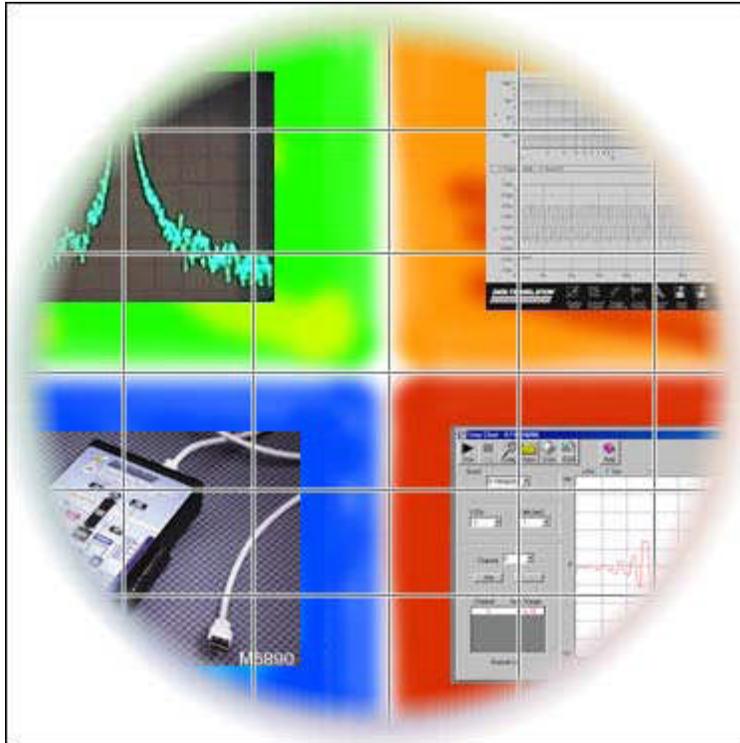


Benefits of the Universal Serial Bus (USB) - for Data Acquisition Professionals



Imagine adding data acquisition capabilities to your PC as easily as plugging in a mouse or a keyboard. Just connect a compact data acquisition module to your computer (you don't even have to power-down), install the supplied software, and connect your sensor directly to the module. In minutes, and with state-of-the-art accuracy, you're capturing data: temperature, pressure, sound level, whatever you need. And you have done this without programming, without opening up your PC, without even thinking of IRQs, board configuration, power requirements, or connection schemes.

A pipedream? Not any more. This convenience and power are available today, thanks to the USB, a serial expansion bus, and to a growing range of USB-compatible data acquisition function modules. Together, USB bus and modules promise to greatly simplify the way people perform data acquisition on PCs.

USB: A Truly Universal Bus for Computer Peripherals

Acceptance of the USB has grown amazingly. Today, virtually all IBM- and Macintosh-compatible desktop PCs on the market provide two USB ports. Most laptops provide one. USB ports for existing PCI Bus machines can easily be added. Equally important, these USB ports have full software support under the most popular personal computer operating systems, including Microsoft® Windows® 2000 and XP, and Mac® OS 10.

The USB was created by a group of manufacturers (including Intel®, Microsoft, and Compaq) to simplify the connection of external peripherals to personal computers. It seems destined to embrace virtually all moderate-speed computer peripherals: keyboards, mice, expansion drives, digital cameras, and more. The USB's Web site (<http://www.usb.org>) lists dozens of such products.

With all these devices available, are one or two USB ports enough? Expandability is another USB strong point. Up to 127 devices can connect to a single port simultaneously, using expansion hubs and cable assemblies that are widely available at low cost.

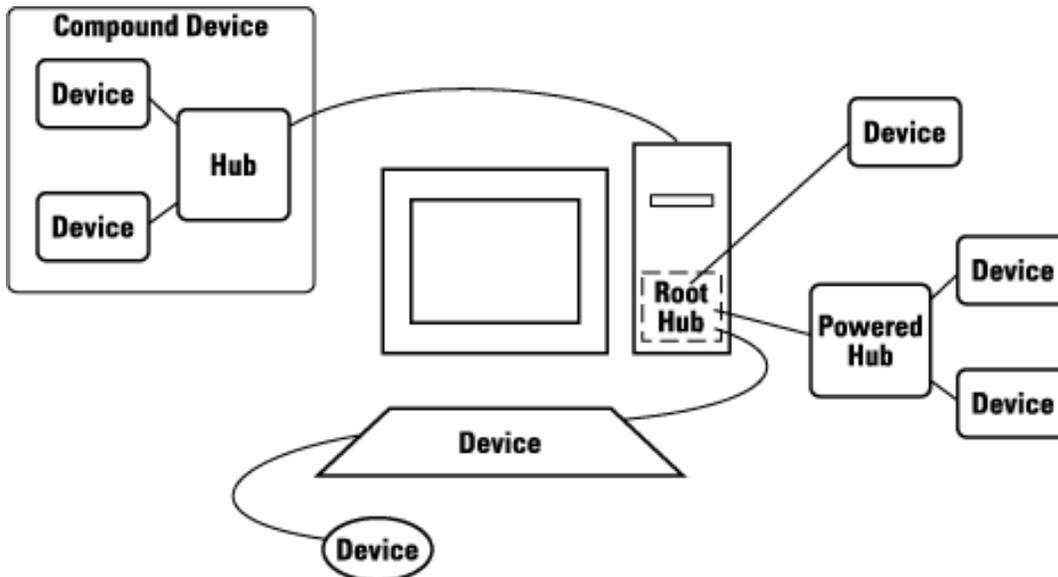


Fig. 1: USB Bus Configuration Overview

USB 2.0 Improvements

The first specification for the USB, version 1.1, featured 12 Mb/s (megabits per second) data throughput, which is fine for moderate-speed applications, including most data acquisition uses, but not fast enough to support video, imaging, and highest-speed data acquisition applications. This technical limitation was addressed with a new version of the USB specification. In April 2000, the USB 2.0 Promoter Group released the final USB 2.0 specification. USB 2.0 exceeds the previous version's speed barrier with 40 times the bandwidth: 480 Mb/s. Advances such as larger packet size and new transfer modes make high-speed transfers more efficient. As higher performance USB peripherals become more widespread, 2.0's additional bandwidth will make it feasible to connect more USB peripherals, supporting multi-tasking software operations without slow-downs. USB 2.0 (Hi-Speed USB) is fully compatible with USB 1.1 (Original USB), and uses the same cables and connectors.

Easy Installation

Since ease of use was primary in the creation of the USB, many features have been designed in to make USB devices among the easiest to install. To begin, USB devices are true "plug-and-play". There is no setting of address lines, interrupts, or configuration jumpers. The host PC automatically identifies a peripheral when it is plugged in, and searches for the software necessary to operate it. The first time a device is used, the user is prompted to install the drivers and application, a process that takes just a few minutes. Ease of installation means USB peripherals can be shared between computers, even between laptop and desktop models.

USB devices are also external to the computer – there is no need to open up the computer to install them. This external location also provides performance benefits for noise-sensitive devices like data acquisition peripherals: They are away from the computer's noisy mother board and power supplies, and closer to the sensors they will be measuring.

Hot-swappable USB devices are designed to be installed or removed while the computer is running. Peripherals no longer need to clutter the workspace when they aren't needed. Just plug the device in, use it, then remove it when done.

Peripherals can either be powered by the USB or from an external power source. Being powered from the USB is most convenient, but, since only limited power is available, a device must typically be designed from the ground up for USB operation.

USB devices can plug directly into a USB port, located on the PC, in powered hubs that can be standalone, or built into monitors and computer peripherals.

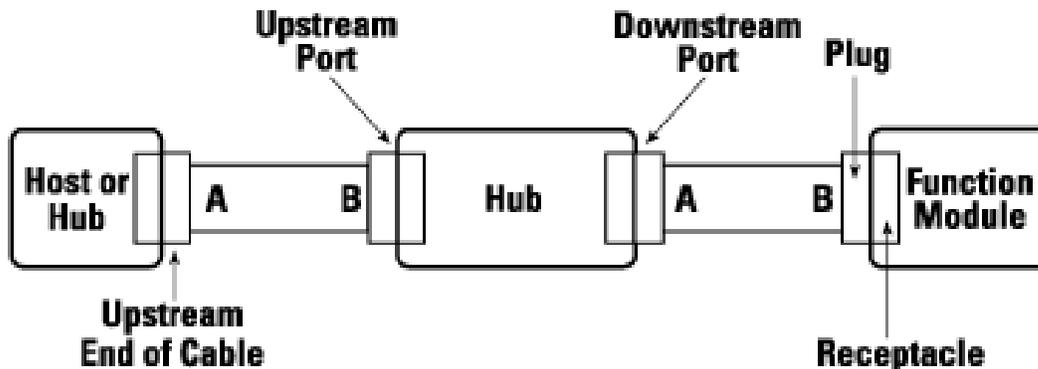


Fig 2: USB Connections

Connection to the PC is easy, too. A single, low-cost cable (from 1 to 5 meters long, and often supplied with the peripheral) carries power and signal connections to the USB device. Since all devices use the standard cables, USB users don't have to hunt down expensive, hard-to-find adapters to change the pin configuration or "gender" of connectors before they can use their peripheral. USB cables are available off-the-shelf at computer and office-supply stores, and cost about \$10.00 each.

USB devices for data acquisition may also include removable terminal blocks that conveniently handle all user I/O connections. This saves time and money: No external screw terminal panel is required.

Worry-Free Operation

Perhaps the most profound benefit to the USB is the confidence it inspires in PC users of all levels of experience. Anybody who can operate a PC can install a USB peripheral and have it running in minutes.

For data acquisition users, this benefit can be enormous. No longer does the peripheral gather dust until a computer expert can install it, or a busy scientist can take hours or days to figure out how to configure and program it for the task at hand. Because USB devices work directly with most current laptops, even the most sophisticated data acquisition applications come out of the lab and into the field.