# USB pinout

**USB (Universal Serial Bus) designed to connect peripherals such as mice, keyboards, scanners, digital cameras, printers, hard disks, and networking components to PC. It has become the standard connection method for wide variety of devices.**

**Universal Serial Bus (USB)** is a specification to establish communication between devices and a host controller (usually personal computer). Nowdays USB has replaced a variety of earlier PC interfaces (such as RS-232 serial or parallel port). Due to the ability to supply power to the preipheral devices USB is often used as a power charger for portable devices.

An USB system architecture consists of a host controller, a USB ports, and multiple connected devices. Additional USB hubs may be included allowing branching into a tree structure with up to five tier levels.  USB can connect computer peripherals such as mice, keyboards, digital cameras, PDA, mobile phones, printers, personal media players, flash drives, GPS, Network Adapters, and external hard drives. For many of those devices, USB has become the standard connection method.

**USB interface** aimed to remove the need for adding expansion cards into the computer's PCI or PCI-Express bus, and improve plug-and-play capabilities by allowing devices to be hot swapped or added to the system without rebooting the computer.

## The USB Pinout:

| Pin | Name | Cable color | Description |
|---|---|---|---|
| 1 | VCC | Red | +5 VDC |
| 2 | D- | White | Data - |
| 3 | D+ | Green | Data + |
| 4 | GND | Black | Ground |

### USB connectors

There are several types of USB connectors. The connector mounted on the host or device is called the receptacle, and the connector attached to the cable is called the plug. The original USB specification detailed Standard-A and Standard-B plugs and receptacles. Nowdays there are 7 USB connectors known: Standard-A, Standard-B, Mini-A, Mini-B , Micro-A, Micro-AB, Micro-B. Mini-USB pinout and Micro-USB pinout are slightly different: standard USB uses 4 pins while Mini-USB and Micro-USB uses 5 pins in connector. The additional pin is used as an attached device presence indicator.

### USB pinout signals

USB is a serial bus. It uses 4 shielded wires: two for power (+5v & GND) and two for differential data signals (labelled as D+ and D- in pinout). NRZI (Non Return to Zero Invert) encoding scheme used to send data with a sync field to synchronise the host and receiver clocks. In USB data cable Data+ and Data- signals are transmitted on a twisted pair. No termination needed. Half-duplex differential signaling helps to combat the effects of electromagnetic noise on longer lines. Contrary to popular belief, D+ and D- operate together; they are not separate simplex connections. USB 2.0 provides for a maximum cable length of 5 meters for devices running at Hi Speed.

### USB transfer modes

Univeral serial bus supports Control, Interrupt, Bulk and Isochronous transfer modes.

### USB interfaces: USB 1.0, USB 2.0, USB 3.0.

There are three USB versions known nowdays:

#### USB 1.0

- released in 1996.
- Specifies data rates of 1.5 Mbit/s (Low-Bandwidth, is mostly used for Human Input Devices (HID) such as keyboards, mouses, joysticks and often the buttons on

higher speed devices such as printers or scanners) and 12 Mbit/s (Full-Bandwidth).
- nowadays is still used used by some devices that don't need faster data transfer rates.

### USB 2.0

- released in 2000
- in addition to USB 1.0 adds signaling rate of 480 Mbit/s (Hi-Speed)
- compatible with USB 1.0, but some hardware designed for USB 2.0 may not work with USB 1.0 host controllers.

### USB 3.0

- released in 2008
- added transmission rates up to 5 Gbit/s (SuperSpeed)

USB 1.0 and USB 2.0 shares same connector pinout, USB 3.0 pinout features new connectors.

A USB device must indicate its speed by pulling either the D+ or D- line high to 3.3 volts. These pull up resistors at the device end will also be used by the host or hub to detect the presence of a device connected to its port. Without a pull up resistor, USB assumes there is nothing connected to the bus.

In order to help user to identify maximum speed of device, a USB device often specifies its speed on its cover with one of the USB special marketing logos.

When the new device first plugs in, the host enumerates it and loads the device driver necessary to run it. The loading of the appropriate driver is done using a PID/VID (Product ID/Vendor ID) combination supplied by attached hardware. The USB host controllers has their own specifications: UHCI (Universal Host Controller Interface), OHCI (Open Host Controller Interface) with USB 1.1, EHCI (Enhanced Host Controller Interface) is used with USB 2.0.

### USB powered devices

The USB connector provides a single 5 volt wire from which connected USB devices may power themselves. A given segment of the bus is specified to deliver up to 500 mA. This is often enough to power several devices, although this budget must be shared among all devices downstream of an unpowered hub. A bus-powered device may use as much of that power as allowed by the port it is plugged into.

Bus-powered hubs can continue to distribute the bus provided power to connected devices but the USB specification only allows for a single level of bus-powered devices from a bus-powered hub. This disallows connection of a bus-powered hub to another bus-powered hub. Many hubs include external power supplies which will power devices connected through them without taking power from the bus. Devices that need more than 500 mA or higher than 5 volts must provide their own power.

When USB devices (including hubs) are first connected they are interrogated by the host controller, which enquires of each their maximum power requirements. However, seems that any load connected to USB port may be treated by operating system as device. The host operating system typically keeps track of the power requirements of the USB network and may warn the computer's operator when a given segment requires more power than is available and may shut down devices in order to keep power consumption within the available resource.

**USB power usage:**

**Bus-powered hubs:** Draw Max 100 mA at power up and 500 mA normally.
**Self-powered hubs:** Draw Max 100 mA, must supply 500 mA to each port.
**Low power, bus-powered functions:** Draw Max 100 mA.
**High power, bus-powered functions:** Self-powered hubs: Draw Max 100 mA, must supply 500 mA to each port.
**Self-powered functions:** Draw Max 100 mA.
**Suspended device:** Max 0.5 mA

**Dedicated charger mode:**

A simple USB charger should short the 2 data lines together. The device will then not

attempt to transmit or receive data, but can draw up to 1.8A, if the supply can provide it.

### USB voltage:

Supplied voltage by a host or a powered hub ports is between 4.75 V and 5.25 V. Maximum voltage drop for bus-powered hubs is 0.35 V from its host or hub to the hubs output port. All hubs and functions must be able to send configuration data at 4.4 V, but only low-power functions need to be working at this voltage. Normal operational voltage for functions is minimum 4.75 V.

### USB cable shielding:

Shield should only be connected to Ground at the host. No device should connect Shield to Ground.

### USB cable wires:

**Shielded:**
Data: 28 AWG twisted
Power: 28 AWG - 20 AWG non-twisted

**Non-shielded:**
Data: 28 AWG non-twisted
Power: 28 AWG - 20 AWG non-twisted

| Power Gauge | Max length |
|---|---|
| 28 | 0.81 m |
| 26 | 1.31 m |
| 24 | 2.08 m |
| 22 | 3.33 m |
| 20 | 5.00 m |