

## COMPUTER INTERCONNECTIONS II

(USB: THE ANSWER TO OUR SERIAL PORT PRAYERS)



### Tech Tip 43 - Computer Interconnections (USB: The Answer to Our Serial Port Prayers)

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Last week, we talked about how to get power to your computer without getting a jolt yourself. This time, let's go into the latest in connecting gadgets to your computer, the Universal Serial Bus, or USB. It has made computer interconnect so simple that it's easy to forget what a nightmare serial ports used to be.

When I say "serial port," oldsters among us will flash back to the big, clunky 25-pin connector for the cable that went to an external telephone modem. Since early modems could send or receive only one bit at a time, the data had to be spoon fed to them on a single wire, one for sending and one for receiving. Add a common wire and you only need three wires for the data. Then why did they design the serial port with 25 pins?



Back in the even earlier days, the serial connection was used for mechanical teletypes and printers that had separate control signals for announcing when the machine was ready to send and ready to receive the next character and even a pin for when the telephone rang. When PCs became popular, the serial port was pared down to nine pins by throwing away most of those unused control signals. Apple went one better by reducing the pin count to eight and using a much smaller circular DIN connector. (DIN is short for Deutsches Institut für Normung eV, the standards-setting organization for Germany. A DIN connector is a connector that conforms to one of the many standards defined by DIN).



Over the years, the serial port grew to include many other uses other than telephone modems. It was used to connect early printers, scanners, and security devices ("dongles"). The lowly serial port was even used with a crossover cable for the first poor-man's

network where two computers are connected to transfer files.

OK, that's the history of the traditional serial port, but what most people miss is that there are all sorts of other serial ports on your computer. The PS2 keyboard connection is really a serial port, as is the PS2 mouse. Your network cable is really just a very high-speed serial port.

There are other ports that could be serial ports, if the data rate was just fast enough. An example is the printer port that sends eight bits at a time over eight separate wires. That makes for fatter cables and bigger connectors. How about your joystick or other game controller? There is only one joystick port on a PC and it's a pretty crude design.

With all these different, incompatible peripheral interfaces, no wonder it's a nightmare of tangled wires behind my computer. Finally, the designers of computer interconnects have come up with a modern solution – the Universal Serial Bus or USB.



Inspired by the Apple Desktop Bus (ADB) found on Macintosh computers, which could support multiple and varied devices, USB started out to be better than the 115 Kilobit per second old style serial port by upping the data rate to 1.5 Mbps, but that's now known officially as Low Speed. With this data rate, USB keyboards, mice and trackballs are easily handled.



Then came Full Speed at 12 Megabits per second and USB 1.1 was suddenly the interconnect of choice for printers, scanners and even external computer sound systems. Recently, USB 2.0 has been introduced and now we have a High Speed of up to 480 Mbps, though most devices can't keep up with that blistering speed. This makes USB the method of choice for connecting high-speed Flash memory devices, external hard drives, DVD/CD readers and writers, external professional grade video and audio interfaces and your network connections. If my computer had to exist with only two connectors on it, my choice would be power (because you have to) and USB. For older peripherals you can buy inexpensive adapters that have a connector for your legacy device and a USB plug to go into your computer.

Until USB came along, the connectors on the back of your computer were either big clunky (but rugged) throwbacks to an earlier age, or tiny (and flimsy) round ones that are difficult to get aligned and plugged in. USB connectors are small, but built to take some abuse, and easy to figure out which way to line up with the socket, even when feeling with your fingers behind your computer.

The Type A USB connector is what you find on your computer and on the output side of USB hubs. It's flat with four pins that are protected inside a metal shield. Being flat, you can only try sticking it in the jack two ways, and



the wrong way won't even try to go in. This is known as being "keyed." The other common type of USB connector is the Type B. It looks very different from the Type A and is generally used only for the input side of hubs. This way, you can't mix up the uplink and downlink cables. There are miniature USB connectors, but they are generally specific to very portable devices like digital cameras and MP3 players. The miniature USB connectors are always a standard Type A connections.



I mentioned USB hubs. Previous computer interconnects were one-to-one, so you needed one port for every device you wanted to plug into your computer. The "B" in USB means bus in the true sense of the word: it can carry several passengers at once. By using a hub, several devices can be plugged into one USB port on your computer. Hubs

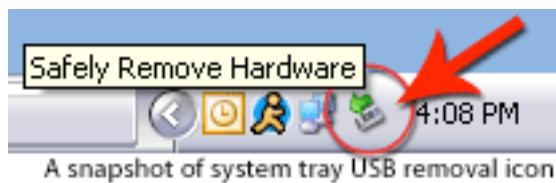
can be built into almost any thing. You can buy a USB keyboard that has a hub in it. That way, you can have one cable running down to the computer and plug your mouse or trackball (or both!) right into your keyboard. Yes, you can have multiple pointing devices and use whichever feels right at the time.



Another innovation of USB is that it doesn't just carry data – it carries power, too. The PS2 mouse and keyboard ports did supply power for those devices, but USB has enough juice behind it to run lots of other things. For instance, I just bought a wireless network adapter from Geeks.com, and it connects to the computer using USB. That means only one cable for both data and power, which is a lot better than having a separate power brick to find a socket for.

<http://www.geeks.com/details.asp?invtid=PQP-WU221L&cpc=SCH&srm=0>

Peripheral devices used to have to be plugged into their special port on your computer. They had to be plugged in before powering up your machine. Plugging or unplugging while the power was on was a good way to crash your computer or even damage the hardware. Of course, you had to make sure you had installed the proper driver software for the device, and you had to match the driver with the device and the right version of Windows. If you bought an older device, it might not even have a driver that would work with the latest Windows. USB replaces these headaches with automatic device



installation when you plug it into the computer. You can even plug it in after booting up. Just don't forget to stop the device using the applet in the system tray before removing it with the power on.

Normally, USB power is limited to 100 milliamps, or one tenth of an Amp when you plug a device in. That's enough to power most gadgets, but if you have a power-hungry unit it can negotiate a boost up to 500 milliamps from most computer USB ports. Now, if you are using a hub, the computer isn't going to want to supply the boosted power to many devices. To overcome this obstacle, you can buy hubs that have their own power

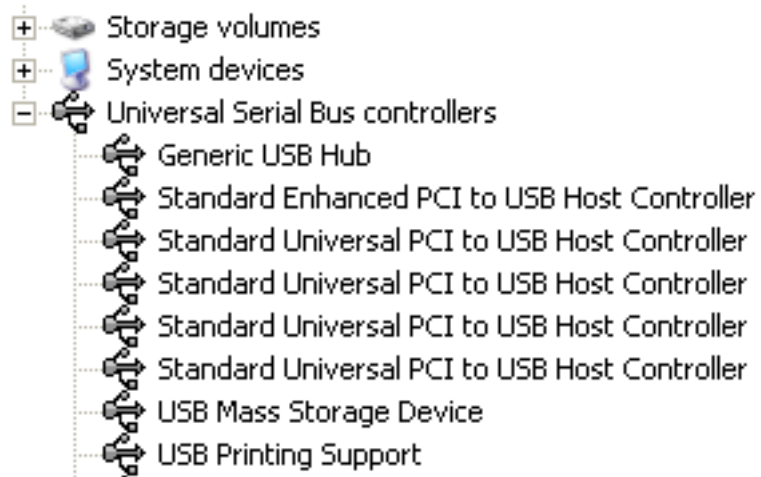
brick. The unpowered hubs are fine to tote along with your laptop computer to hook up low-powered devices, but for your desktop machine, you should get a hub with its own power supply.

Cell phones and MP3 players are now coming with USB cables for charging their batteries. They don't need a power brick of their own; they just steal power from your computer. On a trip, this is great because you can charge your portable devices from your laptop and carry only the charger for your computer.



My main home computer has three pairs of USB ports on the back and one on the front. I know that some are USB 2.0 and the other USB 1.1 So how do you tell if you computer is equipped with USB 1.1 or 2.0 ports? Often you have both, so check all of them to be sure where you can plug in your low speed devices, like a mouse, or a high-speed device like a new flash memory stick.

First, to make sure you aren't reading any external USB hubs you have, unplug them from your computer and reboot. Start at the Control Panel and select the System applet. Pick the Hardware tab and then the Device Manager button. Expand the Universal Serial Bus controllers item at or near the bottom of the list. Scan through the list and look for USB 2.0 and/or Enhanced. The term Enhanced means that it is USB 2.0 even if it doesn't explicitly say 2.0.



If you do happen to have both USB 2.0 and 1.1 ports on your computer, and they are not labeled, you might be in for some trial-and-error to get your high-speed devices stuffed in the right hole. It doesn't hurt to have a low-speed device plugged into a high-speed port, but the other way around will only run at the lower speed. When you do plug a USB 2.0 device into a USB 1.1 port, you should get a message balloon on the taskbar that warns you of the mismatch (assuming you are using Windows XP).



USB ports are usually in pairs on the back of your computer. Say you have one USB 2.0 pair and one USB 1.1 pair. If you remove all your USB devices and boot up your computer, then plug in your high-speed devices until you get

them in the USB 2.0 ports, then you can plug your slow-speed USB 1.1 devices in the other pair of ports. If you have more devices of one type than you have ports on your computer, buy a USB hub to split out your ports. Hubs are cheap and give you lots of expansion capability. Make sure if you have USB 2.0 devices that you get a USB 2.0 compliant hub!

If you are really a hardcore geek, you can read lots more about USB at <http://www.beyondlogic.org/usbnutshell/usb-in-a-nutshell.pdf>.

### **Final Words –**

USB has taken the computer industry by storm. Every laptop and desktop computer sports several USB ports and you almost can't buy a peripheral these days that doesn't have a USB cable attached. It's so popular because people have struggled for years with many different and incompatible computer interfaces. You can start packing away those 25 to 9-pin serial port adapters and put away those fat parallel printer port cables that have been replaced by USB. Your joystick for games, mouse for drawing and trackball for text editing can all plug into a single hub and from there into a single USB port on your computer. With hot plugging convenience, you can jack in all sorts of new toys and enjoy the benefits of USB interconnectivity.