Dell Proprietary (Nonstandard) ATX Design

If you currently own a desktop system made between 1996 and 2000 from Dell, you will definitely want to pay attention to this section. A potential booby trap is waiting to nail the unsuspecting Dell system owner who decides to upgrade either the motherboard or power supply in his system. This hidden trap can cause the destruction of the motherboard, power supply, or both! Okay, now that I have your attention, read on....

As those of you who have attended my seminars or read previous editions of this book will know, I have long been a promoter of industry-standard PCs and components and wouldn't think of purchasing a desktop PC that didn't have what I consider an industry-standard form factor motherboard, power supply, and chassis (ATX, for example). I've been down the proprietary road before with systems from Packard Bell, Compaq, IBM, and other companies that used custom, unique, or proprietary components. For example, during a momentary lapse of reason in the early '90s, I purchased a Packard Bell system. I quickly outgrew the capabilities of the system, so I thought I'd upgrade it with a new motherboard and a faster processor. It was then that I discovered, to my horror, that LPX systems were not an interchangeable standard. Because of riser card differences, virtually no interchangeability of motherboards, riser cards, chassis, and power supplies existed. I had what I now refer to as a "disposable PC"—the kind you can't upgrade and have to throw away instead. Suddenly, the money I thought I had saved when initially purchasing the system paled in comparison to what I'd now have to spend to completely replace it. Lesson learned.

After several bad upgrade and repair experiences, I decided never again would I be trapped by systems using proprietary or nonstandard components. By purchasing only systems built with industry- standard parts, I could easily and inexpensively upgrade, maintain, or repair the systems for many years into the future. I have been preaching the gospel of industry-standard components in my seminars and in this book ever since.

Of course, building your own system from scratch is one way to avoid proprietary components, but often that route is more costly in both time and money than purchasing a prebuilt system. And what systems should I recommend for people who want an inexpensive prebuilt system but one that uses industry-standard parts so it can be inexpensively upgraded and repaired later? Although many system vendors and assemblers exist, I've settled on companies such as Gateway, MicronPC, and Dell. In fact, those are really the three largest system vendors that deal direct, and they mostly sell systems that use industry-standard ATX form factor components in all their main desktop system product lines. Or so I thought.

It seems that when Dell converted to the ATX motherboard form factor in mid-1996, it unfortunately defected from the newly released standard and began using specially modified Intel-supplied ATX motherboards with custom-wired power connectors. Inevitably, it also had custom power supplies made that duplicated the nonstandard pinout of the motherboard power connectors.

An even bigger crime than simply using nonstandard power connectors is that only the pinout is nonstandard; the connectors look like and are keyed the same as is dictated by true ATX. Therefore, nothing prevents you from plugging the Dell nonstandard power supply into a new industry-standard ATX motherboard you installed in your Dell case as an upgrade, or even plugging a new upgraded industry-standard ATX power supply into your existing Dell motherboard. But mixing either a new ATX board with the Dell supply or a new ATX supply with the existing Dell board is a recipe for silicon toast. How do you like your fried chips: medium or well-done?

Frankly, I'm amazed I haven't heard more about this because Dell has climbed to the lead in worldwide PC sales. In any case, I figure by getting this information out I can save thousands of innocent motherboards and power supplies from instant death upon installation.

If you've already fallen victim to this nasty circumstance, believe me, I feel your pain. I discovered this the hard way as well—by frying parts. At first, I thought the upgraded power supply I installed in one of my Dell systems was bad, especially considering the dramatic way it smoked when I turned on the system: I actually saw fire through the vents! Good thing I decided to check the color codes on the connectors and verify the pinout on another Dell system by using a voltmeter before I installed and fried a second supply. I was lucky in that the smoked supply didn't take the motherboard with it; I can only surmise that the supply fried so quickly it sacrificed itself and saved the motherboard. You might not be so lucky, and in most cases I'd expect you'd fry the board and supply together.

Call me a fool, but I didn't think I'd have to check the color-coding or get out my voltmeter to verify the Dell "pseudo-ATX" power connector pinouts before I installed a new ATX supply or motherboard. You'll also find that

motherboard and power supply manufacturers don't like to replace these items under warranty when they are fried in this manner due to nonstandard connector wiring.

Dell's official explanation for its lack of conformance to the ATX standard was, "In the mid-90s the industry moved to a higher use of 3.3v motherboard components. Dell engineers designed a connector that supported the increased use of 3.3v current which differed from the industry proposed designs that we deemed less than robust." Unfortunately, this explanation doesn't hold much water because the standard ATX connector incorporated three 3.3v pins, allowing for up to 18A of current, and the addition of the Auxiliary Connector added two more pins with 10A of additional current. Dell's pseudo-ATX design had only three 3.3v pins in the Auxiliary Connector, which could supply only up to 15A to the board. You can see that even the main ATX Connector alone had more 3.3v current than Dell's design using two connectors!

Because its technical explanation fails to address the issue, the only other reason I can imagine it did this is to lock people into purchasing replacement motherboards or power supplies from Dell. What makes this worse is that Dell uses virtually all Intel-manufactured boards in its systems. One system I have uses an Intel D815EEA motherboard, which is the same board used by many of the other major system builders, including Gateway and Micron. It's the same, except for the power connectors, that is. The difference is that Dell has Intel custom-make the boards for Dell with the nonstandard connectors. Everybody else gets virtually the same Intel boards, but with industry-standard connectors.

Tables 3.8 and 3.9 show the nonstandard Dell main and auxiliary power supply connections. This nonstandard wiring is used on Dell's pseudo-ATX systems.

Table 3.8 Dell Proprietary (Nonstandard) ATX Main Power Connector Pinout (Wire Side View)

Color	Signal	Pin	Pin	Signal	Color
Gray	PS_On	11	1	+5v	Red
Black	Gnd	12	2	Gnd	Black
Black	Gnd	13	3	+5v	Red
Black	Gnd	14	4	Gnd	Black
White	–5v	15	5	Power_Good	Orange
Red	+5v	16	6	+5VSB Standby)	Purple
Red	+5v	17	7	+12v	Yellow
Red	+5v	18	8	–12v	Blue
KEY (blank)	—	19	9	Gnd	Black
Red	+5v	20	10	Gnd	Black

Pin	Signal	Color	Pin	Signal	Color
1	Gnd	Black	4	3.3	Blue/White
2	Gnd	Black	5	3.3	Blue/White
3	Gnd	Black	6	3.3	Blue/White

At first I thought that if all Dell did was switch some of the terminals around, I could use a terminal pick to remove the terminals from the connectors (with the wires attached) and merely reinsert them into the proper connector positions, enabling me to use the Dell power supply with an upgraded ATX motherboard in the future. Unfortunately, if you study the Dell main and auxiliary connector pinouts I've listed here and compare them to the industry-standard ATX pinouts listed earlier, you'll see that not only are the voltage and signal positions changed, but the number of terminals carrying specific voltages and grounds has changed as well. You could modify a Dell supply to work with a standard ATX board or modify a standard ATX supply to work with a Dell board, but you'd have to do some cutting and splicing in addition to swapping some terminals around. Usually, it isn't worth the time and effort.

If you do decide to upgrade the motherboard in any Dell system purchased between 1996 and 2000, a simple solution is available—just be sure you replace both the motherboard *AND* power supply with industry-standard ATX components at the same time. That way nothing gets fried, and you'll be back to having a true industry-standard ATX system. If you want to replace just the Dell motherboard, you're out of luck unless you get your replacement board from Dell. On the other hand, if you want to replace just the power supply, you do have one alternative. PC Power and Cooling now makes a version of its high-performance 300W ATX power supply with the modified Dell wiring for about $100. The internals are identical to its industry-standard, high-performance 300W ATX supply (which it sells for about 30% less)—only the number and arrangement of wires has changed.

Fortunately, starting in 2000, Dell switched to using industry-standard ATX power connections in its Dimension 4300, 4400, 8200, and newer systems. That means barring any other unforeseen glitches, these systems should be more easily upgradable by just replacing either the power supply or the motherboard alone. I, for one, am glad to see Dell moving back toward industry standardization because its systems are now more appealing to purchase as a starting point for a system that will be user upgradable and repairable in the future.

Power Switch Connectors

Three main types of power switches are used on PCs. They can be describes as follows:

- Integral Power Supply AC switch
- Front Panel Power Supply AC switch
- Front Panel Motherboard Controlled switch

The earliest systems had power switches integrated or built directly into the power supply, which turned the main AC power to the system on and off. This was a simple design, but because the power supply was mounted to the rear or side of the system, it required reaching around to the back to actuate the switch. Also, switching the AC power directly meant the system couldn't be remotely started without special hardware.

Starting in the late '80s systems began using remote front panel switches. These were essentially the same power supply design as the first type. The only difference is that the AC switch was now mounted remotely (usually on the front panel of the chassis), rather than integrated in the power supply unit, and connected to the power supply via a four-wire cable. The ends of the cable are fitted with spade connector lugs, which plug onto the spade connectors on the power switch. The cable from the power supply to the switch in the case contains four color-coded wires. In addition, a fifth wire supplying a ground connection to the case might be included. The switch was usually included with the power supply and heavily shrink-wrapped or insulated where the connector lugs attached to prevent electric shock.

This solved the ergonomic problem of reaching the switch, but it still didn't enable remote or automated system power-up without special hardware. Plus, you now had a 120v AC switch mounted in the chassis, with wires carrying dangerous voltage through the system. Some of these wires are hot anytime the system is plugged in (all are hot with the system turned on), creating a dangerous environment for the average person when messing around inside her system.