PC Chop Shop:
Tricked Out Guide to PC Modding

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SYBEX® San Francisco • London

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To everyone who ever disassembled anything to see how it worked.

Acknowledgments

I want to thank everyone at Sybex for having faith in this book. Of all the books I've ever written, this was probably the most fun. I would like to thank Elizabeth for her work in the development of the book and its concept and Leslie for commandeering the project and making it happen. Thanks go to Jeff Kellum, Sally Engelfried, Nancy Riddiough, Amy McCarthy, Jack Lewis, and the great design folks at Happenstance Type-O-Rama.

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Finally, thanks to my wife, Linda—who was patient while I was grumpy, and to my kids—who helped me relax by letting me read them stories when I needed to.

Foreword

Have you ever seen the film *The Fast and the Furious*? The testosterone-fueled film that features eye candy–laden hot rods adorned with unending modifications and glaring lights is a true testament to the potential that mankind has when art meets passion, function, and performance. I often use that film as a way to help people understand the hobby of PC modding. The similarities between a hot rod enthusiast and a PC enthusiast are many. PC modification is a hobby that is relatively new, and what makes it so appealing is that it is an outlet for artistic creativity that in some cases can yield tangible benefits to performance. In others, it can lead to fame or even a full-time career. No matter what mod you do, part of the end result will always be that it was rewarding. Whether successful or failed, attractive or ugly, you learned something (and hopefully have a sweet looking and/or running PC).

My first "mod" was performed by taking a plain beige midtower case and drawing tribal flames up, around, and over the case using a blue sharpie marker (`http://gallery.pimprig.com/showphoto.php?photo=894`). Shortly after that little mod done back in 2000, I began to notice others who had the same ideas but already were beginning to take it a step further. You can see my latest project to see the progression here: `http://gallery.pimprig.com/showphoto.php?photo=2757`. Manufacturers quickly took notice and hustled to sell innovative specialty products for the growing modding community. Have you noticed how it is actually easier to find a colored case than a beige one now? The PC modding trend has definitely outgrown fad status.

Not long after that first mod I launched PimpRig.com, which has experienced unexpected, rapid growth. In less than two years I had a website with over 5000 members and a forum that has an average of 100 members discussing topics at any given time. PC modding, and my coverage of the topic since my start, has been a major contributing factor to my success and has allowed me to run the website as a full-time career. Other creative PC enthusiasts have been able to use their modding skills to create their own careers that revolve around the creation and sale of these tricked out computers. PC modding is big, and it will only get bigger.

What exactly *is* a PC mod? Anything you have done to alter the PC. For instance, here are some topics the guides at PimpRig.com cover: custom window etching techniques, custom wire sleeving techniques, and painting. There are *countless* mods that can be performed on nearly any PC case and/or component. Any mod guide that you read will contribute to your overall knowledge, and the instructions and techniques contained in *PC Chop Shop* will undoubtedly help you make your own modding ideas a reality. Remember that PC modding is a hobby for anyone and everyone. I have seen high school students, teachers, military, medical professionals, and nearly any other profession or demographic. Get informed, get involved, and have fun!

Smack ya rig up!
GARY MULLINS
Administrator
www.pimprig.com

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Introduction

For years, people have put up with the designs from major computer manufacturers because they felt they had no choice in the way their computer looked. However, some people have taken it upon themselves to make their computers match their personalities and their own sense of style. As time goes on, more and more people want to make their computer their own and customize it to their liking. This ever-growing trend is known as computer modification or modding.

There are some similarities between modding and the hot rodders of the ’50s and ’60s. Hot rodding started with people who wanted to build a car that was unique and matched their personality, so they took existing cars and customized them. People tend to customize things to make them more their own, to match their sense of style. In fact, that’s why we called the book the *PC Chop Shop*—to pay homage to the rod shops of the ’50s and ’60s.

You will learn in this book about the different types of modifications that have been done, and you will see how to do them. But, if you are going to do any computer modification, you must realize that these procedures are only the beginning. Build on them yourself and come up with new modifications to make something truly unique. Let your imagination go and design a computer that isn’t just another gray or beige lump sitting next to your desk!

Contributing Companies

Corsair Memory provided the author with a 512MB Corsair Pro Memory Module. Corsair Memory has been designing and manufacturing high-speed modules to meet the performance demands of extreme gamers since 1994. For information on this and other quality products from Corsair Memory, visit their website: `www.corsairmemory.com`.

Xoxide.com provided the following products:

- Rounded IDE cable
- Blue cold cathode with extra blue bulb
- Blue meteor light
- 120mm blue fan
- Serial ATA power adapter
- 18" EL wire SATA cable
- Blue Lazer Tri-LEDs
- PS change-over kit
- Techflex chrome sleeving kit
- Silver lighted keyboard

For a full list of the products available from Xoxide.com, visit their website: `www.xoxide.com`.

Many of the pictures of mods in the color section were collected by Gary "Glitterkill" Mullins and his staff at PimpRig.com. Visit them online at `www.pimprig.com`.


IBM


PCHertz.com

Introduction to PC Modification

Okay, you may have picked up this book out of sheer curiosity and asked the question everyone asks: "What is this book about?" Well, it is about the process and art (and yes, it is truly an art) of modifying a computer to make it match the modifier's vision

If you looked at the cover of this book and couldn't guess what was inside, the figure on the facing page shows the difference between a standard computer and a modified one.

In this chapter, you will learn about what computer modification is, the tools and skills needed to do it, and some of the warnings that go along with it.

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Chapter Contents

The What, Why, and Who of Modification

Before we get into the meat of modification, I'll give you a little background on what exactly computer modification *is*. It's primarily a PC-related phenomenon, but there have been several Macintosh computers modified over the years (remember the Mac Plus fish tanks?). First off, it is important to use the right terminology. A modified computer is normally designated as having been *modded*. And a single modification or single theme is often known as a *mod*. A person who does these mods is known as a *modder*.

Note: Mod is actually short for case mod because the first modifications were mainly to the case of the computer, not to any other component.

What Is It?

Mods fall into two categories: case mods and computer mods. *Case mods* are those modifications that really only affect the case or the looks of the internals—that is, visual modifications. *Computer mods* are generally those mods that include not only case mods, but entire electronic constructions and modifications.

For example, Figure 1.1 is an example of a typical case mod. It uses colored lights, has a window in the side, and has multiple case fans.

Figure 1.1 A sample modded case

Why Do It?

Because you can!

Most people who do case modding do it because they don't want the same computer that everyone else has. Computer modders are usually those people who customize everything to make it resemble their personality.

Modding is truly an art form. It is an expression of the creativity and talents of the modder. By looking at the case mods a person does, you can get a sense of who they are.

Besides, when you go to a LAN party, in addition to your gaming skills, don't you want to show off your case modding skills? As a matter of fact, at most major LAN parties (especially ones like QuakeCon) there are case mod contests for cash and prizes. Cool, huh?

Who Is Doing It?

You might be asking yourself, "Yes, this is cool, but who is doing this?" Well, gamers are the primary people doing case modding. You might think that this represents a fairly small percentage of the entire population (the demographic is mainly the 14–22 year old male). However, the case modding trend is becoming so popular that major computer retail chains (Best Buy, CompUSA, and so on) are carrying modding parts.

More and more people are trying to create something unique for themselves out of their computer. They don't want the same old beige box sitting on or next to their desk. For that matter, some don't want a box at all—some mod the computer right into their desk.

Warnings

Okay, from here on out, you're going to learn about how to mod your computer. But I would be remiss in my duties as an author and case modder if I didn't make extremely clear *before* you do anything some of the things you need to understand about the dangers of modding your computer or building a modified computer. These issues include:

- Warranty issues
- Parts destruction

Warranty Voiding

Most often, modding will void any and all warranties by the manufacturer. These components (except for modding components themselves) were not designed to be modified. So, in case you missed it:

Any modification work you do on computer components outside of what the factory intended will most likely void your warranty. *If you mess up, it's your fault*. You will have to buy a new part. If you don't want to buy a new part, *don't do it*.

Parts Destruction

With some of the advanced mods, you will be taking apart components that may not have been designed to be taken apart (for example, hard drives). It is completely possible that unless you are careful, you may destroy a very valuable component. Even if you follow the directions I outline here, problems do occur. Something as small as a single particle of dust or metal filing can render a component unusable.

Safety

As if the other warnings weren't enough, there are several safety issues to consider as well. In addition to damaging components, it is possible to harm yourself while modding computers if you're not careful. You will be working with tools and, unless you are completely familiar with their proper use, you can seriously hurt yourself.

Pay attention to the warnings in this chapter and those dispersed throughout the book.

Safety Equipment

Safety begins with proper attire. What you wear while modding is important. Your clothes should fit, and there should not be any loose fabric that might catch in a spinning blade or shaft. Also, if you have long hair, your hair should be pulled back and out of your face so it doesn't interfere with what you are doing.

Some of the other safety equipment you may need to use includes:

- Eye protection
- Ear protection
- Gloves
- Breathing masks and filters

You can buy many of these items at your local hardware store or paint store. Let's take a quick look at each of these and how each should be used properly. Some of these pieces of equipment you may have used before, but some you may not have.

Eye Protection

My shop teacher in high school used to say, "You only get two eyes, fellas, so put them goggles on." Eye protection of some kind is usually made of polycarbonate or some other tough plastic material and comes in two styles: safety glasses and true goggles. Safety glasses look like regular glasses, except they have polycarbonate lenses and extra side guards attached to the earpieces. Safety goggles, on the other hand, are better for people who wear glasses because they completely surround the eyes and are secured to your head with an elastic band.

Whichever works for your particular situation, just make sure you use them whenever there's a possibility of flying dust or debris.

Ear Protection

When working with metal and plastic, you'll often use high-speed cutting tools. These tools make loud, high-pitched noise when they're doing they're job (though they do their job very well). These high-pitched noises can damage your hearing when you're exposed to them for a long time. So, it's a very good idea to wear some kind of ear protection, like ear plugs or the sort of ear muffs that look like large padded headphones.

Gloves

You might be thinking, "Why would I need gloves?" Well, for one main reason: to protect your hands from sharp edges and dangerous chemicals. Freshly cut openings can be razor sharp, so it's a good idea to have a pair of canvas or similar gloves to protect your hands when working with metal.

Additionally, when working with solvents or paints, it's a good idea to use some kind of nitrile gloves that are solvent proof. You can usually buy a pack of 100 at a tool store like Harbor Freight (`www.harborfreight.com`) for around $10. Isn't your skin worth $10?

If by chance you might be welding on your case, you should have a pair of thick welding gloves. They're usually made of leather and are long enough to protect you hands and forearms from sparks and burns. Most mods are done without welding, however.

Breathing Masks and Filters

Probably the most important and most overlooked safety equipment is breathing protection equipment. Whenever you do modding, you will constantly be creating particulate matter like small metal filings, paint dust, and so on. It is not healthy to breathe this in. In addition, painting creates dangerous fumes. These fumes, if inhaled, can cause headaches, dizziness, even death (especially if using automotive urethanes).

For this reason, you need to use the right kind of breathing protection. For dust and other particulate matter, you should wear a *dust mask* according to the manufacturer's directions. Dust masks are made of a tightly woven paper fabric.

However, a dust mask only filters dust, it doesn't filter out fumes. So, if you're going to do any painting, you should buy a *painting respirator*. These masks have dual charcoal filters and a one-way valve. When you breathe in, the valve is held closed and the incoming air is filtered through the charcoal filters. When you exhale, your breath goes out the one-way valve. Figure 1.2 shows an example of a painting respirator.

Figure 1.2 A sample painting respirator

Warning: These painting masks are okay for aerosol spray can painting, but if you are going to use automotive paint and automotive spray equipment, this kind of a mask is not sufficient.

Warning: The charcoal filters in painting respirators should be replaced every six months or so (more often if used heavily). If you can smell paint while wearing the respirator, stop painting and replace the respirator's filter cartridges.

The final kind of breathing protection equipment is only necessary if you are doing automotive painting. If you spray automotive paints using a spray gun, you must use a *forced air breathing apparatus (FABA)*. This system (as shown in Figure 1.3) uses a compressor or air pump to bring in fresh, filtered air from outside the spraying area and feed it directly to the mask. That way, no contaminated air can be breathed because fresh air is always pushed to the mask. These systems are very expensive ($500–$1000), but are worth it if you do any automotive paint jobs.

Note: If you want this quality of paint job and are only going to do it once, it makes sense to sand the panels yourself, then take them to a body shop. They can usually do the job for much less than it would cost you to buy the equipment.

Figure 1.3 A forced air breathing apparatus (FABA)

Metal Safety

First of all, most cases are made of some type of metal (be it steel or aluminum). You will often need to make holes in the case metal (using a drill, nibbler, or whatever) to install a fan or window. When you are cutting these holes in the metal, you must be very careful not to cut yourself on the sharp edges of a fresh cut. It is a good idea to dress the fresh cut with a file or sandpaper (I'll cover exactly how to do that later).

Also, when cutting metal, as we already discussed, make sure to wear the proper safety gear, especially when using power cutting tools. To minimize the chances of cutting yourself, wear thick leather gloves. These tools will also often throw sparks and small shards of metal with force, and these shards can embed themselves in your skin or your eyes. In addition to the gloves, you should wear goggles and ear protection when cutting metal with power tools.

Also when cutting metal, be aware of combustible fumes in the air. Stray sparks may ignite these fumes and cause a fire, or worse, an explosion.

These same power tools can also catch on the metal and possibly "kick back" so take your time when making a cut and hold the tool security.

Above all, *pay attention* to what you are doing. The biggest cause of accidents is distraction!

Tool Safety

Tool safety is primarily about knowing the proper way to use a tool so that you don't injure yourself or others. It's fairly obvious to state don't put your fingers into any moving parts, don't run with scoring tools, pencils, or scissors, yada yada yada.

In addition, follow the correct procedure for using the tool and the instructions that came with the tool. Most power tools come with safety instructions, so be sure to read and follow them before using the tool.

Chemical Safety

You will be using several dangerous chemicals when doing case modding, including paints, thinners, and cleaners. These chemicals pose danger because you can inhale their fumes, get the chemical on your skin, or accidentally ingest the chemical.

Each chemical has a special sheet that lists the hazards it can be to human health and well being. These sheets are known as a Material Safety Data Sheets (MSDS), and they are available from the manufacturer and distributors of chemicals. An MSDS also tells what should be done in case of exposure to the chemical.

Generally speaking, it is a good idea when working with chemicals of any kind to wear protective gear (eye protection, gloves, and so on). Also, if the chemical you are using (paints, thinners, and so on) emits fumes, you should wear breathing protection and work in a well ventilated area.

Preventing Electrostatic Discharge (ESD)

Electrostatic discharge (ESD) happens when two objects of dissimilar charge come in contact with one another. The two objects exchange electrons in order to standardize the electrostatic charge between them. This charge can cause problems such as making a computer hang or reboot. It can also, and often does, damage electronic components.

The likelihood that a component will be damaged grows with the increasing use of Complementary Metal Oxide Semiconductor (CMOS) chips, because these chips contain a thin metal oxide layer that is hypersensitive to ESD. The previous generation's Transistor-Transistor Logic (TTL) chips are more robust than the newer CMOS chips because they don't contain this metal oxide layer. Most of today's ICs are CMOS chips, so ESD is more of a concern.

Note: CPU chips and memory chips are particularly sensitive to ESD. Be extremely cautious when handling these chips.

The lowest static voltage transfer you can feel is around 3000 volts (it doesn't electrocute you because there is extremely little current). A static transfer that you can *see* is at least 10,000 volts! Just by sitting in a chair, you can generate around 100 volts of static electricity. Walking around wearing synthetic materials can generate around 1000 volts. When you shuffle your feet across the floor and shock your best friend on the ear, you are discharging static electricity into the ear of your friend. You can easily generate around 20,000 volts simply by dragging your smooth-soled shoes across a shag carpet in the winter. (Actually, it doesn't have to be winter to run this danger. This voltage can occur in any room with very low humidity.)

It makes sense that these thousands of volts can damage computer components. However, a component can be damaged with as little as 80 volts! That means if even a small charge is built up in your body, you could damage a component without realizing it.

Antistatic Wrist Strap

There are measures you can implement to help contain the effects of ESD. The first and easiest is wearing the antistatic wrist strap, also referred to as an *ESD strap*. To use the ESD strap, you attach one end to an earth ground (typically the ground pin on an extension cord) and wrap the other end around your wrist. This strap grounds your body and keeps it at a zero charge. Figure 1.4 shows the proper way to attach an antistatic strap.

Warning: An ESD strap is a specially designed device to bleed electrical charges away *safely*. It uses a 1-megohm resistor to bleed the charge away slowly. A simple wire wrapped around your wrist will not work correctly and could electrocute you!

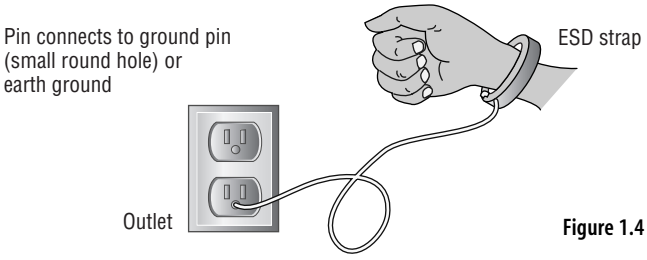

Figure 1.4 Proper ESD strap connection

Warning: There is only one situation in which you should not wear an ESD strap: if you wear one while working on the inside of a CRT monitor, you *increase* the chance of getting a lethal shock.

Antistatic Bags for Parts

Antistatic bags are important tools to have at your disposal when disassembling a computer for modification because they protect the sensitive electronic devices from stray static charges. These silver or pink bags are designed so that the static charges collect on the outside of the bags rather than inside on the electronic components.

You can obtain antistatic bags from several sources. The most direct way is to go to an electronics supply store and purchase them in bulk—most have several sizes available. Perhaps the easiest way to obtain them, however, is simply to hold on to the ones that come your way. That is, when you purchase any new component, it usually comes in an antistatic bag. Once you install the component, keep the bag. It may take you a while to gather a collection of bags if you take this approach, but eventually you will have a fairly large assortment.

Now that we've gotten all the negative stuff out of the way (so you can't say no one told you), let's get to my favorite part, the tools!

Tools

Ask anyone that knows me—one of my favorite parts of modding is the great tools I get to use. Any chance to buy or borrow and use a new tool is for me! <*insert male grunt here*> Tools are a great thing. I can change and modify my world at my very whim while making a lot of noise the whole time!

Modding PCs doesn't require many special tools, but there are a few that you'll need to use for specific projects, and we'll need to discuss the tools and work area before we get to the projects themselves.

Workspace

Where you work is almost as important as what you work on. Ideally, you're going to want to have a workshop, or at least some space you can spread out all of your components and parts while you are working. Keep in mind that if you are doing any of the paint work yourself, you can paint outside, but you'll have more work when cleaning up the paint job because there will be more dust and trash in the paint.

So, find a place you can work, like a basement or garage, that has a flat, stable, level surface to work on, like a workbench. Although you can use a table without any