

## THE COMPUTER CORNER

# No. 184: USB

Stan Kaplan, WB9RQR

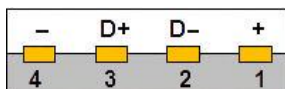
715 N. Dries Street, Saukville, WI 53080-1664 (262) 268-1949

[skaplan@mcw.edu](mailto:skaplan@mcw.edu)

That rectangular-shaped slot you plug your memory stick into is really neat, and I'd like to explore it in this month's column.

Compaq, DEC, IBM, Intel, Microsoft, NEC and Nortel began developing USB way back in 1994, and Intel began producing the first integrated circuits supporting USB a year later. USB appeared in January 1996, with the moniker USB1, and all PC chipsets since February 1996 include USB support. USB1 could transfer data as fast as 12 megabits per second (= 12,000,000 bits per second). Since there are 8 bits in a byte, that's about 1.5 megabytes per second if my math is correct. USB2 followed in April 2000, and could move data at 480 megabits per second, or 60 megabytes per second, 40 times faster than USB1. In November 2008, USB3 appeared, and could pump data at the astounding rate of 3.2 Gb/s (about 400 megabytes/second), 10 times faster than USB2. Windows 8 is the 1<sup>st</sup> Microsoft Operating System to have USB 3 support built-in.

So why USB? Basically, it is a replacement for the old parallel (printer) and serial ports. Old machines had one parallel port and one or two serial ports. If you had more devices than that, you were out of luck, unless you added more cards to supply additional ports. With USB, you can have up to 127 devices (printers, cameras, keyboards, flash drives, mice, etc.) on a single USB bus (though they all will share the bandwidth). A modern printer may not only have a USB cable to plug into the computer, it may also have several USB sockets itself. Thus, you could theoretically plug your keyboard and mouse into those printer sockets and they will work.



A typical USB 1 or 2 socket or plug (type A) is shown here. As you can see, there are only 4 contacts (wires), plus the cable has a shield that connects to the socket or plug housing. For power, contact 1 and 4 provide 5 volts at least 0.5 watts. Contact 2 and 3 are data lines. In the cable, a red wire feeds contact 1, black or blue feeds 4, green feeds 3 and white or gold feeds 2. Only 4 contacts! A far cry from the old parallel socket with 25 contacts or serial with 9! Well, not quite. USB 3 has 8 wires plus a shield in the cable. But it also transmits data at an astounding rate. It is also backwards compatible, so if you purchased a new laptop recently with a telltale blue USB 3 socket, you can plug in your old USB 2 data stick (flash drive) and it will work fine (but at USB 2 data rates). Clever engineers arranged it so your flash drive connects to the four contacts shown above, but not to the other USB3-only contacts that are buried deeper in the connector.

When you plug a device into a USB socket on your computer, the device first sends a message telling the computer what the device is. This message, called a class code, says, "I am a mass storage device ... 08h" in the case of a flash drive, or "I am a printer ... 07h", or "I am a keyboard, mouse or joystick ... 03h". Of course, the device only sends the hexadecimal code shown (08h, 07h, 03h), but the English translation above is what those codes mean. There are a bunch of those codes, identifying everything from Wi-Fi adapters to webcams to fingerprint readers to pulse monitors and more. Whatever the device is, Windows fetches drivers to service it, or tells you that you need to supply it with a driver. For most common devices, Windows has the drivers built right into the Operating System. Hey, that's called "plug and play".

USB connectors will wear out through repeated connects and disconnects. The life cycle of a typical type A USB male connector, such as the connector on the end of a cable that plugs into the socket shown above, is about 1,500 connects. So, if something is not working, as it should,



don't disregard a bad cable end, or even a bad connector on your flash drive.

There are all sorts of USB connector shapes and sizes, beyond the typical type-A shown above in the illustration. There is a type B (probably connecting your USB-capable printer to its cable), mini-A, mini-B (mini's are no longer supported), micro-A and micro-B. Take a look at the plug on your cell phone through which you recharge the battery. It is most likely one of the micros. Your camera has another. Those micro connectors will last through about 10,000 connects/disconnects, thank goodness!

Since the last half of 2004, most computers have been capable of booting from attached USB mass storage devices. This includes flash drives. There are lots of computer-geek folks that carry a complete copy of the Linux operating system on a bootable flash drive ("thumb drive", "memory stick", "memory dongle"). They plug it into their Windows machine and reboot when they get tired of Windows and want to play around with Linux. It works!

Happy computing!

-----  
*"Everything that can be invented has been invented."* Charles Duell, Commissioner, US Office of Patents, 1899.