

USB Isolation – Things to Consider

Isolation protects your computer’s USB port from dangerous ground loops and provides for data integrity in electrically noisy environments; such as near a variable frequency motor drive, welding, or other large loads. However, this added protection and reliability do not come without a price. Before deciding to use USB isolation, you need to consider your bandwidth, downstream power, and cascade requirements.

Bandwidth

The USB 2.0 standard calls out three speeds. The first two speeds are actually carryovers from the earlier USB 1.1 standard – Low Speed and Full Speed. When USB 2.0 came out, High Speed was introduced. USB 2.0 is also backwards compatible with the lower USB 1.1 speeds. As you can see, the naming convention can cause a bit of confusion because “Full Speed” is lower than “High Speed.” Be careful when spec’ing out your equipment.

Name	Standard	Speed
Low Speed	USB 1.1	1.5 Mbps
Full Speed	USB 1.1	12 Mbps
High Speed	USB 2.0	480 Mbps

Adding isolation limits bandwidth to “Full Speed” or 12 Mbps. While this is still technically USB 2.0, the host controller will not pass data at “High Speed” or 480 Mbps. It will automatically ratchet down to 12 Mbps. Therefore, if you require 480 Mbps “High Speed,” you should not use isolation. Luckily, most industrial applications will work fine at 12 Mbps. Our USB Hubs come in both isolated and non-isolated versions.

Model	Isolation	Ports	Low Speed USB 1.1 (1.5 Mbps)	Full Speed USB 1.1 (12 Mbps)	High Speed USB 2.0 (480 Mbps)
UHR204	None	4	YES	YES	YES
UHR207	None	7	YES	YES	YES
UHR304	4 kV	4	YES	YES	NO
UHR307	4 kV	7	YES	YES	NO

We also have a number of one or two port USB isolators. The UH4xx series products are fixed at a particular speed, either 12 Mbps or 1.5 Mbps. This is an important distinction because “Low Speed” isolators will not work with “Full Speed” devices and vice versa. The UHRxx series isolators also contain a USB hub chip. The addition of the hub chip makes them “smart” in the sense that they can self-select between 1.5 Mbps “Low Speed” and 12 Mbps “Full Speed.” None of the port isolators are capable of operating at “High Speed” 480 Mbps. This reference chart shows the bandwidth capabilities of each of our port isolators.

Model	Isolation	Ports	Low Speed USB 1.1 (1.5 Mbps)	Full Speed USB 1.1 (12 Mbps)	High Speed USB 2.0 (480 Mbps)
UH201	2 kV	1	NO	YES	NO
UH401	4 KV	1	NO	YES	NO
UH401-2KV	2 kV	1	NO	YES	NO
UH401SL	4 KV	1	YES	NO	NO
UH401SL-2KV	2 kV	1	YES	NO	NO
UHR401	4 KV	1	YES	YES	NO
UHR402	4 KV	2	YES	YES	NO

Power

Another thing to consider is the power requirement. Our isolated USB Hubs, both the four and seven port versions, require the use of an external power supply. As a powered hub, they provide 500 mA through each port to power downstream devices. The non-isolated four port hub also has the option of operating in a USB bus powered mode. In this mode, downstream power is limited to 100 mA from each port. The UHR401 and UHR402 must be powered from an external source and provide 500 mA downstream power from each port. The UH201 and UH40x family of isolators do not have an external power option and are limited to 100 mA downstream power.

Model Number	USB Port Power	External 10 to 30 VDC	Downstream Power Available
UHR204	YES	YES	100 mA per port or 500 mA per port, external power
UHR207	N/A	YES	500 mA per port
UHR304	N/A	YES	500 mA per port
UHR307	N/A	YES	500 mA per port
UH201	YES	NO	100 mA
UH401	YES	NO	100 mA
UH401-2KV	YES	NO	100 mA
UH401SL	YES	NO	100 mA
UH401SL-2KV	YES	NO	100 mA
UHR401	NO	YES	500 mA per port
UHR402	NO	YES	500 mA per port

Cascading

Finally, USB Isolation limits the number of hubs that can be cascaded. This is a rare use case, but it is worth mentioning. The USB 2.0 standard allows up to five hubs to be cascaded. This includes the USB controller hub built into the PC. If you are using an isolated USB hub, the isolation chip introduces a propagation delay equivalent to one USB hub. Therefore, the isolated hub counts as two hubs in the cascade. So you can only hook together two isolated hubs on a single USB host controller.

The key to selecting the correct USB Hub or isolation product is to understand your application. The information provided above should make this easier for you. If you have additional questions, please feel free to contact our support staff at 800-346-3119. They will guide you in the right direction.