



## White Paper: StackableUSB™ Extended Power

StackableUSB™ differs from the desktop PC implementation of USB in the way that power is distributed to the various devices. StackableUSB™ boards are bolted together and interface through a connector with redundant power pins, whereas desktop PCs connect USB devices through cables that may extend some distance. Because of this, the power capabilities of StackableUSB™ are extended beyond what is outlined in the standard USB specification.

USB 2.0 provides for up to 500mA of +5 V power to each device. The device requests power in 2mA increments via the MaxPower field in the device's configuration descriptor. The field is one byte in size and the maximum allowable value is 250 for a total of 500mA requested.

The StackableUSB™ specification states that a StackableUSB™ Single Board Computer (SBC) must be capable of providing 937.5mA of +5 V and 937.5mA of +3.3 V power to each attached device.

On Windows XP if you attach a device with a MaxPower value greater than 250 (0xFA), requesting more than 500mA of power, the operating system will pop up an error message stating that the USB hub power has been exceeded. When this occurs, the device will show up disabled in the device manager and the device status will state, "This device can not start". Due to USB 2.0 specification power limits, existing operating systems and drivers do not allow a device to request more than 500mA of power from the bus.

StackableUSB™ devices that require more than 500mA of +5 V or use the +3 V supply have no way to tell the host about these additional power requirements. Since StackableUSB™ systems are bolted together it is very unlikely that new boards will be attached to the system dynamically with power applied. The system components will typically be known and fixed at the time that the system is developed and deployed. It is therefore possible to establish the power requirements of each device at build time and to be sure that no more than 937.5mA of power is drawn by any device in the system. All StackableUSB™ SBCs are required to be able to provide full power to each device on each supply. The number of devices is limited by the number of native ports on the SBC.

The max power setting should not exceed 250 according to the USB 2.0 specification. If more than 500mA is drawn by a device, the device should set its MaxPower field to 250.

This renders the USB 2.0 power management scheme unable to manage power requirements in a StackableUSB™ system. The power budget is therefore the responsibility of individual StackableUSB™ device manufacturers and StackableUSB™ system designers.