

How To Build A Custom PC

A Visual Guide by Chad Jordan

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Introduction

In this guide, you will learn the basic step-by-step procedures of assembling a custom desktop PC. I've made this tutorial for people who have little to no experience in building a custom machine. The step-by-step approach is designed to be very specific with the visual aid of photos for those who are new to assembling custom computers. There's no secret to assembling computer hardware in a desktop-built machine. You don't need any background in computer science, no engineering experience, or really any education for that matter. I first started opening computers and replacing hardware when I was in junior high so it's not the kind of field that has a demand for any formal education. As of the making of this technical guide, I've already been working in I.T. as a Desktop Technician at my university for 3 years. Building a desktop computer doesn't make you a "*Computer Scientist*" or Engineer by any stretch of the imagination. It simply means you are a person with a technical skillset in computer hardware. The issue is, I've seen people who have built computers in all the wrong ways, mixing incorrect cache devices such as RAM and CPU's to motherboards just because "*they fit in the slots*". Just because something might fit, doesn't mean you should plug it in. I've also witnessed clients burn out capacitors and transistors on motherboards in a couple of weeks because of improper voltage. Once again, just because it fits doesn't mean you should plug it in. The same is said with any adaptor to an electronic device. If the voltage and amps do not match, **DO NOT PLUG IT IN!** Insufficient or too much electrical current was not meant to be mismatched with devices. When we assemble parts, they must be designed to work hand in hand with regard to electrical current, memory/cache, temperature cooling, RPM speeds/data transfer (*cache*) rates, and of course ensuring that the pins of the hardware do match the interface slots that you're plugging them into. All of these need to be taken into account, but in the old days of parallel port and flip-chip, it was more obvious what you could and could not plug in then. When I was contemplating my new desktop build, I briefly went back and forth between a liquid-cooled system versus an air-cooled one. While liquid-cooled computers seem a lot fancier, air-cooled systems have come a long way with better direct flow designs. This tutorial is for my latest desktop computer build, so let's jump right in!

Component Checklist

Let's create a checklist of everything you'll need before we start building:

1. Tower Case
2. Power Supply
3. Motherboard
4. CPU & Heatsink
5. Optical Disc Drive
6. Hard Disk Drive
7. Video Card/s
8. RAM

You obviously do not have to purchase the same type of components that I have in this guide. Whatever brand/s interest you for the right price, go with what works for you. It should go without saying that you want to make sure the era of all your components are purchased and designed within the same timeframe of when they were released on the market. E.g. cache speeds and architecture with motherboard, memory, graphics, and CPU types all need to match.

Step 1: Unpack Tower

There isn't much to prepare for the tower of your desktop computer. Simply remove it from the box, along with any other protective foam or padding from the inside out from it. I purchased the Antec 1200 series v3 full steel tower as my new tower and love it. The cold and solid steel chassis will keep my components extra cool with plenty of room to breathe. You'll see some small cables with jumper headers on the ends with small lettering already attached inside of the tower. Do not worry about those at the moment. Simply leave them alone for now as we will use them later.

Step 2: Observe Motherboard Components

Get your motherboard out in front of you and take a good look at the components that come inside of the box. Verify everything is complete and accounted for.

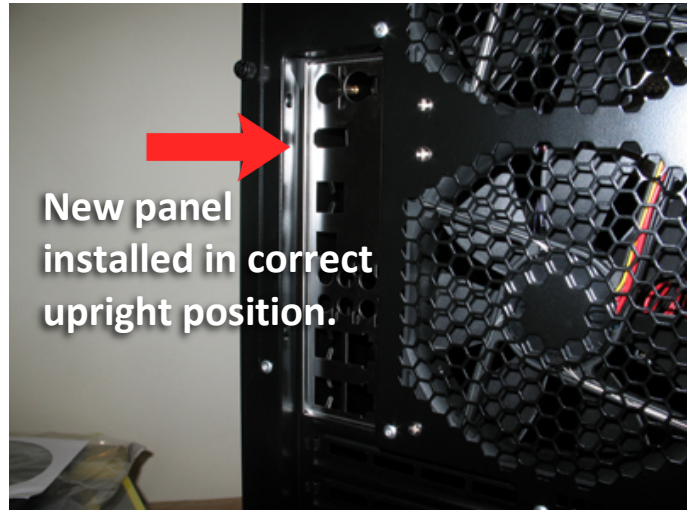
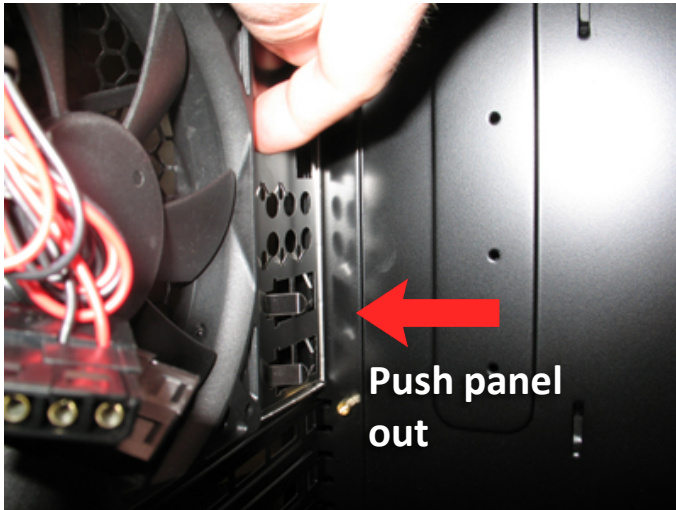


Since we are building a custom pc, your motherboard package should include what is known as an I/O (Input/Output) Panel. This is a small thin metal bracket with holes that signify where your peripherals will plug in through the back and into the motherboard. **Be sure to observe** the IO Panel that came with your motherboard compared to the generic default one that came with your tower.



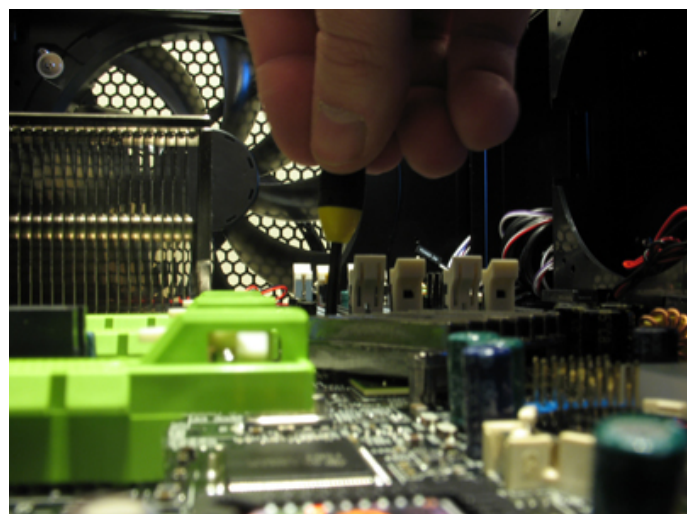
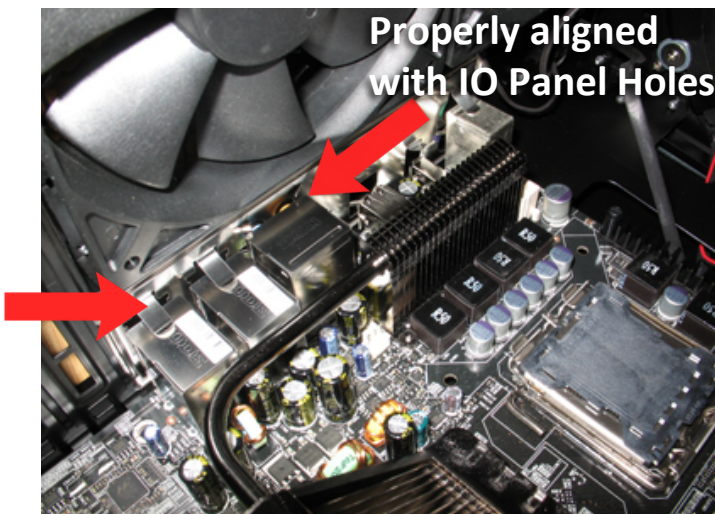
Step 3: Replacing Generic IO Panel

Since our panel obviously has to match the motherboard input and output connections, you'll want to replace the default I/O panel that was included in your case, with your new panel to fit the motherboard connectors. Now just pop out the default panel by either pressing or pulling in the direction that your case requires and it should easily come right out. Hang on to the original panel should you decide to sell your case down the road.



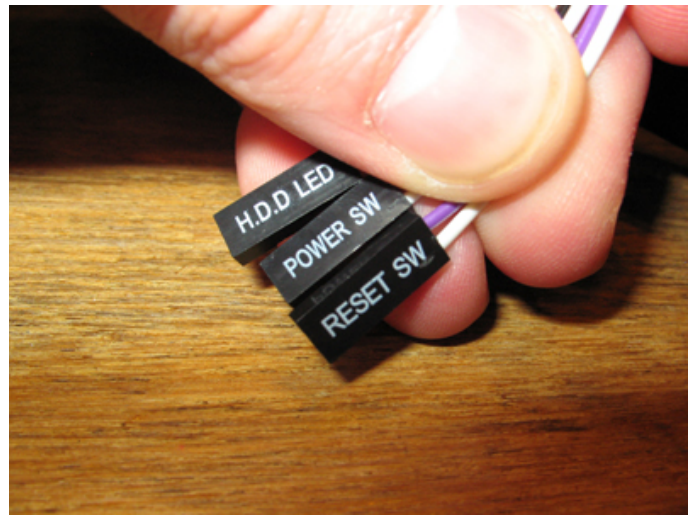
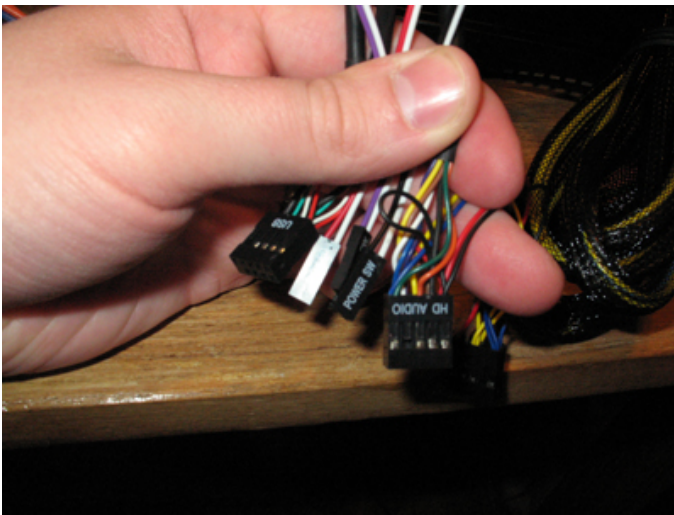
Step 4: Installing Motherboard

Now that we have our I/O panel in place, it's now time to install the motherboard. Once you've removed your motherboard from the box, this is nothing to feel intimidated about. Simply slide it into place with your I/O panel so that it is aligned with the holes. See picture below on the left for example. If aligned correctly, you'll see the screw holes lined up underneath your motherboard as well. Also, notice how the metal support flaps are resting above the I/O connectors. Now it's only a matter of screwing in the board. Use the screws that came provided in the box. Sometimes companies are short one or two screws. Be sure the board is securely in place so that it will not flex or bend at any point in the future while working on it.



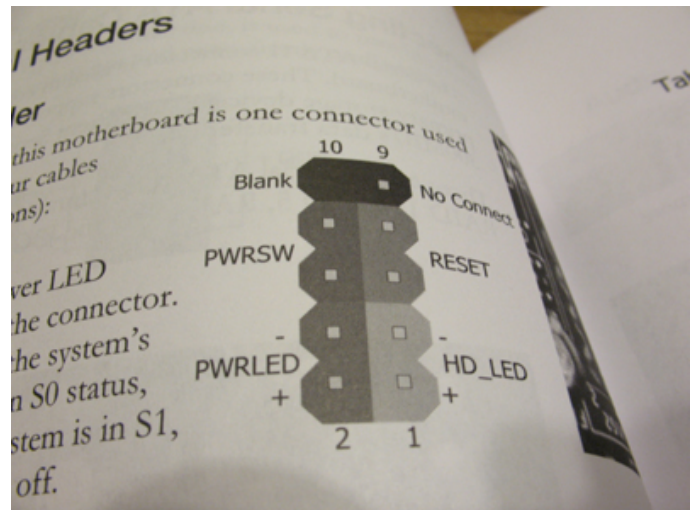
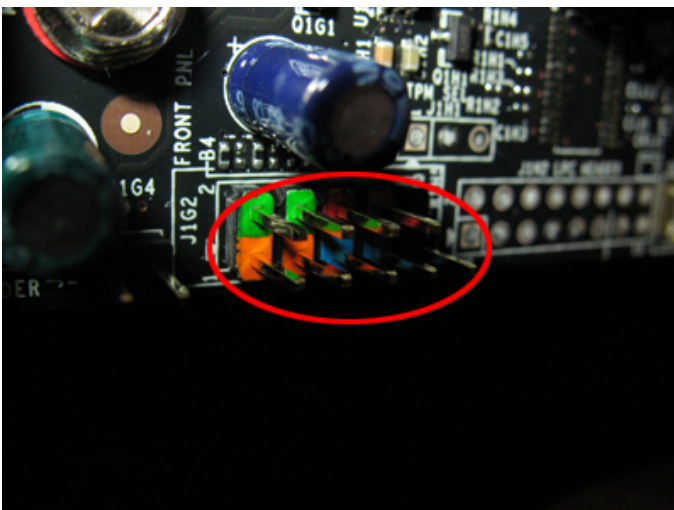
Step 5: Identifying Component Cables

Remember me mentioning the small cables attached inside of the tower earlier? In order for the motherboard to function and properly communicate with the computer's components, we need to attach the power switch wires, USB, hard drive, and audio jumper headers to the pins found on the lower right side of the board. Take a minute to observe your cables. The H.D.D. LED is the hard drive LED light that blinks on the front of the computer indicating hard drive activity. The SW's are the switches for your power and reset buttons. The rest are already labeled for USB and Audio so those are self-explanatory.



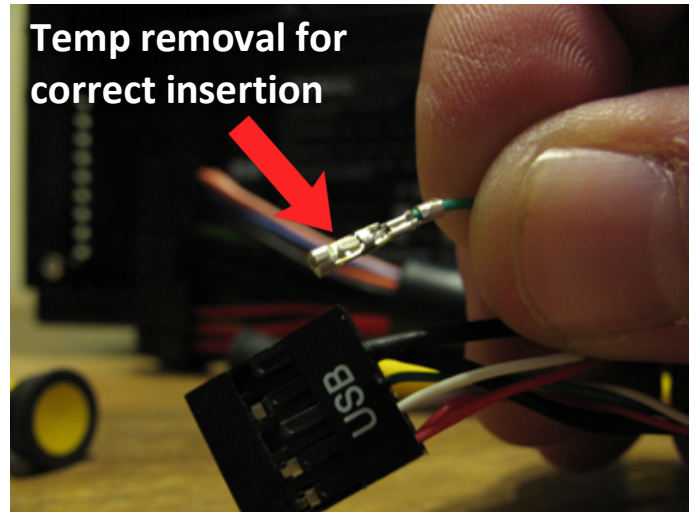
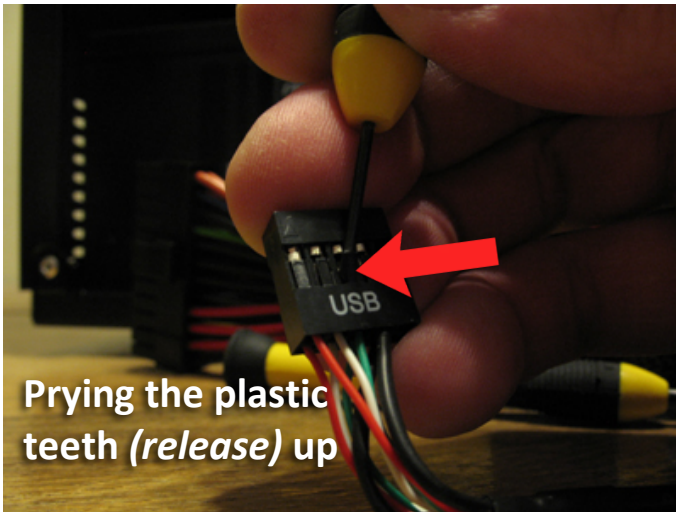
Step 6: Locating Component Pins

Before we can connect the cables, first, we have to prep the cables and locate the pins on the bottom of the motherboard. They'll look very similar to the photo on the left. This is where you need the manual. Many standard motherboard brands have similar configurations. However, there are newer boards from various brands that have different jumper settings on their motherboards. This is the primary reason you need the manual. Some boards even have labels on them. The photo on the right demonstrates the cable placement for my board. If for some reason you do not have a manual with you, you will need to search online for the brand and model of the motherboard so you can reference the online version.

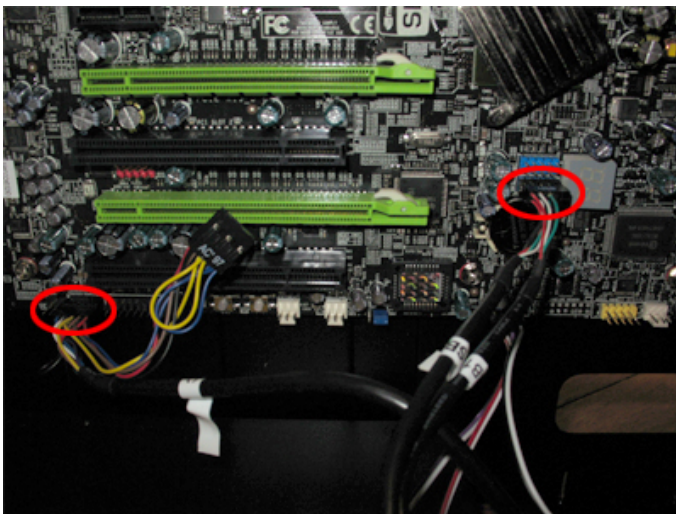


Step 7: Prepping and Connecting Component Cables

My manual requires me to change the contacts inside the jumper headers. If you find that your manual settings do not match the default jumpers, you will have to relocate the pins inside the headers. To do this simply lift up the small plastic teeth on the headers and pull out the electric contact that needs relocated. Remove and relocate any contacts the manual specifies. This is not as hard as it may seem. Just re-insert it in the proper slot and make sure it catches on the plastic tooth so that the contacts align with the requirements. With all of your jumpers prepared for insertion, plug them into the pins on your motherboard specified by your manual.



When I connect the power jumpers and component cables to the pins on my motherboard, they look like the following photo.

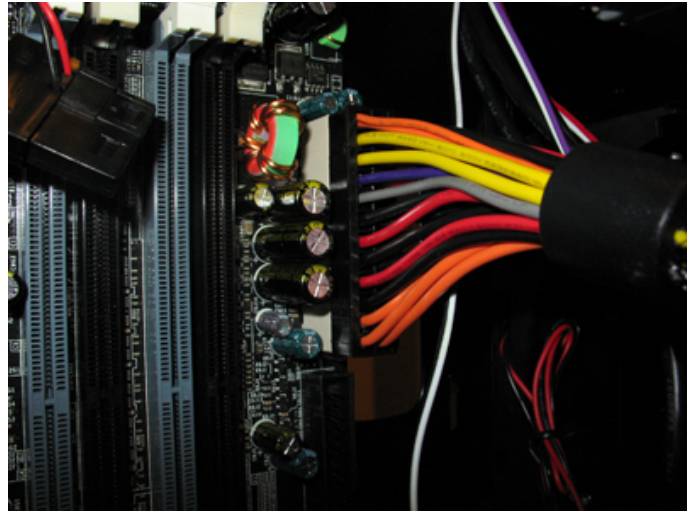


Now we prepare to install the power supply.



Step 8: Installing Power Supply

Once you remove your power supply from its box, align it to the rear of your tower's case, and screw it in place with the supplied screws. Your power supply should be in place and once it is, you can plug the main internal 20/24 pin Molex connector into your computer.



Step 9: Installing Optical Drive

Next, we'll prepare your disc drive for installation. This is another easy step. Just remove one of your 5.25 panels and then you only have to slide it in. Align the holes, screw them in tightly, then connect the SATA or ribbon cables for the power and motherboard connection. If you're still using IDE ribbons, refer to your manual if needed. The IDE slot on the far right of the motherboard should be self-explanatory though.



Step 10: Installing Hard Drive

Now let's install the hard drive. Carefully unpackage it and do not touch any exposed circuitry on the bottom of the drive. Another easy install for you is the hard drive. For my particular case, it's easier for me to remove the individual drive bays from the front of the case rather than installing the hard drive from the inside. Your computer case may be different. If so, just slide it in so you can plug in the SATA cables or IDE ribbons from the drive to your motherboard.



Step 11: Installing the CPU and Heatsink

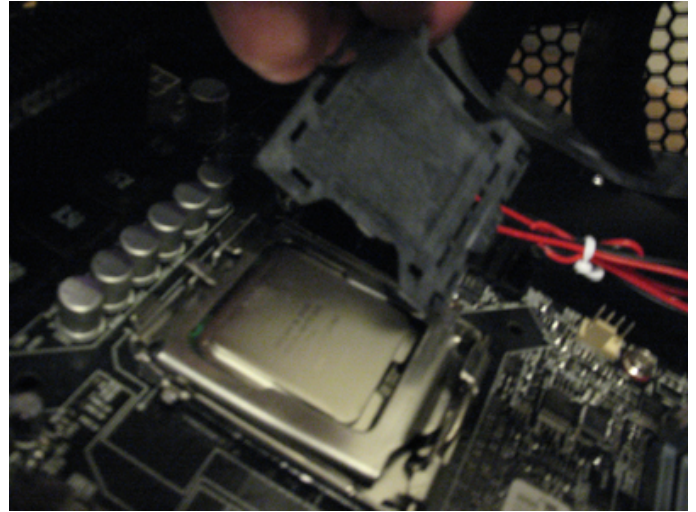
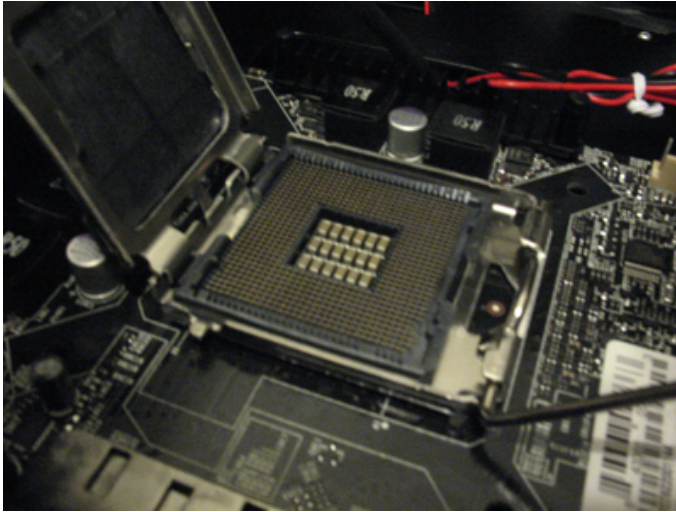
Now it's time to install the CPU (Central Processing Unit). Your processor will vary from mine if it's an AMD or single-core chip. Either way, it's time to do some close-up inspection of both your chip and CPU socket on the motherboard. Open your CPU packaging. Depending on your heatsink and CPU, you may or may not have to apply thermal compound to the top of the chip. Most heatsinks today are made of copper with an already applied compound on the bottom. This helps to regulate the temperature of your CPU while in use so it does not overheat.



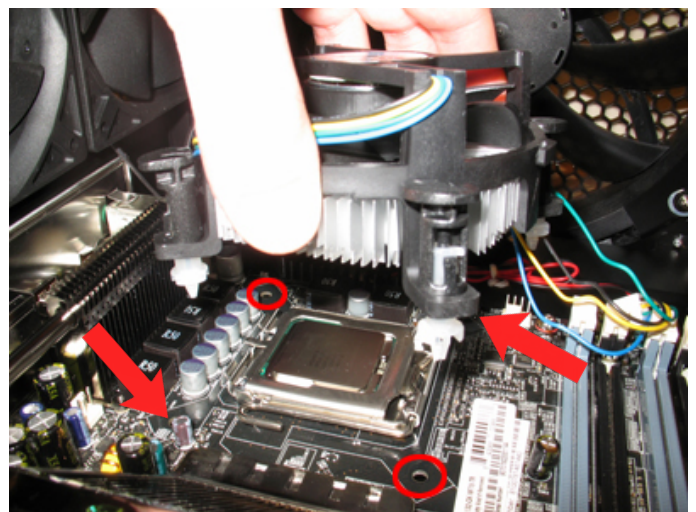
Important Note:

Do not touch any part of the CPU on the bottom once you've removed it from the packaging. CPUs are always handled by holding them on the tips of the edges.

Next, let's begin by lifting the small tension bracket allowing us to unlock the CPU face clamp once you've lifted it, be sure to not touch any part of the inside of the circuitry. If you have an Intel board, you may have a plastic guard that came with it to cover up the CPU clamp. If so, make sure you now remove the plastic cover after placing the CPU in the socket. My CPU socket is referred to as an LGA 775 socket so it's very particular to all Intel motherboards.



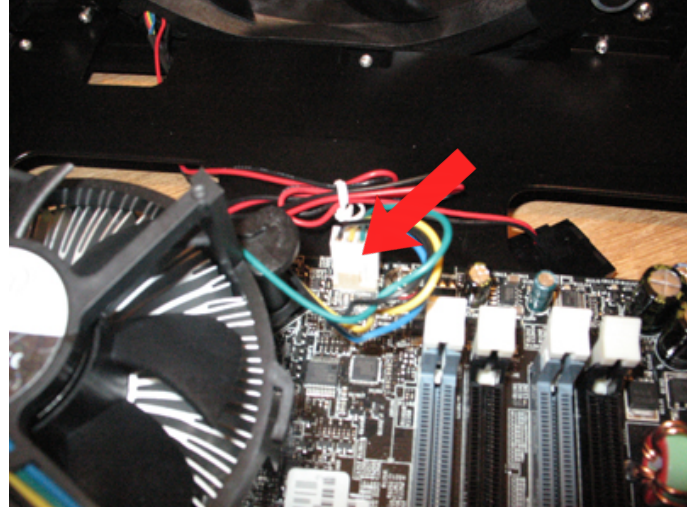
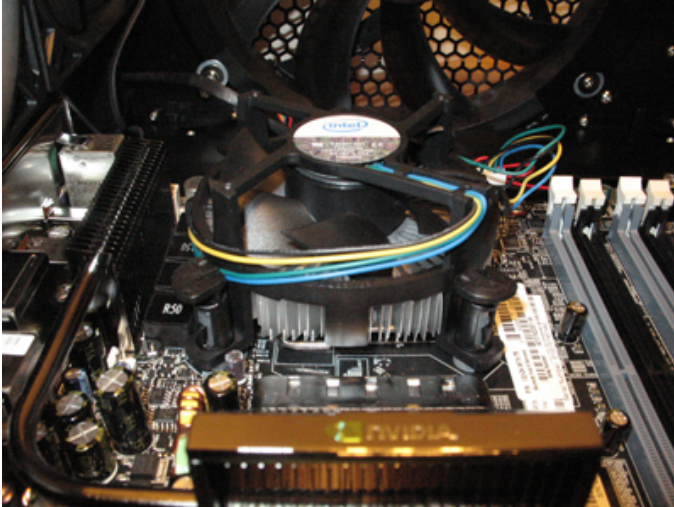
With the CPU properly in place, just close the clamp, lock down the tension bracket and your CPU should now be properly seated. Now, let's lower the heatsink on top of the CPU. This step will definitely vary from CPU to CPU. For my model, it's just a matter of pushing in the plugs on all four holes on the corners of the CPU and then locking them in. If you observe your heatsink and motherboard closely, it should be very straightforward of how to connect it to your CPU and motherboard. If you are unsure, refer to the manual for your motherboard.



Important Note:

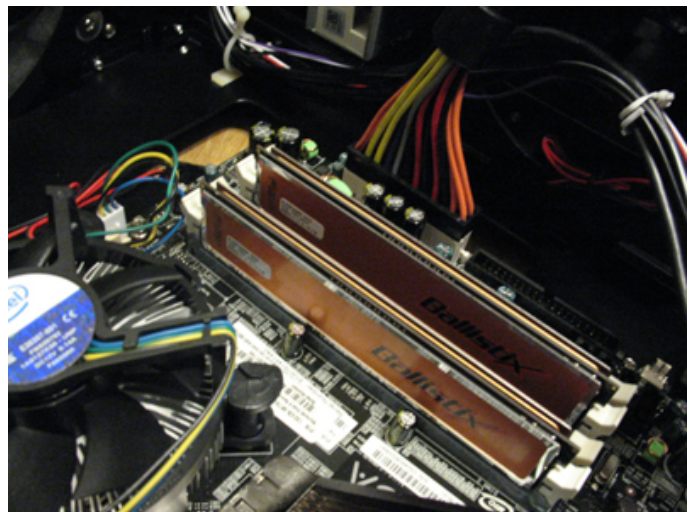
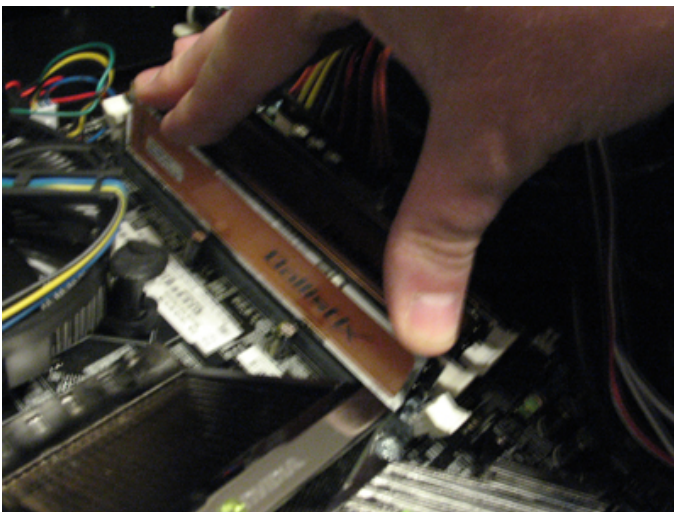
Your heatsink must be compliant with the motherboard and processor otherwise you will not be able to connect it.

Once you clamp down all four sides, your heatsink should be securely locked down tightly to the CPU. Next, be sure to plug the three-prong power connector into your motherboard. Near the heatsink should be three pins where you can connect to the board. Most boards will even be labeled 'pwr' or 'htsnk pwr' so you should be able to locate this very easily.



Step 12: Installing the RAM

The RAM (*Random Access Memory*) is the single most easy component of the entire computer to install. Just to the right of my CPU and heatsink sits four parallel slots for memory sticks to be installed. Look at the bottom of your memory sticks and see there is a single small gap that sits between a plastic divider on the memory slot. Before you place them in make sure your RAM is properly rotated to align with that gap and ensure the teeth of your ram are properly lined up with the ram slots. Pull back the slot clamps, line them up and gently apply pressure to snap them into place. You'll know the ram is secure when the slot clamps click back into place.



Important Note:

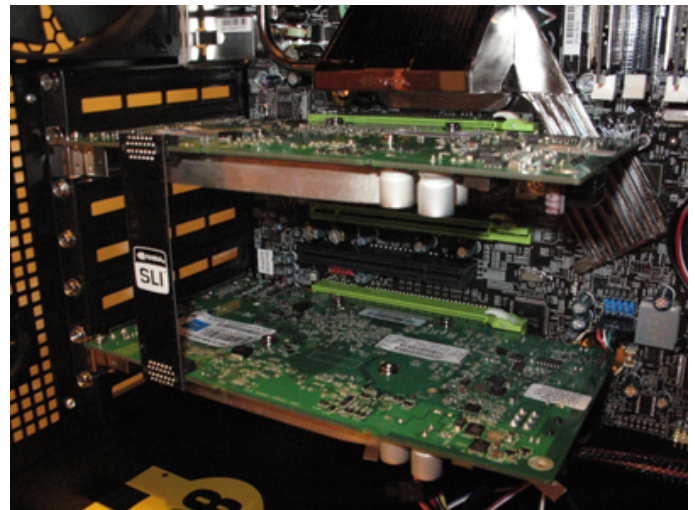
If your motherboard supports dual channel memory then you'll need more than one stick of ram. You'll want to make sure the sticks are both placed in matching banks.

Step 13: Installing the Graphics Cards

Now it's time to install our graphics (*video*) cards. This is another very easy step and will essentially finalize this tutorial. Just install the card/s into the proper slots. My board supports three PCI-Express slots, but for this tutorial I am just using two. If you have one card, it's only a matter of connecting it to the board and securing it to the case with the supplied screws.



However, if your motherboard supports SLI (*Scalable Link Interface*) capable cards and more than one, then you should have an SLI bridge that came with your motherboard. SLI is a deprecated multi-GPU technology developed by Nvidia for linking two or more video cards together to produce a single output. SLI is a parallel processing algorithm for computer graphics, meant to increase the available processing power. Serious gamers harness the power of Nvidia graphics for higher-end games, and while I use it for some gaming, I mostly use the power for accelerated-rendering of my computer graphics projects.



Important Note:

You cannot mix two different graphics cards even if it's another PCI Express x16 slot that fits the SLI bridge. For SLI to function properly with no system errors they must be two of the exact

same cards. It's the same scenario even if you have a triple SLI bridge with three slots on the motherboard. It will not work so do not attempt to try mixing unmatched/alternate cards.

Final Step: Testing the CMOS Battery

Our final step in this process involves confirming a successful power test on our newly built desktop computer. What do I mean by successful? Every motherboard for PC's have a small CMOS battery seated on it. Upon booting up a PC, there is a small computer program that runs. This program is responsible for booting up your computer and configuring data flow. The CMOS battery powers your desktop and laptop's BIOS firmware. If you hear a single beep after you've turned on the computer, the firmware has successfully been activated and the computer can continue running the boot sequence. If you turn on the computer and do not hear the beep, then the program has reached an error and the system will not allow the boot up process to complete due to a system error. Since my computer gave the single CMOS beep, I knew it was all set to go. I put my side panel on, and connected it to the rest of my peripherals since the build was a complete success!



Conclusion:

This concludes my technical guide on how to build a custom PC. I hope it successfully assisted any potential readers who wanted to learn how to build their own custom desktop computer, or at nothing else, allowed you to learn some new things with how the process works. It's really not difficult at all to build your own computer. Everything I learned about this was through trial and error, and just applying basic common sense to electronic components. Everything has a manner in which it's built to function, and this is how it's performed with building a PC. All images used in this guide were captured by me and the knowledge applied was from years of exposure and experience to computer technology. If you have any questions about this guide or any other general inquiries, you can email me at technologicguy@gmail.com