

THE COMPUTER CORNER

No. 131. USB

- by Stan Kaplan, WB9RQR
715 N. Dries Street
Saukville, WI 53080-1664
(262) 268-1949
skaplan@mcw.edu

USB stands for Universal Serial Bus, and is a darned neat thing. Virtually every PC sold today has four or more USB ports built into the motherboard (though not all machines have four external ports), so it is more or less a standard in the industry. This external connection to the PC was designed so that a device plugged into it could be recognized and treated as a Plug and Play device. You no longer need special ports or special I/O (input/output) cards with devices that are designed for USB. Just plug in the device while the machine is running and it is recognized. Oh yes, you may need to install drivers so the computer can interact with it, but it will be recognized immediately without the need to reboot or do a special setup. USB is therefore said to be “hot-swappable”, which means you can plug a device in while the computer is running. However, with at least some devices, you need to tell the OS (Operating System) when you are going to unplug it.

Another advantage to USB is that up to 127 devices may be connected to a single bus, and it takes only a single IRQ (Interrupt Request line). Of course, if you plug 127 devices in, things will slow down somewhat since they all share the same bandwidth.

USB uses only four wires. You can't ordinarily see the wires inside a USB cable, but if you could, a red wire supplies bus power. White is data minus, green is data plus, and black is ground. I suppose you could consider the shielding on the cable as a fifth wire, but it acts only as a drain and carries no signals or power. Simple enough.

USB carries data (on the green and white wires) in a serial fashion, as the name implies. The data goes down the wire much like a single-file line of people moving into a movie theater. This is different from a parallel cable, such as used by many printers. In a parallel cable there are typically 8 data wires, and the line at the movie theater is 8 people wide, moving into the lobby shoulder to shoulder. Hence the name parallel. Sure, you can move data faster with a parallel setup (8 people reach the lobby door at a time, whereas with serial, only one reaches the lobby door). But parallel architecture suffers from skew and jitter, sort of like the 8 people who are shoulder to shoulder bumping into each other. This results in some of the 8 reaching the lobby door very slightly sooner or later than others, which certainly matters if you try to increase the speed (asking people to run instead of walk). The faster the data, the more a person is likely to be out of kilter with the other 7. Not a problem with serial data, since only one person reaches the door at a time. If you ask everyone to run, it is not likely to mess up the data that reaches the lobby. The whole point is that it is easier to increase the speed of serial data, and more difficult with parallel. Serial cables are smaller, too (fewer wires) and less expensive. Also, with only two data wires in serial (data plus and data minus), there is less chance of crosstalk – bleeding of the data from one wire into another. The chance is four times as great in a parallel cable, with 8 data wires.

USB moves data pretty quickly. If you have an older computer with USB 1.1, data can be moved over the cable at 1.5 megabytes per second. The newer USB 2.0 (“High Speed USB”) can move data up to 60 megabytes per second, which works out to nearly 30 times the rate of an old printer (parallel) port. For example, the Windows 2000 Professional installation files (4,010 files, 204 MB) would take about 3.4 seconds to transfer from one place to another over USB 2.0. That's moving!

There is another even faster port – FireWire (also called IEEE 1394 or i.Link). The latest version moves data at about 100 megabytes per second (compared to 60 for USB). However, Intel largely developed USB and has put USB support in all its chipsets since 1996. Few motherboard chipsets include FireWire,

so it has to be added at extra cost, plus a royalty per machine to Apple Computer, the developer. Therefore, FireWire is not nearly as popular as USB. But it does have a market, particularly in video (camcorders and the like). Another advantage of FireWire was that you could connect two peripherals together without a PC in between. Thus, you could connect two compliant cameras together and transfer pictures between them, without any intervening PC. However, at the end of 2001, the new USB On-The-Go standard was released which permitted this for USB as well.

If you have one or more older peripherals that you want to use with the USB ports on your newfangled computer, there are adapters. Some look just like cables, but they may well have electronics built into the connectors on one or another end. You can get:

- USB to serial
- USB to parallel (printers only)
- USB to SCSI
- USB to keyboard and mouse
- USB to Ethernet
- USB to video and/or TV
- USB to USB – a direct connect cable for networking two computers.

Some of the computers sold today do not have serial, parallel, keyboard or mouse connectors on the back, and they no longer have a floppy controller built into the motherboard. Everything, including a floppy drive, must be plugged into the USB port. Those computers usually have four or even more USB connectors, to take over the job of the older ports.

My personal use for USB is largely with those incredibly useful “keychain drives” or “flash drives”, little baubles you plug into a USB port to send data to or from the PC. I purchased one (19May06) from Office Depot for \$39.99, minus a \$10 mail-in rebate, making my cost under \$30, not counting tax or postage for the rebate. It holds 1 gigabyte of data! It comes with a lanyard, and I wore it around my neck at Field Day this year, backing up the logging data from time to time at the Ozaukee Radio Club’s FD site. Plus, it already contains all the logging software needed for our five networked logging stations. Maybe I will put Windows 2000 Professional on it, too! Amazing! Happy computing!