

Maximizing USB 3.0 Data Transmission Speed and Performance



Pushing Performance

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One of the most common problems when implementing USB 3.0 cables and panel feed-through is ensuring that the USB is properly connected to reach USB 3.0 SuperSpeed, instead of slowing down to USB 2.0 speeds. This short article explains what causes the slower speed, how to prevent it, as well as solutions for ensuring SuperSpeed with HARTING solutions.

Unlike other data transmission protocols, such as Ethernet and USB 2.0, USB 3.0 SuperSpeed does not use auto-crossing or bi-directional data transmitting/receiving. Instead, specific pairs on either end must be crossed to ensure SuperSpeed.

To start let's first compare the pin out of a USB 2.0 and USB 3.0 solution.

USB 2.0: 4 pins + shield

- 2 pins for +5V + ground
- 2 pins for full duplex data transmission (bi-directional)

USB 3.0: 9 pins + shield

- 2 pins for +5V and ground
- 2 pins for full duplex USB 2.0 data transmission
- 2 pins for USB 3.0 high speed data transmission (uni-directional)
- 2 pins for USB 3.0 high speed data receiving (uni-directional)
- 1 additional ground

For USB 3.0 data transmission to reach SuperSpeed the two additional high speed pairs have to be crossed once both devices are connected. This means that the "transmission" end of device A must be connected to "receiving" and at device B and vice versa.

If two crossed cables of the SuperSpeed pairs are improperly connected, such as the "transmission" end of device A is connected to "transmission" end of device B, the SuperSpeed (USB 3.0) transmission will not work and reverts to sending data along the USB 2.0 lines.

As USB 2.0 uses bi-directional data transmission this is not an issue.

It is important to note that two pins within a USB 3.0 cable do utilize USB 2.0 bi-directional pins. This allows a mismatched cable and device to still function, although at lower speed.

USB 2.0 Pin-Out				
Pin	Color	Signal Name ("A" Connector)	Signal Name ("B" Connector)	Description
Shell	N/A	Shield		Metal housing
1	Red	VBUS		Power
2	White	D-		USB 2.0 differential pair
3	Green	D+		
4	Black	GNC		Ground for power return

USB 2.0 utilizes 4 pins and allows bi-directional data transmission.

USB 3.0 Pin-Out				
Pin	Color	Signal Name ("A" Connector)	Signal Name ("B" Connector)	Description
Shell	N/A	Shield		Metal housing
1	Red	VBUS		Power
2	White	D-		USB 2.0 differential pair
3	Green	D+		
4	Black	GNC		Ground for power return
5	Blue	StdA_SSRX-	StdB_SSTX-	SuperSpeed transmitter differential pair
6	Yellow	StdA_SSRX+	StdB_SSTX+	
7	N/A	GND Drain		Ground for signal return
8	Purple	StdA_SSTX-	StdB_SSRX-	SuperSpeed receiver differential pair
9	Orange	StdA_SSTX+	StdB_SSRX+	

USB 3.0 utilizes 9 pins and can only reach SuperSpeed when the SuperSpeed pair are crossed correctly.

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HARTING Solutions for USB 3.0 SuperSpeed

One of the most common problems HARTING sees is when coupler solutions are used with USB 3.0. This section explains how to solve or avoid this problem altogether.

Often HARTING USB 3.0 coupler products are together with a standard market crossed cable. However, the wiring within the coupler is 1:1 and not crossed. If the USB 3.0 couplers are used with typically crossed USB 3.0 cables, the high-speed cables will be improperly matched and the speed will lower to USB 2.0.

Some examples of these coupler products include:

- USB 3.0 coupler type A-A
[0945 545 1902](#)
- *har-port* USB 3.0 coupler type A-A
0945 425 1902 and 0945 425 1904
- HARTING PushPull V4 USB 3.0 coupler type A-A 0945 245 1904 and 0945 245 1905

The solution is to use a 1:1 wired cable such as the below:

- USB 3.0 IP20 cable 0,5m; 2x type A 1:1
[0945 145 2930](#)
- USB 3.0 IP20 cable 1,0m; 2x type A 1:1
[0945 145 2931](#)
- USB 3.0 IP20 cable 1,5m; 2x type A 1:1
[0945 145 2932](#)
- USB 3.0 IP20 cable 2,0m; 2x type A 1:1
[0945 145 2933](#)

By using a 1:1 wired cable, only one pair is crossed, allowing SuperSpeed data transmission.

A second solution would be to use a 1:1 wired USB 3.0 type A jack to plug, such as the below:



- USB 3.0 PFT A plug - A HIFF jack 0,5m
[0945 545 1930](#)

- USB 3.0 PFT A plug - A HIFF jack 1,0m
[0945 545 1931](#)
- USB 3.0 PFT A plug - A HIFF jack 1,5m
[0945 545 1932](#)
- USB 3.0 PFT A plug - A HIFF jack 2,0m
[0945 545 1933](#)
- USB 3.0 PFT A plug - A HIFF jack 3,0m
[0945 545 1934](#)

This cable can be combined with HARTING PushPull V4 housings [0945 545 0028](#) and [0945 545 0032](#).

For the *har-port* solution, HARTING offers complete sets for USB 3.0 that are wired 1:1 and work with one crossed USB 3.0 to achieve USB 3.0 SuperSpeed.



- *har-port* USB 3.0 A-A PFT cable 0,5m
[0945 452 1930](#)
- *har-port* USB 3.0 A-A PFT cable 1,0m
[0945 452 1931](#)
- *har-port* USB 3.0 A-A PFT cable 1,5m
[0945 452 1932](#)
- *har-port* USB 3.0 A-A PFT cable 2,0m
[0945 452 1933](#)
- *har-port* USB 3.0 A-A PFT cable 3,0m
[0945 452 1934](#)
- *har-port* USB 3.0 A-A PFT black cable 0,5m
[0945 452 1970](#)
- *har-port* USB 3.0 A-A PFT black cable 1,0m
[0945 452 1971](#)
- *har-port* USB 3.0 A-A PFT black cable 1,5m
[0945 452 1972](#)
- *har-port* USB 3.0 A-A PFT black cable 2,0m
[0945 452 1973](#)
- *har-port* USB 3.0 A-A PFT black cable 3,0m
[09 45 452 1974](#)

For more information, or for further assistance with your USB 3.0 solution, please contact our Tech Support team:

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