

USB Uncovered

USB (Universal Serial Bus) is a system for connecting devices to personal computers. USB became the standard for consumer devices nearly overnight. Apple adopted USB as the only peripheral connection to their iMac line of computers, and USB connections were built into nearly every PC on the market. Consumer device manufacturers realized that they no longer had to sell devices with separate Mac and PC versions. USB is easy to use, fast, and cheap to manufacture: a gem of simplicity in an ever growing mountain of computer complexity.

USB Types

There are two types of USB signals: version 1.1 and version 2.0. While you must use cables that are compatible with your signal type, USB 1.1 is compatible with 2.0 cables. Moreover, most cable manufacturers have stopped making 1.1 style cables, so nearly all cables sold today are already 2.0.

The problems come up when trying to match connector types. Here's what they look like:



This is the most common USB connector found on the backs of computers, mice, keyboards, mp3 players, and some hubs.



This type of connector is typically found on the back of printers and upstream ports of some USB hubs.



This is commonly used with consumer electronic devices such as cameras, mp3 players, and PDAs. This version is missing a particular pin for power. Some devices require power from the USB connector, and won't function properly without that power. Please consult the documentation to see which you need.



Much like its 4-pin cousin, this cable is used for devices such as cameras, mp3 players, and PDAs. This version has the pin for power connected. Some devices may be damaged if they're not expecting this pin to be connected, so please consult your products manual to determine which you may need.

Going for Speed

USB version 1.1 (designated "Full Speed USB" by the USB consortium) is by far the most common for today's computers and computer components. USB 1.1 can run a single channel at 12 Mb/s (1.5 MB/s), or it can be broken into 8 subchannels at 1.5 Mb/s (187.5 KB/s) each. USB version 2.0 (designated "High-

Speed" by the USB consortium) has a maximum bandwidth of 480 Mb/s (60 MB/s). USB 2.0 is one of the fastest consumer data transfer systems on the market. To give you an idea how fast it is, here's a list of data rates for different types of connections:

Type	Million bits/sec	Million Bytes/sec
Serial Port:	.115 Mb/s	.0143 MB/s
Parallel Port:	.920 Mb/s	.115 MB/s
Broadband Internet:	1.5 Mb/s	.187 MB/s
10Base-T Network:	10 Mb/s	1.25 MB/s
USB 1.1:	12 Mb/s	1.5 MB/s
PCP/EPP Parallel:	24 Mb/s	3 MB/s
100Base-T Network:	100 Mb/s	12.5 MB/s
IDE ATA 33:	264 Mb/s	33 MB/s
IEEE-1394 (aka. FireWire, iLink):	400 Mb/s	50 MB/s
USB 2.0:	480 Mb/s	60 MB/s
SCSI Ultra-Wide2:	640 Mb/s	80 MB/s
IEEE-1394 800 (aka. FireWire 2.0):	800 Mb/s	100 MB/s
IDE ATA 166:	1328 Mb/s	133 MB/s
SCSI LVD Ultra-Wide 320:	2560 Mb/s	320 MB/s
1000Base-T Gig. E.:	1000 Mb/s	125 MB/s

Units:

bit = 1 or 0

Byte = 8 bits

Kb = 1,000 bits

KB = 1,000 Bytes

Mb = 1,000,000 bits

MB = 1,000,000 Bytes

A USB Bridge Too Far

The major complaint about USB is the length limitation of 5 Meter (16.4 ft). There are several solutions to this problem, and most of them are device specific. There are some general solutions, but they tend to be cost prohibitive. Here's a few options along with their benefits and drawbacks.

Optically Isolated cables A USB signal can be converted into an optical signal, run along a fiber optic, and converted back on the other end. With the proper fiber, you could conceivably run this up to a kilometer (or longer if the optical switching system is faster than the USB reflection). However, this won't work for bus powered peripherals (devices that are powered by the USB cable), and the cables are extremely expensive. A 30 Meter (~100 ft) cable will commonly sell for \$200; which is often more than the device that you're trying to control.

USB Network Print Servers The most common device to want to have far away from a computer is a printer. A USB print server is a small network device about half the size of your mouse that allows you to hook your USB printer up to your home or office local area network. The server is configured once with a PC, and then any computer on the network can print to that printer.

USB Repeater Cables Repeater cables use the same chips as USB hubs, but they have a single input and a single output. A single repeater cable will allow you to extend your device up to 10 Meters (32.8 ft), and you can chain up to five repeater cables together. However, running five of them together won't work for bus powered devices, is incompatible with some devices, and often only works at a reduced speed with intermittent operation. While some have been successful with five, you probably shouldn't use more than two repeaters for one device.

Simple Extension Cables The best solution can also be the most simple. If you're trying to extend a simple device like a mouse or keyboard, you can often just use a simple USB extension cable (male on one side, and female on the other). While this won't always work, USB cables are very inexpensive it's sometimes worth just trying.

Other Common USB Problems and Their Solutions

Old Computer, New Trick

If you have an older computer that doesn't have USB ports, then you may still have the option of installing a USB controller card. They're simple to install, reasonably inexpensive, and make for an easy way to update your older computer.

Old Trick, New Computer

If your computer is so new that it doesn't have a serial port on it and you have an older serial device (GPS unit, thermal printer, serial device controller, etc) that you wish to use, then you can use a USB to DB9 converter. You can set these devices to simulate any COM port on your computer to accommodate existing software, and you're up and running in minutes.

Two Computers, One USB Printer

While this problem can be solved with a USB Network Print Server as described above, not everyone has a network in their home. An Auto-Sharing Switch will allow either computer to print to the printer and simply switch between them. However, if both printers try to print at the same time, there may be problems with the print job, so the network solution may be preferable in some cases.

PS/2 (MiniDin6) Woes

Much like the serial example above, if you have a PS/2 mouse and keyboard and would like to use them on your USB computer, then you can use a PS/2 Active Adaptor. This acts as a small PS/2 controller and will work with any brand of any keyboard and mouse.