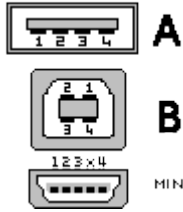


USB cable schematic pinout

Maximum length of cable is 5 m.



[4 pin USB A / USB B / mini-USB jack connector](#)

Pin one side	Signal	Description	Pin other side
1	USB Vcc (Vbus)	usually RED, wire should be 20-28 AWG	1
2	USB Data -	usually WHITE, wire should be 28 AWG	2
3	USB Data +	usually GREEN, wire should be 28 AWG	3
4	GND	usually BLACK, wire should be 20-28 AWG	4



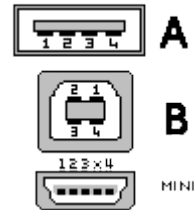
[4 pin USB A or USB B plug connector](#)

USB D+ and D- are twisted in cable.
Outer shell is made of copper braid and aluminium shield.

USB pinout



4 pin USB A or USB B plug connector
at the peripherals



4 pin USB A / USB B / mini-USB jack connector
at the controller

The Universal Serial Bus is host controlled and there can be only one host per bus. An USB system consist of a host controller and multiple devices connected in a tree-like fashion using special hub devices. Hubs may be cascaded, up to 5 levels. Up to 127 devices may be connected to a single host controller. USB interface aimed to remove the need for adding expansion cards into the computer's PCI or PCI-E bus, and improve plug-and-play capabilities by allowing devices to be hot swapped or added to the system without rebooting the computer. 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) and OHCI (Open Host Controller Interface) are used with USB 1.1, EHCI (Enhanced Host Controller Interface) is used with USB 2.0

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

Pin x of mini-USB connector may be not connected, connected to GND or used as attachment identification at some portable devices.

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 transfer modes

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

USB transfer rates: Low Speed, Full Speed, Hi-speed.

USB supports three data rates: Low Speed (1.5 Mbit per second) that is mostly used for Human Input Devices (HID) such as keyboards, mice, joysticks and often the buttons on higher speed devices such as printers or scanners; Full Speed (12 Mbit per second) which is widely supported by USB hubs, assumes that devices divide the USB bandwidth between them in a first-come first-serve basis - it's easy to run out of bandwidth with several devices; Hi-Speed (480 Mbit per second) was added in USB 2.0 specification. Not all USB 2.0 devices are Hi-Speed. 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, USB device often specify it's speed on it's cover with one of USB special marketing logos.

USB Hi-speed devices

Hi-Speed devices should fall back to the slower data rate of Full Speed when plugged into a Full Speed hub. Hi-Speed hubs have a special function called the Transaction Translator that segregates Full Speed and Low Speed bus traffic from Hi-Speed traffic.

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

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 it's 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

mini-USB connector pinout

USB (Universal Serial Bus) designed to connect peripherals and exist in a wide variety of digital devices.



[5 pin mini-USB plug connector](#)
at the peripherals



[5 pin mini-USB jack connector](#)
at the controller

Pin	Name	Cable color	Description
1	VCC	Red	+5 VDC
2	D-	White	Data -
3	D+	Green	Data +
X	ID		May be N/C, GND or used as an attached device presence indicator (shorted to GND with resistor)
4	GND	Black	Ground

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.

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