CMP 104 – COMPUTER SYSTEM DESIGN
(3 UNITS)

Module 2B

PC BUILDING

There are about four major steps to take in building your own personal computer.

The First Step: Choosing the Parts

The first step in building your own computer is choosing the parts. This part can be the most difficult and if you do not know what you are looking for then it is easy to get bewildered by the huge range of computer components on the market. The list below is structured in the order you should choose your computer parts. For some parts it makes no difference when you choose the parts, but for others it can be very important. A computer is made up of a case, also called a chassis, which houses several internal components, and the external components, including peripherals. Inside the case are the following internal parts: Power Supply/PSU power supply unit, Motherboard/mainboard, Processor/CPU central processing unit, RAM random access memory, Hard Drive/Hard Disk, Optical Drive device, Video Card/Graphics Card/GPU. Some motherboards have an "onboard" GPU built in so you do not need (but may add) a separate video card. Otherwise, you will need a video card. On top of the internal components listed above, you will also need these external components: Keyboard, Mouse for pointing and clicking, Monitor. One of the most important things to do when you choose your computer components is to make sure that they are all compatible with each other. There is no point having a Pentium IV motherboard, if you have a Core 2 Duo, or having a small case, if you have a big motherboard, or having a SATA hard drive, with only IDE connections. So once you have chosen all your parts the next step is to go and buy them.

The Second Step: Buying the Parts

Buying the parts for your computer is the second step in build your own computer. These are the parts that a standard PC will use. Before you jump onto the web and start spending lots of money on expensive computer parts, there are three important questions you should answer which will guide your purchases:
1. What will be the main function of the computer?
2. What useful parts do you have on hand, from an old computer or otherwise?
3. How much can you afford to spend on the system?

This step can be quite difficult as you need to make many selections, choices and comparisons. You need to ask questions like, 'Where are the cheapest parts for the best prices?' and 'How long is the warranty?' and other questions similar to these. There are many places where you can get computer hardware, so it is important to have a look around at the different places and buy that piece for the best and most affordable price. A few options are:
1.   Local Computer Shops

2.   Large Retailers
3.   Small Computer Retailers
4.   Online Stores
5.   Ebay

There are also many online stores such as:
- Tiger Direct
- TheNerds.Net
- AllPCDeals Inc.
- PC Universe, Inc.

The Third Step: Building the Computer
It is now time to install all the computer parts into your computer. It is time to get your hands dirty and do the actual building of the computer. You can do so in the following order, although it may not necessary matter. Installing the Motherboard, Power Supply, RAM (Memory), CPU, Hard Drives, CD/DVD Drives, Network Card and other cards, Floppy Drive (optional) etc. You do not need to install a case, since that is where you place everything.

The Fourth Step: Installation of Operating System and Application Programs
Once all your computer components are successfully installed, it is time to for your computer to boot for the first time. It is also time to format your hard drive and to install the operating system you desire or need. After this, other needed application programs can now be installed.

PC ASSEMBLY
Actually assembling the system is easy after you have lined up all the components. In fact, you will find the parts procurement phase the most lengthy and trying of the entire experience. Completing the system is basically a matter of screwing everything together, plugging in all the cables and connectors, and configuring everything to operate properly together. In short order, you will find out whether your system operates as you had planned or whether some incompatibilities exist between some of the components. Be careful and pay attention to how you install all your components. It is rare that a newly assembled system operates perfectly the first time, even for people who are somewhat experienced. It is very easy to forget a jumper, switch, or cable connection that later causes problems in system operation. Most people's first reaction when problems occur is to blame defective hardware, but that is usually not the source. The problem can typically be traced to some missed step or error made in the assembly process. Above all, the most crucial rule of assembling your own system is to save every piece of documentation and software that comes with every component in your system. This material can be indispensable in troubleshooting problems you encounter during the assembly process or later. You should also retain all the packing materials used to ship mail-order components to you until you are certain they will not have to be returned.

PC Assembly Preparation

First up you will need a few tools of the trade before you can start putting anything together, you can usually buy kits from your local computer store which will have all you need to get going, but if you wish to buy things individually here are the main tools you will need.

- Anti-static wristband
- Head screwdriver
- Flathead screwdriver

Remember to wear your Anti-Static wristband when dealing with fragile things susceptible to static such as the CPU and RAM, you do not have to wear it all the time but just as a precaution you may want to keep it on during the course of putting your PC together, if you accidentally damage your CPU or RAM you will not be happy - so remember that wristband.

Other tools required are: a 1/4" nut driver or Phillips-head screwdriver for the external screws that hold the cover in place and a 3/16" nut driver or Phillips-head screwdriver for all the other screws. Needle-nose pliers can also help in removing motherboard standoffs, jumpers, and stubborn cable connectors. Because of marketplace standardization, only a couple of types and sizes of screws (with a few exceptions) are used to hold a system together. Also, the physical arrangement of the major components is similar even among different manufacturers. Note that the components discussed here are for a standard PC. Your final component list might vary. Other tools you will need are software related. You will need the master operating system CD-ROM or DVD-ROM, and if your particular CD-ROM version is not bootable or your system is older and does not support booting from CD, you will also need an operating system startup floppy disk with CD-ROM drivers installed.

This way, your system will recognize the CD-ROM drive and enable you to install the operating system from it. Newer operating systems often come on bootable CDs, but sometimes only the OEM (and not retail) versions of the OS are configured that way. The Windows 98 and later versions' startup floppies include generic ATAPI and SCSI CD-ROM drivers on them, enabling virtually all CD-ROMs to be recognized after booting from them. If you are installing Windows 95 or some other operating system that does not include a startup disk with CD-ROM drivers already installed, you can either use a Win98 or later startup disk or take your existing startup disk and install the CD-ROM drivers that came with your drive.

PROCEDURES FOR PC ASSEMBLY

With regard to assembly and disassembly, it is best to consider each system by the type of case it uses. All systems that have AT-type cases, for example, are assembled and disassembled in much the same manner. Tower cases are basically AT-type cases turned sideways, so the same basic instructions apply. Most Slimline and XT-style cases are similar; these systems are assembled and disassembled in much the same way. The following is the order of assembly and disassembly of the components:

- Case or cover assembly
- Power supply
- Adapter boards
- Motherboard
- Disk drives

The Case

If you have purchased a fairly decent case it will have its own 250-300 watt power supply. Anything lower may run you into trouble with devices not having enough power to work. It will come with a set of screws. Do not worry if you find yourself coming up short of a specific screw just try to place them out evenly so the device you are screwing in is secure. However, if you have some spare do not worry, they will be for other devices you may want to add in later on. The side panels of the case should be easily removable by just taking out a couple of screws; both sides should then be able to slide off. Now you should have a clear view of the inside of the case ready for you to start fitting things in.

Install a PC Power Supply

Before you begin, you should know that many brand name PCs use specially designed power supplies. You may also contact them directly before installing a new power supply. Also, an unplugged power supply still can give you a powerful electric shock by putting something inside an open vent. To install the New PC Power Supply, align the new power supply with the cooling fan facing out the back of the case. Mount the unit with your screws. It is a good idea to hold the unit in place so it does not fall on other components. After this, you can now set the Power Supply Voltage. A fairly basic installation, just lineup the holes and screw it on. Do not plug it in yet. Remember, the cable going to the remote switch on the front of the case carries 110 volts AC. If you took the wires off the switch, make sure you connect them just as they were before. A wrong connection here can burn up your PC. After your power supply is installed, do not plug it in, you may not be able to tell if the switch is on or off and you don't want to turn the power supply on without a load. Once it is firmly in place, you must set the voltage switch. If you live in North America or Japan, set the switch to 110/115v. If you are in Europe or Africa, set the switch to 220/230v. Check to see what voltage your power supply is if you live outside of these areas. It's time to plug in all of your computer components. Take the biggest plug and connect your motherboard. Attach the four pin connectors to hard drives and CD or DVD drives, and use the small four pin connector for your floppy drive if you have one.

The Motherboard

Depending on your type of case it will either be in a fixed position or have a tray which can slide out to attach the motherboard. If it is a fixed plate you will have to lay the case on its side to install the motherboard. Now you can screw in the spacer mounts, these are the screws your motherboard will sit on. Try to spread them out evenly as the tray may have several holes for spacer screws to fit in and you only have so many

spacers, this is dependent on different motherboards, so remember to screw in the spacers in a position which will align with the holes on the motherboard. Once you have aligned the holes in the motherboard with the spacers you can now screw down the motherboard. Most PC cases will allow you to remove the metal tray that the motherboard attaches to by removing 2 or more screws. If you did not do that during disassembly then you should familiarize yourself with it now. The plastic standoffs on the motherboard are to keep the solder-side of the board from touching the metal case and shorting out. Orient the motherboard properly and either clip in, or slide in the standoffs until the mounting screw holes line up. Insert the screws that hold the board in place. The screws need to be snug, but do not twist them into the motherboard. You may be able to connect the power to the system board as you install the tray. Usually, it is better to install the RAM and CPU first to avoid the possibility of flexing the board and cracking solder connections or traces. A power supply with a baby-AT form factor will have two motherboard connectors (P8 and P9). These connectors are keyed but can be reversed. Make sure the black wires on the two connectors are beside each other. Clip the keyed edge in at an angle, then straighten the connector up and slide it on. ATX power connectors slide in until the tab clicks. Once the motherboard and tray are secured in place, you can re-install the wires for the front of the case (refer to your documentation). At this point, you can install the video card.

The CPU (Central Processing Unit) and Cooler

To insert the CPU into the socket on the motherboard you will first have to raise the lever on the side of the socket. The socket will have a pin slot missing and the processor will have a pin missing and will have the corner coloured or marked in some way to indicate that it is the corner you must align with the missing pin slot, once aligned properly the processor will fit in easily without any force needing to be applied, once the processor is in lower the lever on the side of the socket to lock the processor in place. If your processor has come with a thermal pad or thermal paste you will need to apply this to the top of the processor now this helps to transfer heat to the cooler, after you have done this you can place the cooler on top of the processor. On older motherboards the cooler will have clips that fix to the motherboard which will click into place, the newer coolers for P4 and above will simply have 2 levers on either side of the cooler. Raise these, then place the cooler on top of the processor and lower the levers to lock the cooler in place. Make sure the cooler is firmly attached. If it comes loose it can cause serious damage and on older processors you can damage it if this happens to your processor, though all modern processors will have some degree of thermal protection to prevent overheating. Luckily, CPU sockets are not friction fit anymore. If you have a PGA Central Processor (Pentium MMX or Celeron, Cyrix or AMD), it will fit into a ZIFF (zero insertion force) socket. Pin#1 on the chip has to be lined up with pin#1 on the socket. This can be indicated on the socket with an arrow, a #1 silk-screened on the board, or a flattened corner. Usually the CPU will indicate pin#1 with a flattened corner (and, or a dot on top, and, or an arrow on the bottom center of the chip). Unclip and lift the handle, insert the chip, lower the handle and

clip it in. If it's a Pentium II or a Pentium III, it will fit into a Slot 1 socket. These are rectangular in shape and have 242 pins in two rows. They are keyed, and the cartridge should only fit in one way. Check any documentation that came with the motherboard or CPU, and refer to your notes.

The RAM (Random Access Memory)

The RAM is easy to install. Different types of RAM will have the notch in different positions. Make sure you have the right type of RAM for your motherboard - check your motherboard manual to ensure this. Presuming you are using the right kind of RAM, the notch at the bottom will line up with the key in the memory slot. Now line it up and carefully press the memory into the slot - a little force may need to be applied to get it to seat correctly in the slot then once the clips close your know its securely seated. When dealing with older RAM it may be necessary to insert it on an angle to get it to fit in correctly. DIP memory modules are the hardest to install. SIMMs are inserted at about a 45 degree angle then stood up until they clip into place. If they don't clip in properly, maybe you have them in backwards. They'll usually have a key cut into one side. DIMMs are keyed on the edge connector side, they can only be inserted one way. Once they are lined up, push them down until the locking tabs on the side come up. You may have to support the motherboard from underneath if it looks as though its going to flex too much. COAST modules are also keyed on the bottom and insert much like an adapter card (Coast On A STick memory is cache SRAM).

AGP (Advanced Graphics Port)

All good modern video cards will need to be seated in the AGP slot, if you are dealing with an older video card it may need to be seated in the PCI slot which will be discussed later. The AGP slot will be brown in colour. You will need to remove the metal tab at the back of the case, if it is a new case you can just break these off, afterwards though you will need to screw in or use a plastic clip to hold the metal tab in place. Only do this if you have broken off a tab and do not intend to place a PCI card there. Installing the graphics card is easy - simply insert it into the slot and make sure it is seated correctly then use a screw to hold it in place.

PCI (Peripheral Component Interconnect)

Installing PCI cards such as sound cards and network cards are the same as installing the graphics card. There will be several free slots for various PCI cards, try to space them out if possible to prevent heat buildup in the system. Once you have installed a PCI card it is best not to remove it then place it in another slot as this can cause IRQ conflicts with some motherboards.

Floppy Disk

To install the floppy disk drive for old systems, simply slide it into the drive bay remembering to remove the plastic front panels first and removing any metal panels behind this by knocking them out. It will be the smaller of the drive bays and will be located nearer the bottom compared to the larger CD-ROM drive bays which will be located nearer the top. Once you have slid the Floppy disk drive in, secure it with screws.

HDD (Hard Disk Drive)

The HDD goes in a similar way as floppy disk but will be hidden behind the casing and is fixed into position in the exact same way as the floppy disk drive, except will only require 2 screws instead of four. Just remember to set the drive as you want it either master, single or slave. This is done by changing the jumper settings at the back of the drive.

CD-ROM (Compact Disk-Read Only Memory) or DVD-ROM/RW

Putting in the CD-ROM drive or CD-Writer or DVD is the same as putting in the HDD - just remember to use the fine threaded screws, also remember to first set the jumper settings to either slave or master bearing in mind you cannot have 2 masters on the same system.

Ribbon Cables

Now, everything you want is installed and you are getting close to finishing up but first you will need to connect all the cables. There are two main ribbon cables - the 40 pin IDE cable for the hard disk and CD-ROM drive and the 34 pin cable for the floppy drive. Cables are always colour coded to show pin 1. Most drives also provide some kind of identification for pin 1. If you find that this is not the case, just remember that pin 1 is the one next to the power plug.

Drive Power Connectors

The drive power connection is the large 4-pin connections which can only fit in one way so do not worry about plugging them in the wrong way around, a bit of force to ensure there fitting snugly may be needed. Just remember the floppy drive will use a smaller plug. The last plug is the larger ATX plug that plugs into the power socket on the motherboard.

Other Connections

For this part you may want to refer to your motherboard manual which will clearly point out where each plug goes, it will also have abbreviations on the motherboard to point out where each connection should be plugged in. For example.

• RS, RE, RST or RESET: connect the two-pin Reset cable here.

 • HD, HDD LED: these two pins connect to the cable for the hard disk activity LED.

- SP, SPK, or SPEAK: the loudspeaker output. It has four pins.

- PWR, PW, PW SW, PS or Power SW: power switch, the PC's on/off switch. The plug is two-pin.

- PW LED, PWR LED or Power LED: the light located on the front panel of the case lights up when the computer is switched on. It is a two pin cable.

Finally, if a light is not working try reversing the plug. Now your PC is completely assembled but you may want to make a last minute check of the system before turning it on. Make sure all cables are properly connected and that all devices are properly seated or screwed in, you may want to leave the case cover off when turning the PC on for the first time just in case something is not connected correctly. If you hear any beeps this will indicate that something is not correctly connected or seated. Congratulations you can now feel the satisfaction from having put your own PC together.

Final Tips

Finally, do a final check on everything installed. Re-check all installations and connections, attach and plug in the monitor. Turn the computer on. Watch for lights on the front panel. How far does the BIOS POST routine get? Are there any error messages? Is this expected? One thing that I do not like to do is to completely re-assemble a computer and then just turn it on. If it does not work at that point, then you have to tear it all apart again to find the problem. Once you have installed the power supply, motherboard, CPU and RAM, install the video card, hook up the keyboard and cables and start your computer. Of course, there are no drives installed and some expansion cards are missing, so you are going to get errors. But if it recognizes your video card, counts the memory and allows access to you CMOS setup program, then you know everything installed to that point is working. Now, turn your computer on after installing each new device. If you get an unexpected error, then it should be due to the last device you installed.

DISASSEMBLING THE COMPUTER

When the time comes to put a computer apart, it is usually just a matter of reversing the order in which you put it together.

Preparatory questions

Here are some questions to think about or discuss as you proceed: Should I document everything I do or everything I remove? Am I taking the best ESD precautions available to me right now? When you remove an expansion card what kind of card is it? What kind of expansion slot did it come from? How many bits wide is that slot? What is the bus speed? What does the card do? If there are any wires attached to the card, what is the other end attached to and what are the wires or cables for. What kind of port is on the end of the card? When removing a drive, what kind of drive is it? Is there information documented right on the drive itself? What kind of power connector does it use? Are there jumper settings on the drive? What for? Are any drives connected together or do they all have their own cable? Does it matter which cable I hook up when I reassemble? What are some of the things I know about this particular type of drive? When removing wires or cables, what are the cables for? Which connectors are actually being used and what could the other ones be for? Are they following the pin-1 rule? Is pin-1 actually designated on the device the cable is attached to? Is it designated in more than one way? Am I still taking proper ESD precautions and is my antistatic strap still hooked up? Look at the motherboard again when there is not so much in the way. Can you point out the CPU? How about the BIOS chip, the battery, cache RAM, keyboard connector? Is it an AT, Baby AT, or ATX format? Is there a math coprocessor? Where is it? Is the system memory supplied on SIMMs or DIMMs? How many pins on the memory module? How many memory slots are there for each bank of system memory? Is the CPU installed in a ZIF (Zero Insertion Force) socket or a friction socket? Are there any jumpers on the motherboard? Is there any information silk-screened on the board itself?

These are examples of the questions you should be asking yourself. Try to come up with lots more. Even if you are not prepared to actually take your computer apart at this time, just take the cover off and ask yourself these questions as you visualize the various steps involved. Remember, not all questions can be answered by a single resource. Look in your notes, check out your manuals and resource material and ask questions.

Tools

When putting the computer back together (or disassembling it for that matter), there are some basic tools that you will find handy. Of course, you will need your ESD protection equipment and a Phillips screwdriver (keep a flat-head screwdriver nearby, too. A small flashlight and a magnifying glass may come in handy, as well as needle nose pliers. A useful device for any kind of computer work is a small screwdriver with a Phillips head on one end and a flat-head on the other. When working on computers you want to double-check everything you install or connect.

Before you start, make sure you have taken all your ESD precautions. As you continue, make a conscious effort to remain aware of these precautions.

Electrostatic Discharge (ESD)

Always take ESD precautions. Remember, if you can feel a static shock it's probably close to 3000 volts. Some ICs can be affected by as little as 30 volts. Always use an antistatic wrist strap. Keep a supply of antistatic bags to place components in as they are removed. Leaving the computer plugged in is a recommended procedure. However, make sure it is switched off and remember that the cable going to the remote switch on the front of the case carries AC current at house voltage. Also, ATX motherboards have power to them all the time, even when the switch is off. Before beginning to remove a power supply or an ATX motherboard, always make sure your computer is unplugged.

Other necessary precautions and preambles

Make sure you have all what you need and your wrist strap is attached to the computer. Have a pen and paper ready. Documentation is real important. After you have changed a few jumpers or removed or replaced a few cables and cards, you probably will have to put some back the way they were. If you have documentation, putting things back together can be a simple reverse process. This is true of software troubleshooting as well.

Make sure you have the tools you need and they are all close by and handy. Be sure to have a container to keep the screws in so you have them when you want to put things back together. Make sure you have the resource material, drivers or software that you may need. If possible, enter the CMOS setup and record the information available. At least record the floppy and hard drive configuration and any settings that may be different from the default. You want to be careful not to remove the battery and lose these settings.

Disassembly is major surgery, do a full backup of the system. Programs that you have the original disks for can always be replaced, but any upgrades for those programs and any programs that have been downloaded from the Internet may or may not still be available. Bookmarks, e-mail addresses, phone and fax numbers, dial-up connections, DNS settings and networking protocols can be a real pain to replace. Even the best technicians cannot guarantee your data, so back it up. Also, in Windows9x and above, all the IRQ, I/O addresses, and DMA settings can be found (and printed) from the Device Manager in Control Panel.

Close all programs, shut down Windows, and turn off your computer. Then remove the cables from the back of the case. Finally, you may not have to follow this information to the letter, it is only meant to be a guide. If you think it would be easier to remove some components before others, do so E.g. if you can better access the data cables after the drive is out, then do it that way.

Removing the Cover

The standard way of removing tower cases used to be to undo 4-6 screws on the back of the case, slide the cover back about an inch and lift it off. Manufacturers are beginning to come up with trickier and more intricate methods of assembling these cases all the time. If there is no manual, then a little time taken for careful inspection may be in order. Do not Force Anything. If it has to be forced, it will probably break. If there are no screws on the back of the case for the cover, check the plastic faceplate on the front. Some pry off to reveal screws or release levers (remember, careful inspection). If everything on the front has its own bezel around it (including the LEDs) then maybe the plastic front pops off (or maybe the case slides off the front).

If you notice a separation between the sides and the top, then they must come off separately. A particular ATX case allows you to remove two screws from the back, then slide the side panel to the rear an inch and remove it. The other side removes the same way. Make sure any screws removed are for the cover. You do not want to unscrew the power supply by accident and have it fall inside your computer. After the case is removed, place it in a safe place, where it will not get knocked off a table, kicked or stepped on and bent.

Removing the Power Supply

First make sure it is unplugged. All power connectors should be removed, including the connection to the motherboard and any auxiliary fans. Watch the little plastic tabs on ATX connectors so that they do not break. AT power supplies have a two piece power connector that may be labeled P-8 and P-9. Make note of the orientation. The black wires should be in the middle, black to black. Remove the connection to the remote power switch at the front of the case. Orientation of the colored wires at this switch is critical. If you remove them, make sure you document well, and during re-assembly plug the computer into a fused surge protector before turning it on (this could save your motherboard and components from melting if you reconnected improperly). If you are putting the same power supply back, it is better to remove the entire switch and leave the connectors intact. The remote switch on an ATX form factor attaches to the motherboard. Remove the four screws at the back of the case and gently slide the power supply out of the case. While removing these screws, hold onto the power supply so that it does not fall into the case.

Removing Adapter Cards

Document the type of card and which slot it comes from. Check the card for any cables or wires that might be attached and decide if it would be easier to remove them before or after you remove the card. Undo the screw that holds the card in place. Grab the card by its edges, front and back, and gently rock it lengthwise to release it. Do not wiggle it side to side as you can break the card, the slot, or the solder. Sometimes it helps to grasp the inside corner of the card with one hand and place a finger from the other hand under the associated port out the back of the computer to pry up the one end of the card. Once the card is removed, you may want to record any jumper settings you see, just in case one is accidentally dislodged. Try to store the card in an antistatic

bag. If you do not plan on replacing the card then a cover should be installed over the slot opening.

Removing Drives

Removing drives is not that difficult. They usually have a power connector and a data cable attached from the device to a controller card or a connector on the motherboard. CD-ROMs may have an analog cable connected to the sound card. The power will be attached using one of two connectors, a large Molex connector or a smaller Berg connector for the floppy drive. The Molex connector may need to be wiggled slightly from side to side while applying gentle pressure outwards. The Berg connector may just pull straight out or it may have a small tab that has to be lifted with a tiny flat screwdriver. The data cables need to be documented. Remember the pin one rule. Know where each one goes before you pull it out and record its orientation (which side is the stripe on, where is pin 1?). Pull data cables gently and carefully. In other words, do not force them off, and pull level and in the direction of the pins. Now you need to do a little more inspection, can the entire drive bay be removed? Does that particular drive come out the back of the bay or does it slide out the front before the bay is removed. If a bay is removable, you may have to remove some screws or unclip a lever then slide the bay back and off. If the bay is not removable, there should be access ports on the other side of the case that allow for access to those screws (there should be, I've seen some that you just about have to remove the motherboard to access these screws). Now you can remove the screws and slide the drive out the back of the bay. If the drive slides out the front of the case, then remove the screws and gently slide it forward.

Removing the Memory Modules

Memory modules are one of the chips that can be damaged by as little as 30 volts. Be careful of ESD and handle them only by the edges. SIMMs and DIMMs are removed differently:

SIMM - gently push back the metal tabs holding the SIMM in the socket. Tilt the SIMM away from the tabs to about a 45% angle. It should now lift out. Put each SIMM in its own protective bag.

DIMM- There are plastic tabs on the end of the DIMM socket. Push the tabs down and away from the socket. The DIMM should lift slightly. Now you can grab it by the edges and place it in a separate antistatic bag.

Removing the Motherboard

Document and remove all wire attachments to the motherboard. (Some of these have Pin 1 designations also.) Most cases have a removable panel that the motherboard is attached to. By removing a couple of screws the panel can be taken off and you can gain much better access to the motherboard. Again, a little investigation can save a lot of trouble. There are usually 2 or 3 screws holding down newer motherboards. Make sure you got them right and remove them. Motherboards sit on plastic or brass standoffs that keep the traces and solder from touching the metal case and grounding

out. Once the screws are removed you can lift the motherboard out. In other cases, the motherboard has to be slid horizontally towards the bottom of the case to unclip the plastic standoffs and then lifted out. Place the motherboard in an antistatic bag.