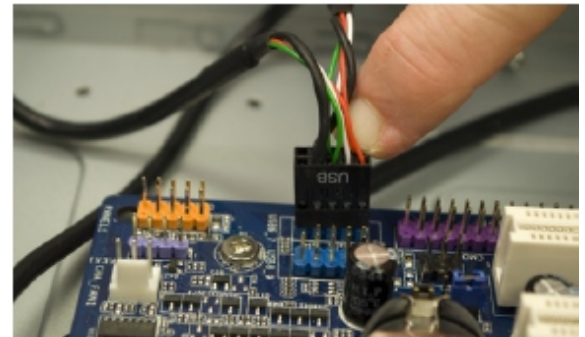


Figure 3-34. Connect the front-panel USB cable to the motherboard

Connecting front-panel switch and indicator cables

Task 2.21 The next step is to connect the front-panel switch and indicator cables to the motherboard. Before you begin connecting front-panel cables, examine the cables. Each is labeled to indicate its purpose. Match those labels with the frontpanel connector pins on the motherboard to make sure you connect the correct cable to the appropriate pins. Once you determine the proper orientation for each cable, connect it as shown in Figure 3-35.

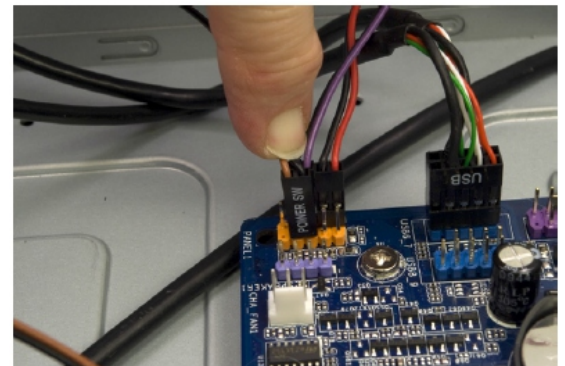


Figure 3-35. Connect the front-panel switch and indicator cables

When you're connecting front-panel cables, try to get it right the first time, but don't worry too much about getting it wrong. Other than the power switch cable, which must be connected properly for the system to start, none of the other front-panel switch and indicator cables is essential, and connecting them wrong won't damage the system.

Connecting drive power and data cables

Task 2.22 We're in the final stretch now. All that remains is to connect a few cables. To begin, connect two SATA data cables to SATA ports 0 and 1 on the motherboard, as shown in Figure 3-36. We'll use one of these cables for the optical drive and the other for the hard drive.

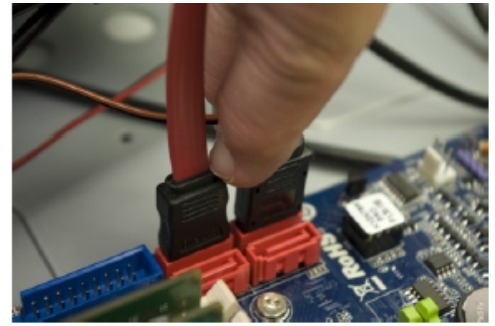


Figure 3-36. Connect the SATA data cables for the hard drive and optical drive to motherboard SATA ports 0 and 1



Figure 3-37. Connect a SATA power cable to the optical drive

Task 2.23 Locate an available SATA power cable in the cable bundle coming from the power supply and connect it to the power connector on the optical drive. SATA power (and data) cables use an L-shaped key on the connector body to prevent installing the cables backward. Make sure the L is oriented properly on the cable and drive, and then press the connector into place, as shown in Figure 3-37. Press the connector firmly straight in until you're sure the connector is fully seated. Do not apply any sideways pressure or torque to the connector.

Task 2.24 Locate the free end of SATA data cable 1 and press the connector onto the optical drive data connector, as shown in Figure 3-38. Once again, make sure the L key is oriented properly on the cable and drive, and then press the connector firmly straight in until the connector is fully seated.



Figure 3-38. Connect SATA data cable 1 to the optical drive

Task 2.25 Locate a SATA power cable in the cable bundle coming from the power supply. You can use a second SATA power connector on the same cable you connected to the optical drive or one of the separate cables with a SATA power connector. Make sure the L key is oriented properly on the cable and hard drive, and then press the SATA power connector into place, as shown in Figure 3-39. Press the connector straight in without applying any sideways pressure, and make sure the cable connector mates firmly with the drive connector.



Figure 3-39. Connect a SATA power cable to the hard drive

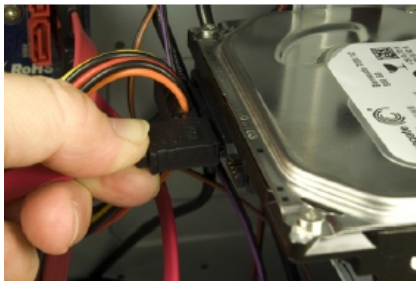


Figure 3-40. Connect SATA data cable 0 to the hard drive

Task 2.26 Locate the free end of SATA data cable 0 and press the connector onto the hard drive data connector, as shown in Figure 3-40.

Final Assembly Steps

Congratulations! You're almost finished building the system. Only a couple of final steps remain to be done, and these won't take long.

Task 3.1 It's time to connect the supplemental case fan to make the case room cool as shown in the picture(right). The final step in assembling the system is to dress the cables. That simply means routing the cables away from the motherboard and other components and tying them off so they don't flop around inside the case. Chances are that no one but you will ever see the inside of your system, but dressing the cables has several advantages other than making the system appear neater.

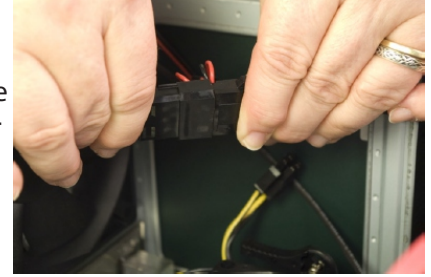


Figure 3-41. Connect power to the rear case fan



Task 3.2 The final step in assembling the system is to dress the cables. That simply means routing the cables away from the motherboard and other components and tying them off so they don't flop around inside the case. Chances are that no one but you will ever see the inside of your system, but dressing the cables has several advantages other than making the system appear neater. The picture(left) is an example of a dressed cables.

Task 3.3 After you've completed these steps, take a few minutes to double-check everything. Verify that all cables are connected properly, that all drives are secured, and that there's nothing loose inside the case. It's a good idea to pick up the system and tilt it gently from side to side to make sure there are no loose screws or other items that could cause a short.

Task 3.4 Also, check one last time that the power supply is set for the correct input voltage. Use the following checklist:

- | | |
|--|--|
| Power supply set to proper input voltage (if applicable) | Optical drive data cable connected to drive and motherboard |
| No loose tools or screws (tilt and shake the case gently) | Optical drive power cable connected |
| Heatsink/fan unit properly mounted; CPU fan connected | All drives secured to drive bay or chassis, as applicable |
| Memory module(s) fully seated and latched | Expansion cards (if any) fully seated and secured to chassis |
| Front-panel switch and indicator cables connected properly | Main ATX power cable and ATX12V power cable connected |
| Front-panel USB cable connected properly | Case fan(s) installed and connected (if applicable) |
| Hard drive data cable connected to drive and motherboard | All cables dressed and tucked |
| Hard drive power cable connected | |

Task 3.5 Once you're certain that all is as it should be, it's time for the smoke test. Leave the cover off for now. Unlike many power supplies, the Antec Earth Watts has a separate rocker switch on the back that controls power to the power supply. By default, it's in the "0" or off position, which means the power supply is not receiving power from the wall receptacle. Ensure the rocker switch is off, then connect the power cable to the wall receptacle and then to the system unit. Next, flip the power supply switch to the "1" or on position. Press the main power button on the front of the case, and the system should start up. Check to make sure that the power supply fan, CPU fan, and case fan are spinning. You should also hear the hard drive spin up. At that point, everything should be working properly.

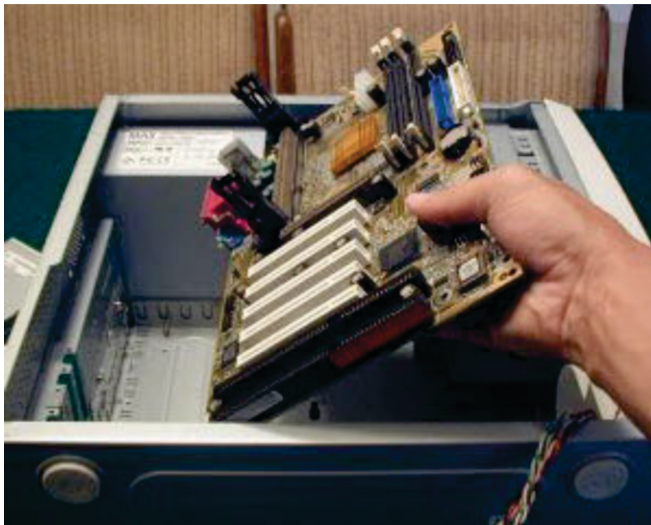
Final Words

This system assembled easily and quickly. If we hadn't had to shoot images, it probably would have taken us about 20 minutes to build. A first-time system builder should be able to assemble this system in an hour or so, and certainly over the course of an evening.

Chapter 3

Laboratory Manual

BUILD / ASSEMBLE A BUDGET PC



Laboratory Activities

- 3.01 Building a Thick Client
- 3.02 Replacing a Power Supply
- 3.03 Removing and Installing a CPU
- 3.04 Removing and Installing a RAM
- 3.05 Installing a Motherboard
- 3.06 Installing a Videocard
- 3.07 Installing a SATA Hard Drive
- 3.08 Installing a DVD Drive

Chapter Analysis and Written Test

Lab Activity 3.02 Replacing a Power Supply

Let's assume that you've found a variance in the 12-V range that explains your client's system lockups. You know that power supplies aren't user-serviceable components you don't fix them, you replace them as a unit so it's time to replace her power supply. Next to the motherboard, the power supply is the most time-consuming component to replace, simply because of all those wires! Nonetheless, replacing the power supply is a simple operation, as described in this exercise.

Learning Objectives

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

- determine the total wattage requirements of the system and select the proper power supply
- replace a power supply

Lab Materials and Setup

The materials you need for this lab are


- a non-production PC with an ATX power supply
- a Phillips-head screwdriver
- a labeled container for holding screws

Let's Get the Lab Started

One of the areas where PC manufacturers cut corners on lower-end systems is power supplies. High-end systems typically come with higher-wattage power supplies, whereas entry-level PCs typically have lower-wattage power supplies. You might not notice it until you add power-hungry components to the system, placing a heavier load on the power supply and causing an early failure. In the following steps, you'll determine the wattage of the power supply on your system, calculate the power usage of your PC, and then remove and reinstall the power supply.

Step 1 To determine the wattage rating of your power supply, look at the label on the power supply (see Figure 3-1).

Locate the watts rating. If you don't see a clear wattage rating as shown in Figure 3-1, or if you see something less evident, like the smaller "430W" marking on the label, the power supply rating may be hidden in the model number, which in this example is "Neo HE430."

 *All power supplies have a wattage rating. If it is not apparent on the power supply itself, search the Internet using the model number for reference.*

What is the wattage of your power supply? _____

nTEC

Model / 型号: Neo HE430
430 Watt Output

Input: 100V - 240V ~ 7A : 50Hz / 60Hz

Output Voltage	+3.3V	+5V	+12V1	+12V2	+12V3	-12V	+5VSB
Current	22A	14A	16A	16A	16A	0.8A	2.5A
Output Power	72.6W	70W	384W		9.6W		12.5W

Total Power 430W continuous output at 50°C ambient temperature

Neo HE High Efficiency

FIGURE 3-1 Typical ATX power supply ratings label

Step 2 When it comes time to replace a power supply, don't skimp on the wattage! As a general rule, get the highest-wattage replacement you can afford while maintaining compatibility with your system. Remember, the system will draw only the current it requires, so you will never damage a system by installing a higher-wattage power supply.



Never replace a PC's power supply with one of lower wattage!

Use the following table to calculate the overall wattage needed for your system. Add the numbers for each component and determine the lowest and highest wattage requirements.

Component	Requirement	Voltage(s) Used
PCIe video card	45-75W	3.3V
AGP video card	30-50W	3.3V
PCI card	5-10W	5V
10/100/1000 NIC	4W	3.3V
SCI controller PCI	20W	3.3V & 5V
Floppy drive	5W	5V
7200 rpm PATA hard drive	5-20W	5V and 12V
7200 rpm SATA hard drive	5-20W	5V and 12V
10,000 rpm SATA hard drive	5-20W	5V and 12V
10,000 rpm SCSI drive	10-40 W	5V and 12V
15,000 rpm SATA hard drive	5-20W	5V and 12V
CD/DVD/Blu-ray media drive	10-25W	5V and 12V
Case/CPU fans	3W (each)	12V
Motherboard (without CPU or RAM)	25-40W	3.3V and 5V
RAM	10W per 128 MB	3.3V
Intel Core i7-860	95W	12V
Intel Core 2 Duo 3.0G Hz	65W	12V
AMD Phenom II X4 965	140W	12V

If the highest total exceeds the power supply wattage rating, you may run into problems. When selecting a new power supply, you should multiply the load by a factor of 1.5. The multiplier provides a safety factor and allows the power supply to run more efficiently. A power supply is more efficient at 30 to 70 percent of its full capacity rating. Thus, a 450-W PSU works best when only 135 to 315 watts are being used.

What wattage is appropriate for your system? _____



Depending on the design of your PC case, you may have to remove data cables or components before you can get to the power supply. Make certain that you have plenty of room to work inside the case!

Step 3 Shut down the system and remove the power cable from the back of the power supply. Then remove the power supply.

- Disconnect the Molex, SATA, and mini connectors from your drive devices, then unplug the main power connector from the motherboard.
- Disconnect the P4 connector from the motherboard.
- Unscrew the four screws holding the power supply onto the PC case (remembering to support it while you remove the last one), and remove the power supply from the case. Store the screws in the labeled container. Was your power supply mounted to the top or bottom of your PC case? _____

Step 4 Take this opportunity to inspect and clean the power supply. Check for any rust or corrosion on the power supply casing or on any of the contacts. Inspect the wires for damage or frayed insulation. Use canned air (outside!) to blow dust and dirt out of the intake and exhaust vents.

Step 5 Reinstall the power supply by performing the preceding steps in reverse order. If you had to remove data cables or other components to get at the power supply, be sure to reattach them.

When you've finished reinstalling the power supply, have your instructor or a knowledgeable tech sign off on it here:

Lab Activity 3.03 Removing and Installing a CPU

Luckily for Joe, his motherboard is compatible with his new CPU. Now he expects you to play your “computer expert” role and install the new CPU in his PC. As a PC tech, you must be comfortable with such basic tasks. In this exercise, you’ll familiarize yourself with the procedure; using your disassembled PC, you’ll practice removing and reinstalling the CPU and fan assembly.

Learning Objectives

In this lab, you’ll practice removing and installing a CPU and CPU fan assembly.

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

- remove and install a CPU safely and correctly
- remove and install a CPU fan assembly safely and correctly

Lab Materials and Setup

The materials you need for this lab are

- an anti-static mat, or other static-safe material on which to place the CPU following removal
- an anti-static wrist strap
- Thermal paste
- a small slotted (flat-head) screwdriver

Let’s Get the Lab Started

Time to get your hands dirty! Removing and installing CPUs is one of the most nerve-wracking tasks that new PC techs undertake, but there’s no need to panic. You’ll be fine as long as you take the proper precautions to prevent ESD damage, and handle the CPU and fan assembly with care.



Be careful not to touch any of the exposed metal contacts on either the CPU or the CPU socket.

Step 1 Open your PC’s case. If you’ve never done this before, you might feel a little nervous. That’s okay. As long as you don’t go unplugging things at random and breaking off bits of the motherboard, you shouldn’t have a problem.

Each PC case is built differently, so each will be opened in its own way. Some use screws, and others use latches. Almost all cases have a removable panel on one side that you’ll need to take off. Refer to the documentation that came with your PC or case for more information.

How do you open your particular case?

Step 2 Find your motherboard, the largest circuit board in your PC. Everything else should be connected to it. Somewhere in that mess of cables, cards, and drives is your CPU.

Determine whether the process of reinstalling and removing the CPU and fan assembly will be easier with the motherboard on an anti-static mat or installed in its case. You may find that it is easier to work with the stubborn fan assembly clamp if the motherboard is secured in the case. The case may even have a removable motherboard tray to ease the installation process.

Step 3 In most cases, you’ll have to remove the heat-sink and fan assembly before you can remove the CPU. (You may also need to unplug any cables in your way.) Screwdown fans are easier to remove than clip fans. Screw-down fans require only that you unscrew the securing hardware. Clip fans, found on many types of CPUs, require you to apply pressure on the clip to release it from the fan mount. Use a small slotted screwdriver to do this, as shown in Figure 3-2. Use caution when prying the clip open, and don’t forget to unplug the CPU fan!



You'll discover that releasing a fan clip takes way more force than you want to apply to anything so near a delicate CPU chip. Realizing this in advance, you can be sure to brace yourself and position the screwdriver carefully, to minimize the possibility of it slipping off and gouging something. Always use two hands when attempting this procedure.

The CPU and fan assembly will have thermal paste residue on the surfaces that were previously touching. You cannot reuse thermal paste, so you'll need to apply a fresh layer when you reinstall the CPU fan. Using a clean, lint-free cloth, carefully wipe the thermal paste residue from the CPU and fan assembly, and then place the fan assembly on an anti-static surface.

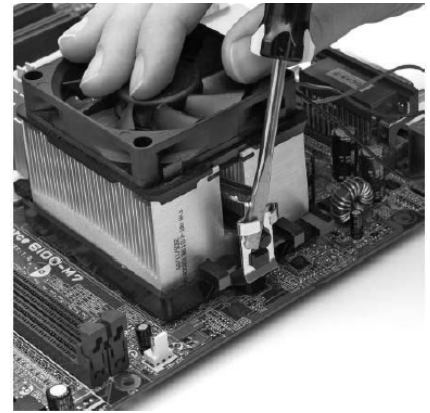


FIGURE 3-2 Using a screwdriver to remove a clip-type CPU fan from its mount

Step 4 Before proceeding, notice the CPU's orientation notches. All CPUs have some form of orientation notch (or notches). Remove the CPU. Start by moving the end of the zero insertion force (ZIF) lever a little outward to clear the safety latch; then raise the lever to a vertical position. Next, grasp the chip carefully by its edges and lift it straight up and out of the socket. Be careful not to lift the CPU at an angle if it's a PGA CPU, you'll bend its tiny pins. LGA CPUs don't have pins, but you can damage the pins on the motherboard, so still be careful! As you lift out the CPU, make sure that the ZIF lever stays in an upright position. Record your socket type in the space provided.

Step 5 Now that you have the CPU chip out, examine it closely. The manufacturer usually prints the chip's brand and type directly on the chip, providing you with some important facts about the chip's design and performance capabilities. Note any markings that denote the processor manufacturer, model, speed, and so forth.



Always handle a CPU chip like a fragile old photograph: very gently, holding it only by the edges. Make sure you take complete ESD avoidance precautions, because even a tiny amount of static electricity can harm a CPU!

Step 6 Reinsert the CPU with the correct orientation, lock down the ZIF lever, and reattach the fan. Now remove the fan assembly and the CPU again. Practice this a few times to become comfortable with the process. When you're finished practicing, reinsert the CPU for the last time. Be sure to apply a thin film of fresh thermal paste onto the square in the center of the top of the CPU before you place the fan. Now reattach the fan assembly. Don't forget to plug the fan back in!

Step 7 You may leave your CPU/fan assembly installed on the motherboard and place the motherboard on your anti-static mat. Optionally, if you reinstalled the motherboard in the case, you may leave it assembled.

Lab Activity 3.04 Removing and Installing RAM

You've found a stick of RAM for Carmela that works with her system, and now you have to install it. Although RAM installation is one of the simpler PC hardware upgrades, it's still important that you follow the correct steps and take all appropriate safety precautions.

Learning Objectives

In this lab, you'll practice removing and installing RAM.

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

- remove RAM safely and correctly
- install RAM safely and correctly

Lab Materials and Setup

The materials you need for this lab are

- an anti-static mat or other static-safe material on which to place the RAM
- an anti-static wrist strap
- a notepad



If you're in a computer lab or you have access to multiple PCs, you should practice on a variety of systems.

Let's Get the Lab Started

Removal and installation procedures vary depending on the type of RAM your system uses. DIMMs and RIMMs snap into the RAM slots vertically. The following steps describe the removal and installation procedures for DIMMs.



Regardless of the type of RAM in your system, be certain to take measures to prevent ESD damage. Shut down and unplug the PC and place it on an anti-static mat. Strap on an anti-static bracelet and ground yourself. If necessary, remove any cables or components that block access to the system RAM before you begin.

Step 1 Open the PC case. Use whatever methods the case requires: some use screws, some use latches. Once the case is open, look for the RAM sticks on the motherboard. Locate the retention clips on either end of the RAM modules.

Step 2 Press outward on the clips to disengage them from the retention slots on the sides of the RAM sticks (see Figure 3-3).

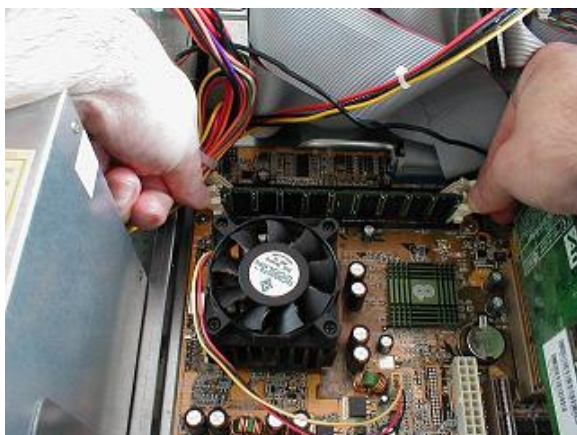


FIGURE 3-3 Removing a 184-pin DIMM (DDR SDRAM)

Step 3 Press down on the clips firmly and evenly. The retention clips act as levers to lift the DIMM sticks up and slightly out of the RAM slots.

Step 4 Remove the DIMM sticks and place them on the anti-static mat, or in an anti-static bag.

Step 5 Make note of the following:

- a. How many pins does the RAM have? _____
- b. Where are the guide notches located? _____
- c. What information is on the RAM's label? _____

Step 6 While you have your system RAM out, this is a good time to check the condition of the metal contacts on both the RAM sticks and the motherboard RAM sockets. Dirty contacts are fairly rare. If you see this problem, use contact cleaner, available at any electronics store.

Are the contacts free of dirt and corrosion? _____

After you've examined your system RAM and inspected the motherboard RAM sockets, reinstall the RAM as described next.

To install a DIMM or RIMM:

Step 1 Orient the DIMM or RIMM so that the guide notches on the RAM module match up to the guide ridges on the RAM socket.

Step 2 Press the RAM stick firmly and evenly straight down into the socket until the retention clips engage the retention notches on the ends of the RAM stick.

Step 3 Snap the retention clips firmly into place.

Step 4 Repeat these steps to install other RAM modules as appropriate.

To finish a RAM installation professionally, specifically if you are on a production-level machine, follow these steps:

Step 1 Once the system RAM is in place, reattach any cables that you may have had to move, and plug in the system power cable. Do not reinstall the PC case cover until after you've confirmed that RAM installation was successful.

Step 2 Once the system RAM is in place, reattach any cables that you may have had to move, and plug in the system power cable. Do not reinstall the PC case cover until after you've confirmed that RAM installation was successful.



If the system has any problems when you reboot, remember that you must turn off the power and unplug the computer again before reseating the RAM.

Lab Activity 3.05 Installing a Motherboard

Now you get the real test of your PC tech skills: installing the new motherboard and reconnecting everything so that the computer works again! Don't be intimidated, though. Everything you need to install a motherboard is right in front of you. When you remove and replace a motherboard in a system, you interact with almost every component of the computer system. In the field, you must not only successfully disassemble/assemble the hardware, but also verify that the system powers up and operates properly afterward. Many competent PC techs, when installing a new motherboard, will check for proper operation along the way. Here's a good checkpoint: After you've installed the CPU and RAM, configured any jumpers or switches, and installed the motherboard in the case, insert the power connections and test the system. A POST card is a real time saver here, but you can also connect the PC speaker, a graphics card, monitor, and a keyboard to verify that the system is booting properly.

Learning Objectives

In this lab, you'll install a motherboard. You can use the motherboard and system you disassembled in the previous activity.

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

- install a PC motherboard and connect all its associated components

Lab Materials and Setup

The materials you need for this lab are

- a working system from which the motherboard has been removed
- components and cables previously connected to the removed motherboard
- the motherboard book or online documentation for the motherboard
- an anti-static mat and anti-static wrist strap
- a notepad and pen

Let's Get the Lab Started

Physically installing the motherboard itself is mostly a matter of being careful and methodical. The more complex part of the task is reattaching all the cables and cards in their proper places.



Motherboards are full of delicate electronics! Remember to follow the proper ESD avoidance and safety procedures.



When installing a motherboard, it's handy to use your notepad to check off assembly steps as you go along.

- Step 1** Carefully line up the motherboard inside the PC case and secure it in place with the mounting screws. Be sure to use the washers and plastic/metal standoffs, if necessary.
- Step 2** Insert the front panel control wires in their appropriate places. These should include the power button, reset button, front panel LEDs (power, hard disk activity, and so on), system speaker, and so on. Refer to the labels and your motherboard documentation for the proper connections.
- Step 3** Connect all power cables to the hard drive, optical drive, floppy drive (for older systems), CPU fan, main motherboard, and so on.
- Step 4** Connect data cables to the hard drive, optical drive, and floppy drive (if applicable), as well as the sound cable and USB connector dongles, if applicable. If you removed the RAM or CPU, reattach them now.
- Step 5** Double-check all of your connections and cards to make sure that they're properly seated and connected where they're supposed to be. If something is wrong, it's definitely better to discover it now than to smell smoke after you've hit the power switch!
- Step 6** Replace the case cover on your PC, then plug the keyboard, mouse, and monitor back in, plug the power cable back in, and finally turn on the PC. Assuming you've done everything correctly, your system will boot up normally.

Lab Activity 3.06 Installing a Video Card

Unless you are building a system from scratch, all PCs come with some sort of video capacity either integrated video, meaning that the motherboard has the capability to output video, a PCIe, or occasionally an accelerated graphics port (AGP) card. Most video expansion cards today are installed in the motherboard's PCIe slot.

The most common reason for you to install a video card is to upgrade the system to display high level graphics. Gamers especially need high-end video cards; however, web and graphic designers also require high-quality video displays. The process is almost identical to that of installing a PCI Express card, but there are a few extra steps, especially if you are upgrading a video card.

Learning Objectives

In this lab, you'll uninstall an old video card with its driver, then install a new video and install its corresponding installer driver.

Lab Materials and Setup

The materials you need for this lab are

- screwdriver(s) to open the access case
- old card
- new card

Let's Get the Lab Started

This exercise will take you through the motions of uninstalling an old video card and its drivers and installing a new card.

Uninstalling an Old Video Card

Uninstalling the Video Card Drivers

Step 1 With the system powered up, click Start, right-click Computer, and then click Properties.

Step 2 In the System box on the left-hand menu, click Device Manager.

Step 3 In the Device Manager, expand Display Adapters.

Step 4 Right-click the name of the desired video card and click Properties.

Step 5 In the Properties dialog box for the adapter, click the Driver tab.

Step 6 On the Driver tab, click the Uninstall button.

Step 7 When prompted, select the Delete the Driver Software for This Device check box and then click OK.

Step 8 After the driver is uninstalled, power down the computer.

Removing/Uninstalling the Old Video Card

Step 1 Unplug the power cable from the power supply.

Step 2 Lay the PC on its side.

Step 3 Locate your screwdriver and remove the screws attaching the access panel to the PC frame.

Step 4 Remove the access panel.

Step 5 Locate the video card.

Step 6 Unscrew the video card from the frame of the computer.

Step 7 Gently pull the old card out of the PCIe socket. (For PCIe x16 and AGP slots, you will need to release an additional locking tab before removing the card).

Step 8 Remove the card and put it in an antistatic bag.

Installing a Video Card

Installing the New Video Card in the PCIe Slot

Step 1 Locate the new video card.

Step 2 Remove it from the antistatic bag.

Step 3 Line it up with the PCIe slot.

Step 4 Gently but firmly press the card into place.

Step 5 Screw the card onto the PC frame.

Step 6 Replace the access panel.

Step 7 Replace the screws, securing the access panel to the PC frame.

Step 8 Set the PC upright.

Step 9 Plug the power cord into the power supply's socket.

Step 10 Connect the monitor back to the PC and make sure the monitor's power cord is plugged into the power strip or surge protector.

Step 11 Power up the PC.



If the video card has an onboard fan, make sure that no cables are at risk of interfering with the fan's operation. Also make sure to follow any special instructions that are required for the proper installation and operation of the fan. High end graphics cards may also require a 6 or 8-pin Molex plug to provide extra power.



If you receive a "New Hardware Found" message, click Cancel and continue to install the video card drivers as described in the video card documentation.

Installing the New Video Card - Drivers

Step 1 Locate the disc containing the video card drivers.

Step 2 After the PC powers up, insert the disc into the optical player, launch the disc, and follow the onscreen instructions to install the drivers.



The onscreen instructions may be slightly different depending on the make and model of card you've installed. You will usually be offered the option of searching for drivers or installing from media like a CD or DVD or Blu ray. It is usually advisable to download and install the latest drivers from the manufacturer's site, if available.

Step 3 When prompted, remove the driver disc and restart the PC.

Step 4 After the PC reboots, right-click anywhere on the Desktop, and in the menu that appears, click Screen Resolution.

Step 5 In the Screen Resolution dialog box, use the Resolution menu to select the desired screen resolution for your monitor, and then click OK.



You can also click Advanced Settings to open the video card's Properties dialog box and configure the adapter and monitor. In most cases, accepting the default settings will work fine.

Lab Activity 3.07 Installing a SATA Hard Drive

Now that you've experienced the installation of an IDE drive, it's time to move on to some more recent technology. The most common reason to install a SATA drive is that it's the current industry standard, or to upgrade a computer's storage from IDE. As previously mentioned, the installation process isn't much different from installing an IDE drive, but there are enough dissimilarities to warrant a separate task in this book.

Learning Objectives

In this lab, you'll install a SATA Hard drive and experience the latest standard cable used in many PC's today.

Lab Materials and Setup

The materials you need for this lab are

- a computer with a monitor, keyboard, and mouse, a SATA hard drive
- separate SATA interface cables and power cables or adapters
- an appropriate screwdriver for removing the PC's access panel
- a small slotted (flat-head) screwdriver

Let's Get the Lab Started

The following steps walk you through the process of installing a SATA drive into a computer and setting the BIOS.

Installing a SATA Hard Drive

Step 1 Verify that the PC is powered down and unplugged.

Step 2 Locate a screwdriver and remove the screws from the PC's access panel.

Step 3 Remove the access panel.

Step 4 Locate the SATA connector on the PC's motherboard.

Step 5 Locate the SATA drive interface cable.

Step 6 Attach one end of the drive interface cable to the SATA connector on the motherboard and the other end to the cable connector on the drive.



The connectors on the interface cable can be attached in only one way, preventing you from attaching the cable incorrectly.

Step 7 Locate the SATA drive power cable. Notice that this SATA power cable is very different from the Molex power cable used with IDE hard drives.

Step 8 Attach the SATA drive power cable to the SATA drive.



Some SATA power connections are mounted next to the SATA host adapter on the motherboard. If the power cable from the power supply is for IDE, you will need a Molex-to-SATA drive power cable adapter, but this is an unlikely occurrence in modern computers.



Some SATA drives have both a SATA power socket and a 4 pin MOLEX power socket. One or the other should be connected, not both.

Step 9 Place the drive into the drive bay.

Step 10 Locate the mounting screws for the drive and the appropriate screwdriver, and secure the drive to the bay.

Step 11 Locate the mounting screws for the PC's access panel and the appropriate screwdriver, and replace the access panel.

Step 12 Reconnect the power cable to the PC's power supply.

Configuring the BIOS

Step 1 Verify that a monitor, keyboard, and mouse are connected to the PC.

Step 2 Make sure the power cord is connected and that the computer is receiving power.

Step 3 Power up the unit.

Step 4 When the system begins its startup routine, enter the BIOS setup.



The BIOS setup may appear automatically, but if it doesn't, you can manually get into the BIOS. Different computers have different ways of entering the BIOS setup, including F1, F2, F10, F11 or Delete key.

Step 5 Select the menu item for the SATA drive and set it to Auto.



Because BIOS setups vary, there is no standard method for locating specific menus and submenus. If you used a PCIe SATA host adapter, your BIOS may not recognize the new SATA drive because the PCIe card uses its own BIOS. Consult the documentation for the PCIe adapter. This issue will not affect the SATA drive's functioning or storage capacity. If you have your drive connected to the SATA adapter on the motherboard and your BIOS does not recognize the drive or identifies it as a SCSI drive, install the drivers for the SATA drive and reboot. Consult the drive's documentation for instructions on how to install the drivers.

Step 6 Verify that your computer is set to look first at your CD/DVD drive when booting.

Step 7 Save the settings and exit the BIOS.

Step 8 If you plan to install an operating system, locate the installation disc and place it in the computer's CD/DVD drive.

Step 9 Reboot the computer.

Lab Activity 3.08 Installing a DVD Drive

Installing different types of drives in a computer requires a very similar process with just a few important differences. Although installing a SCSI drive involves a few different steps compared to installing IDE and SATA drives, in the end you still use the same tools and connect the drive to the motherboard and the power supply.

Installing an IDE DVD drive in a PC involves almost exactly the same steps as installing an IDE hard drive. Most PCs come with some type of optical drive (DVD, DVD-R, DVD-RW), so you won't often be installing the first optical drive in a PC. It is more likely that you'll either be upgrading the drive in a computer, adding a second one, or replacing a faulty optical drive. Back in the day, a computer might come with separate CD and DVD drives but modern computers come with a DVD or Blu-ray drive installed by default, and these drives are also capable of playing CDs.

Learning Objectives

In this lab, you'll install a DVD drive where most PCs have this installed.

Lab Materials and Setup

The materials you need for this lab are

- DVD disc with content on it.
- flat-head screwdriver, Phillips screwdriver
- pair of needle-nose pliers or tweezers to set the jumpers or switches
- standard monitor, mouse, keyboard, and pair of speakers available for testing.

Let's Get the Lab Started

This lesson will walk you through the process of installing and testing a DVD drive in a computer.

Installing a DVD Drive

Opening the Computer and Configuring the DVD Drive

Step 1 Verify that the computer's power cord is unplugged from the power supply.

Step 2 Use your screwdriver to remove the screws from the access panel.

Step 3 Remove the access panel.

Step 4 Locate the desired drive bay.

Step 5 Locate the desired drive bay cover on the front of the PC.

Step 6 Remove the drive bay cover.

Step 7 Remove the DVD drive from the antistatic bag.

Step 8 Locate the jumpers or switches on the drive.

Step 9 Locate the jumper diagram on the drive.

Step 10 Locate your needle-nose pliers or tweezers.

Step 11 Set the jumpers or switches to the slave position.



Step 11 assumes that the optical drive will be on the same IDE controller as the IDE hard drive. The hard drive jumpers are set to master so the jumpers on the DVD drive are set to slave. The DVD drive will be on the same IDE cable as the hard drive.

Installing the DVD Drive

Step 1 Slide the DVD drive into the drive bay from the front.



The front of the DVD drive should fit flush against the face of the computer.

Step 2 Locate the IDE data ribbon cable that is attached to the first IDE controller on the motherboard and that is also attached to the IDE hard drive.

Step 3 Locate the unoccupied IDE connector on the middle part of the IDE ribbon cable.

Step 4 Carefully match the holes in the ribbon connector to the pins on the IDE connector on the DVD drive.

Step 5 Gently but firmly push the connector in, attaching the ribbon cable connector to the DVD drive (it can only fit one way).



In step 5, since you haven't yet secured the screws to attach the DVD drive to the drive bay, you will need to hold the drive in place with your other hand.

Step 6 Locate a vacant Molex power cable coming from the power supply.

Step 7 Connect the power cable to the power socket on the back of the DVD drive.

Step 8 Verify that all IDE cable connections are firmly in place for the DVD drive, the hard drive, and the IDE motherboard connector, since they could have come loose during this process.

Step 9 Secure the screws to the side of the DVD drive rails to firmly hold it in place.

Step 10 Tuck the cables in the PC case so they are not blocking airflow.

Step 11 Replace the PC access panel and secure it in place.

Step 12 Reattach the power cord to the PC and make sure connections to the monitor, mouse, keyboard, and speakers are secure.



Windows XP, Windows Vista, and Windows 7 all support mpeg decoders and Windows Vista and Windows 7 supply modern codecs. Most modern motherboard chipsets provide hardware mpeg decode acceleration. Also, Windows will most likely provide the drivers for the DVD drive relieving you of the necessity of installing drivers by disc, so installing a DVD drive in an modern computer is extremely easy compared to what it was a number of years ago.

Testing the DVD-Drive Installation

Step 1 Locate the test DVD disc.

Step 2 Open the DVD drive.

Step 3 Place the disc in the drive.

Step 4 Close the drive.

Step 5 If Autoplay is engaged, the disc will begin playing automatically.

Step 6 You can also insert a CD music disc to verify that it will play in the drive.