

NETWORKTV

USB 2.0 & 3.0 - Technology and Signal Extension Applications for HD Video

What is USB 3.0

USB 3.0 (aka SuperSpeed or SS) is the successor to USB 2.0 and increases the data rate more than 10 fold, from 480 Mbps (USB 2.0) up to 5 Gbps (USB 3.0). USB 3.0 is often designated by color coding the connector inserts blue, rather than the common black and white connector inserts and by the addition of the "SS" added to the normal USB icon.

USB 3.0 brings a number of improvements over USB 2.0 including: 5Gbps transfer speeds, Full Duplex (i.e. simultaneous send and receive), Sync-N-Go technology that minimizes user wait-time and power delivery up to 900mA (900 mA on PC ports only). USB charging-only adapters can exceed this and deliver higher charging currents of 1A, 1.5A, 2A 3A, etc.).

This upgrade from 500mA to 900mA explains why your smartphone never seems to charge when plugged into your PC's old USB 2.0 ports but charges steadily albeit slowly when plugged into your PC's 3.0 port. Your smartphones original charging adapter may provide between 1A and 2A or on some even 3A.

USB 2.0 vs USB 3.0

USB 3.0 is 10 times faster than USB 2.0. That being said USB 2.0 is much less expensive to run cabling for and does not require a quad-core processor for optimal performance. USB 3.0 can provide uncompressed 1080p video signals. To use a USB 3.0 HuddleCamHD or PTZOptics camera you must have a quad-core processor. USB 2.0 conference cameras can provide a 1920x1080p video signal but it must be compressed. USB 3.0 can provide the highest quality video images completely uncompressed.

Physical Changes with USB 3.0

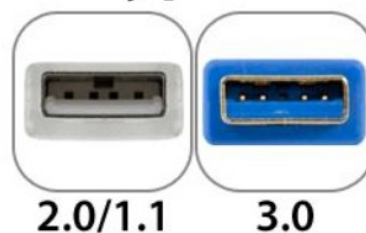
USB 3.0 connectors add an additional 5 pins to the 4 pins of USB 2.0, for a total of 9 pins. The connectors are backwards compatible to a certain extent. The flat and ubiquitous "A" connector that we see on all PCs is fully compatible both ways between USB 2.0 and 3.0. You can plug USB 2 into 3 and USB 3 into 2, as the depth of the USB 3.0 A's added 5 pins is more recessed inside the connector and poses no physical or electrical conflicts. The other connectors however, "B" (the squarer plug historically found on printers), and "micro-B" (found on most modern Android phones) allow USB 2.0 B and micro plugs to fit into USB 3.0 B and micro jacks respectively.

However, due to physical size, USB 3.0 B and micro-B connectors will not fit into USB 2.0 jacks.

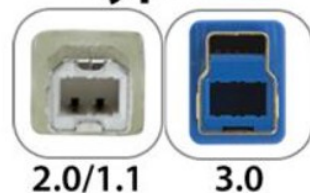
There is no USB 3.0 analog for the USB 2.0 mini connector (small "D" shaped connector found on older phones and many cameras). Here is a visual comparison of connectors including USB 2.0 A.

USB 3.1 and the USB "C" connector are newer evolutions of the USB technology and are not addressed here.

Type A



Type B



Mini-B



Micro-B



USB 3.0 - Technology and Signal Extension

Applications for HD Video

Why USB 3.0 for AV?

Why use USB 3.0 for AV? The 5Gbps data rate available with USB 3.0 allows us to send up to 1080p-30 uncompressed video directly to a PC. This is especially useful for soft codec and web based video conferencing solutions like Lync, Skype, Hang-outs, WebEx, GoToMeeting, Jabber, etc. USB 2.0 is also capable of carrying 1080p-30 resolution but it must first be pre-compressed by the camera (e.g. via H.264 compression) in order to squeeze into the 480Mbps limitations of USB 2.0. Most cameras do not have this compression built-in but more importantly many applications perform better if the conferencing, streaming or recording software is the only step in the signal chain providing compression to the video stream.

USB 3.0 Cabling Length Limitations and Extensions

USB 2.0 cable lengths were limited by specification to about 5m or 16.5'. While USB 3.0 cable length is not specifically limited by the specification, the effective maximum cable length is even shorter at about 3m or 10'. This is fine for connecting appliances to a PC at your desk but will not suffice for installations in larger spaces (e.g. control rooms, conference rooms, auditoriums, etc.).

Luckily, there are solutions for using USB 3.0 beyond the 3m limit. They all require another medium (e.g. proprietary cabling of predetermined length, twisted pair cabling or fibre optic cabling).

Examples of proprietary cabling include both passive (no additional power required) and active (additional power required for electronics in the extension cabling).

Passive extension cabling is typically limited to about 2m or 6'. Longer examples exist but may not perform at HD video rates like 720-60 and 1080p-30. A single extension to your original 6' USB 3.0 cable is all that you will get to work reliably in most video applications.



Passive Extension

Active extension cables are pre-terminated and so purchased for the length you require. Active extensions can be from 3m (10') all the way up to 20m (>60'). Examples of active extension cabling are available from SIIG, ATEN, Tripp Lite, TetherPro, C2G (formerly cable2go), Sabrent, StarTech and others. These cables come with a power supply that typically gets plugged into the device end (e.g. camera) of the cable. Therefore, an additional outlet will be required for this power connection at the device. These cables can often be daisy chained (once) to effectively double the distance. This daisy chain, however is not a viable solution if the daisy chain connection happens to fall inside a wall cavity where it cannot be observed or maintained. Most if not all of the currently available active extensions are also not plenum rated for installation in/across a closed ceiling.



Active Extension

Twisted pair (CATx) solutions for extending USB 3.0 do exist. However, with data rates at 480Mbps (the USB 2.0 data rate), they are not fully USB 3.0 capable and so are not viable options.

For most professional installations in walls and across ceilings, fiber optic is the preferred solution. Examples of fiber optic extenders include those from Icron, Blackbox and others. A fibre modem pair is required with a "remote extender" at the device end and a "local extender" at the PC end.

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While the local extender may be powered directly from the 900 mA available on the PC's USB 3.0 port, the remote extender will need to be powered at the device end (just as the active extension cable is), as power cannot be sent over glass fibre. As with active extension cabling, plan for an additional AC outlet at the device as well as a place to mount the remote extender box within a 2m cable length of the device. Fiber optic cabling can be purchased with both plenum and non-plenum ratings and in pre-determined lengths or as bulk cabling to be terminated by a competent fibre optic installer. The availability of plenum ratings and in pre-determined lengths or as bulk cabling to be terminated by a competent fibre optic installer. The availability of plenum fibre optic cabling and the 100m (328') cable range of these solutions make fibre the ideal extension medium for installed USB 3.0.



Fiber Extension

USB 3.0 Troubleshooting Issues:

The high power delivery capabilities of USB 3.0 and the developing energy awareness of technology have led to new power management features in USB 3.0 implementation in modern PC operating systems.

While these are valuable additions, they can in fact interrupt the functionality of USB 3.0 solutions and need to be managed. Below are the USB 3.0 power setting adjustments recommended for the modern Windows OS when using USB 3.0 devices that require continuous service even when inactive (e.g. Camera and Lync or other conferencing software "Room System").

Managing USB 3.0 Power Settings in Windows-Based Computers

Procedure

1. Global Suspend - Global suspend is only an option in Windows Vista and newer. In older Windows OS, you can skip to step 2, below.
 - a. Go to "Control Panel" -> "Power Options."
 - b. Go to "Change plan settings" on the power plan in use.
 - c. Set "Put the computer to sleep" to "Never."
 - d. Go to "Change advanced power settings."
 - e. Set "Advanced settings" -> "USB settings" -> "USB selective suspend setting" to "Disabled"
 - f. Click "OK" to apply settings and close.
2. Individual USB Hubs and Extension Devices:
 - a. This setting must be applied in addition to the "Global Suspend". All hubs and extension Tx and Rx devices must have their individual power management disabled. This must be done with devices connected to the host. On Windows XP and earlier, this is the only setting to be applied, as Global Suspend (1. Above) is not an option.
 - b. Open device manager.
 - c. In the menu, select "View" -> "Devices by connection."
 - d. Select the topmost element in the list (the name of your host) and type the '*' key to fully expand the entire list.
 - e. Locate your USB 3.0 eXtensible host controller in the list.
 - f. Identify the hubs, local extender and remote extender units may show up as hubs (they will be two hubs connected together).
 - i. Connecting a device to the extension or hub can help remove ambiguity.
 - g. Right click on each "hub" and select "Properties."
 - h. Select the "Power management" tab and deselect the box labelled "Allow the computer to turn off this device to save power" and click "OK."
 - i. If the "Power Management" tab does not exist, the device will not be suspended and should work fine.
 - i. Repeat step 2.g and 2.h for any hubs, local extender or remote extender units attached to the computer.