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Lava I/O News

**LAVA**

Plugging into USB

On USB Cabling

Confusion has been occurring lately about types and qualities of USB cabling. A number of manufacturers are selling "USB 2.0 Cables," and customers have been wondering how those differ from regular USB 1.1 cables.

The confusion is understandable, as the plugs and receptacles for both USB 1.1 and USB 2.0 are the same. So what's the difference? Here's the dirt: there is no difference. If a cable meets the specification for 12 Mbps USB, it meets the specification for 480 Mbps USB. A cable called a "USB 2.0 Cable" should be capable of working with both USB 1.1 and USB 2.0 data and peripherals, at the speed of the interface being used. Similarly, a cable called a "USB Cable" or a "USB 1.1 Cable" should also be capable of operating in precisely the same way, with the same data transfer rates and reliability.

Up to Spec

A look at the USB specification shows why. The Universal Serial Bus Specification Revision 2 defines all speeds of USB: Low-Speed, Full-Speed, and High-Speed (1.5, 12, and 480 Mbps respectively). It includes descriptions of three basic cable assemblies: the standard detachable cable, the high-/full-speed captive cable, and the low-speed captive cable. The captive cables are just as their names suggest: captive to a device; that is, not removable. A good example of a low-speed captive cable is that used on a USB mouse.

All USB cables have five wires: two power conductors, two signal conductors, and a 28 AWG drain wire. Beyond these similarities, important distinctions exist between low- and high-/full-speed cables. The low-speed cable is designed for low-speed signaling only, so twisted-pair conductors and a braided
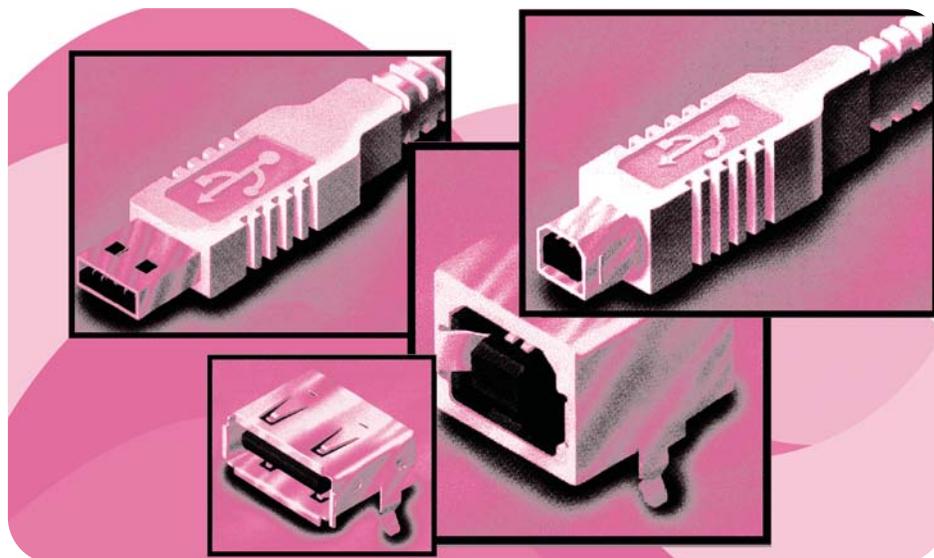
outer shield are recommended but not required by the specification. Consequently, low-speed cable can be thinner than cable for high-/full-speed signaling. The diagrams on the next page show these differences.

In terms of connectors, low-speed cable has a Series "A" plug on one end, and the other end is either hard-wired to the device or uses a vendor-specific detachable connector. Apart from vendor-specific designs, detachable versions of the low-speed cable are prohibited by the specification.

The standard detachable cable and the high-/full-speed captive cable are the same as each other in their cabling and materials requirements, except that the detachable cable is terminated on one end by a Series "A" plug and on the other end by a Series "B" plug, while a high-/full-speed captive cable has a Series "A" plug on one end and is hard-wired or uses a vendor-specific detachable plug on the other.

Specific details on the gauges and materials of the individual wires of a USB cable are outside the scope of this newsletter, but it boils down to this: the USB 2.0 specification that governs USB today makes no distinction between the

cables used for High-Speed USB and the cables used for Full-Speed USB. So, when it comes down to it, there is only one design of detachable cable, aside from vendor-specific designs. If it has Series "A" and Series "B" connectors, it is a high-/full-speed cable.

How long is too long?

What is the maximum length permitted for a USB cable? The answer, my friend, is that the USB specification defines maximum cable length in terms of what is required for a cable to properly handle a USB signal, rather than providing a simple linear measurement. When we are told that the maximum cable length for a USB cable is 15 feet, what we are getting is a digested version of the truth. "Fifteen feet" appears nowhere in the specification.

What the specification *does* say for detachable cables is that the maximum allowable cable length is determined by limits on signal pair attenuation (how much the signal pair loses signal over distance), voltage drop across the ground lead (to a maximum of 125mV from upstream to downstream), and propagation delay (how long a signal takes to travel a given distance of cable). Given that the first two can
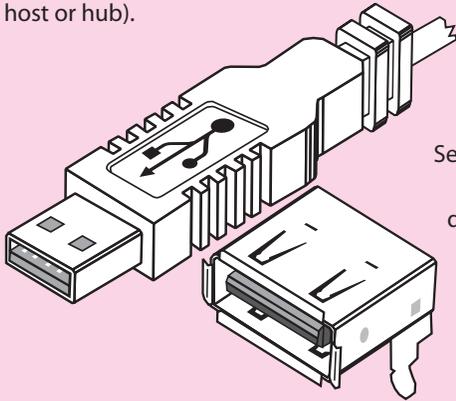
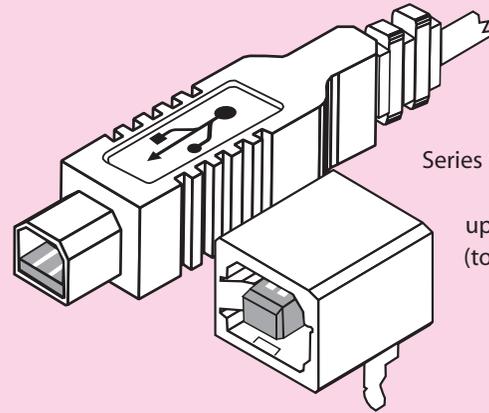be controlled in significant measure by the cable, the really limiting factor is propagation delay. The specification allows a maximum of 70 ns of propagation delay through the upstream cable and hub electronics. Of this, the maximum one-way cable delay allowed is 26 ns. Given that the specification states also that cabling can have no more than 5.2 ns of delay per meter, we can see that 26/5.2 gives 5 meters as the maximum cable length–or 16.4 feet approximately.

What's not allowed in USB cabling?

Generally speaking, as far as USB cables are concerned, if you have to ask whether something is allowed, the answer is no. Even so, the specification does enumerate a few explicitly prohibited cable designs.

First, extension cable assemblies are not allowed. These are cables terminated with a Series "A" plug on one end and a Series "A" receptacle on the other, or a Series "B" plug on one end and a Series "B" receptacle on the other. These designs allow multiple segments
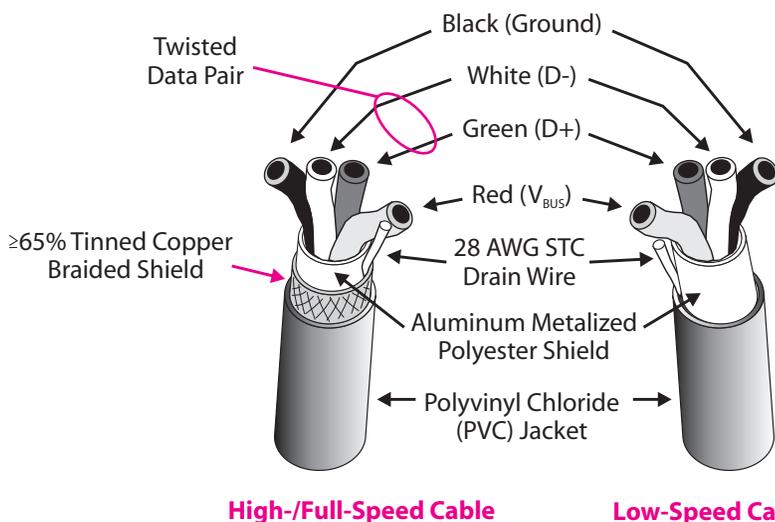
of USB cabling to connect, and possibly exceed the maximum permitted cable length. While they do exist, and are perhaps even useful at times, extension cables are outside the specification.

Second, cables with Series "A" plugs on both ends or with Series "B" receptacles on both ends are not permitted. These cables would allow two downstream ports to be directly connected, which would violate the hierarchical USB topology. Unlike FireWire, USB demands that peripherals be connected to hubs, not to other peripherals.

Third, standard detachable cables are prohibited for low-speed devices. You will not (or should not) see a USB mouse with a cable connector on the mouse, rather than a hard-wired cable. Because the standard detachable cable is rated for full and high speeds, using it exceeds the capacitive load of low speed USB.

On USB Logos

Three USB logos currently exist: the traditional, original USB logo, the "Certified USB" logo, and the "Certified Hi-Speed USB" logo. The success of USB caused the USB Implementers Forum (USB-IF) to realize the value of their trademarked logo, and inspired them to control its use. To do this best, they developed two new logos, as the original USB logo was effectively in free general use. The "Certified USB" logo is licensed for use by manufacturers whose product signals at 12 ,

Twisted Data Pair

Black (Ground)

White (D-)

Green (D+)

Red (V_{BUS})

≥65% Tinned Copper Braided Shield

28 AWG STC Drain Wire

Aluminum Metalized Polyester Shield

Polyvinyl Chloride (PVC) Jacket

High-/Full-Speed Cable   **Low-Speed Cable**

Mbps or 1.5 Mbps, has been submitted to and passed the USB-IF Test Procedure for Basic-Speed products, and has been posted on the USB-IF Integrators List. The USB-IF Hi-Speed logo similarly applies to products signaling at 480 Mbps. The USB-IF states that the granting of license rights to the logos does not constitute a "certification" of the product by the USB-IF, despite the word "CERTIFIED" on the logos.

In addition to the USB logos, the specification includes a USB icon. This is the design required to be embossed into the plugs of a USB cable, as well as located adjacent to each USB receptacle.

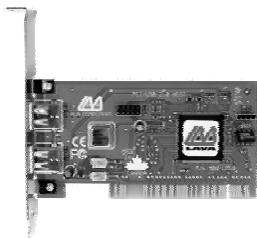## USB Logo Spotting Guide

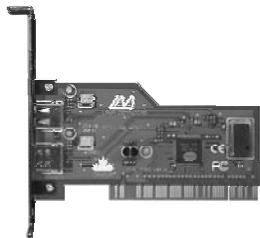| The original USB logo. | The "Certified USB" logo for low- and full-speed devices. | The "Hi-Speed Certified USB" logo for high-speed devices only. | The USB icon for identifying all USB connectors. |

USB 2.0 Host Adapter

USB 1.1 Host Adapter

Kazan USB 2.0 Drive Enclosure

SPH-USB 1.1 Hub

Lava USB Products

In the USB world, adding ports with host adapters makes especially good sense. Increasing the number of USB ports in a system by employing a host adapter adds full bandwidth on each new port.

Lava's USB 2.0 Host Adapter adds two USB 2.0 ports, each with up to 480 Mbps of data throughput. USB 2.0 is currently natively supported in Windows 2000 and ME, and will connect both USB 2.0 peripherals as well as USB 1.1 devices.

The workhorse Lava USB 1.1 Host Adapter can transfer data at up to 12 Mbps. This host adapter is supported in Windows 98SE, ME, 2000, and XP; Mac 8.6+; and Linux 2.4+.

Lava's Kazan – the first USB 2.0-to-IDE drive enclosure on the market – makes great use of the speed and convenience of USB 2.0 by combining USB 2.0-to-IDE bridging electronics, an external power supply, all cables, and a sturdy and compact enclosure. Pop in any IDE drive and you have a high-speed, hot pluggable external drive! It's perfect for taking work between home and office, or for quickly and easily backing up data.

The Lava SPH-USB 1.1 Hub gives real versatility to both notebooks and PCs by adding three powered downstream USB ports, a bi-directional parallel port, and a 16550 UART serial port. It is an effective way to add these ports to systems lacking PCI-bus expansion capability or free PCI slots.

Profile

Cables To Go delivers the highest quality connectivity products to resellers via direct sales and through key distributors such as Tech Data and Ingram Micro. Their innovative and timely solutions are the result of more than 15 years of industry experience. Whether it's a standard product or a custom cable, they are an expert source for resellers' connectivity needs.

Cables To Go uses the finest components and the latest construction technologies to maximize cable performance and to ensure compliance to industry specifications for each cable and its designated application.

From PC Cables and Adapters to Networking and Data Sharing products, Cables To Go delivers the best products–including Lava boards–at an always competitive price. In addition, they keep packaging simple to let resellers customize the final sale to their customers to ensure a superior connection every time.

When a reseller is looking for a complete connectivity solution, Cables To Go can also help. Their 15 years of experience as a custom cable manufacturer enables them to provide built-to-specification connectivity solutions when and where you need them–all at a competitive price. Their consultative approach to sales and engineering helps resellers to determine application requirements, and enables Cables To Go to rapidly accommodate customers' evolving needs.

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