

Test Report:
Impact of Architecture on
Performance of
USB to Serial Adapters

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I. Background

Sealevel Systems utilizes a unique architecture for adapters used to convert signals from USB ports to serial devices. It is important that the marketplace have empirical data comparing the relative performance of a dedicated USB UART design like the “Sealevel architecture” versus the “industry average architecture” of a shared throughput design.

II. Test Objective

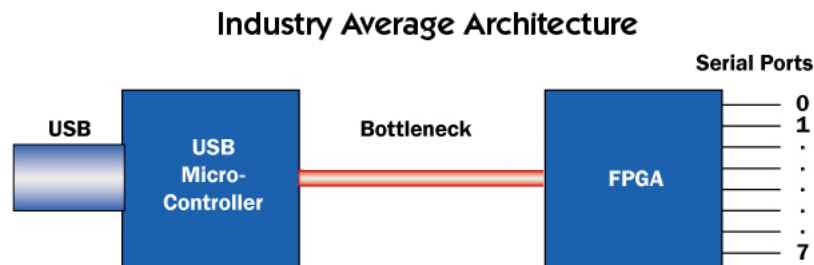
Determine the impact of architecture on the performance of USB to Serial Adapters in order to assist users in selecting products most appropriate for their applications.

III. Findings

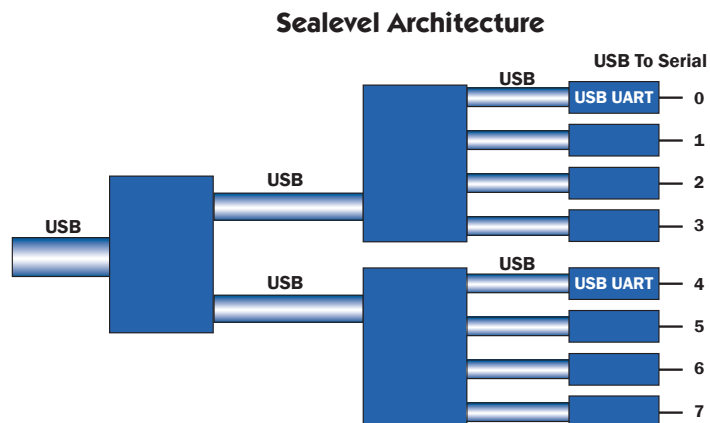
There is a significant difference in performance between the “Sealevel architecture” and “industry average architecture” for USB serial adapters. Performance testing of 8-port USB serial adapters proved that the architecture determines the maximum baud rate and more importantly, the throughput of connected serial devices.

The “Sealevel architecture” uses a USB UART interface that delivers significantly faster and more reliable communications.

The “industry average architecture” 8-port USB serial adapter utilizes a USB microcontroller and a single FPGA wired to all eight serial ports. The interface between the microcontroller and FPGA creates a bottleneck because the serial devices are sharing the throughput of the microcontroller. As a result, each additional serial device added substantially reduces the speed of all eight serial ports.



In contrast, the “Sealevel architecture” 8-port serial adapter (Item# 2801) couples each port with a dedicated USB UART chip. This is equivalent to connecting eight single-port USB serial adapters to the host, thereby allowing each serial port to run at maximum speed. (All Sealevel SeaLINK USB serial adapters have this architecture advantage.) The bottleneck found in the industry standard architecture is the limiting factor and the speed of the USB connection (e.g., USB 1.1 vs. USB 2.0) does not affect throughput.



Key Research Finding

“The ‘Sealevel architecture’ couples each port with a dedicated USB UART chip. This is equivalent to connecting eight single-port USB serial adapters to the host, thereby allowing each serial port to run at maximum speed. (All Sealevel USB serial adapters have this architecture advantage.)”

IV. Test Procedures

Tests on the USB serial adapters utilized a desktop computer with a 3GHz Intel Pentium4 CPU, 2GB of RAM, and a fresh install of Windows XP.

The USB serial adapters were installed per manufacturer instructions and RS-232 loopback plugs were placed on all eight serial ports.

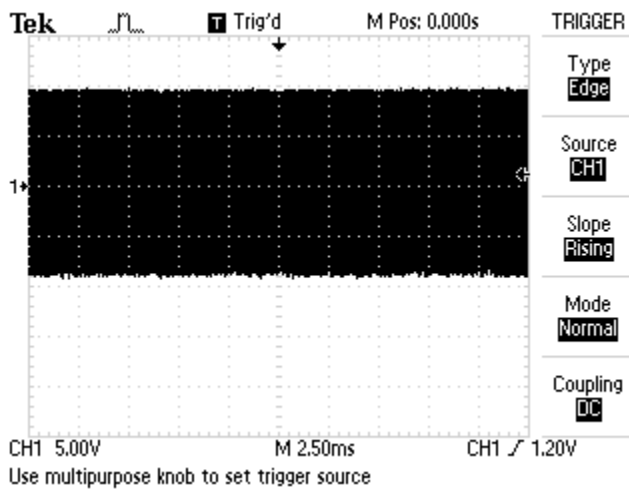
The test was conducted using WinSSD, a serial communications utility. WinSSD provides terminal mode operation and enables modifying default UART settings. WinSSD allows toggling modem control signals, transmitting test patterns, initiating loopback tests, and performing bit error rate testing (BERT) and throughput monitoring.

Each serial port was set at the maximum baud rate, then multiple instances of WinSSD were launched with each serial port opened in order and the bit error rate test (BERT) initiated. The transmit (Td) and receive (Rd) data rates (throughput) were added together for all open ports and compared.

V. Detailed Findings

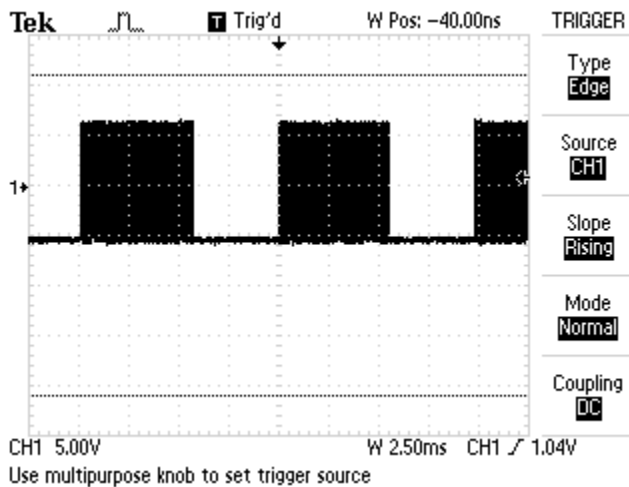
A. Throughput with One Port Opened

With one port on the “Sealevel architecture” adapter open at the standard baud rate of 115.2K bps, the oscilloscope confirmed that the throughput matched the baud rate with a continuous stream of data



The “Sealevel architecture” adapter delivers a continuous stream of data, with one or all ports open.

With one port on the “industry average architecture” adapter open at the standard baud rate of 115.2K bps, data was transmitted in bursts rather than in a continuous stream and the actual data rate was only approximately 65K bps.

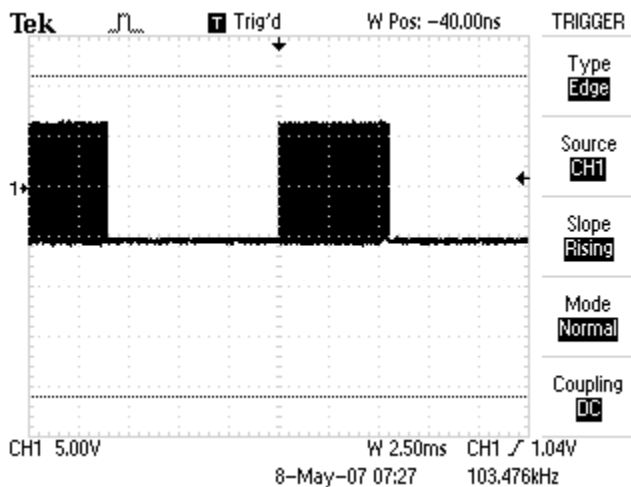


With only one port opened the “industry average architecture” transmitted data in bursts, which prevented reaching maximum bps.

B. Throughput with Multiple Ports Opened

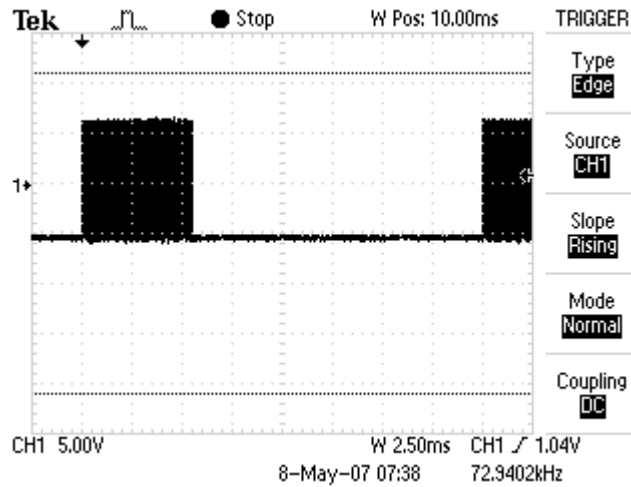
Data rates for the “Sealevel architecture” USB serial adapter remained continuous at the specified baud rate as multiple ports were sequentially opened.

When the second port on the “industry average architecture” adapter was opened at 115.2K bps, the data rate on the first serial port dropped to approximately 48K bps.



When multiple ports were opened on the “industry standard architecture” adapter, the bursting versus continuous data transmission coupled with the shared throughput design significantly reduced bps on all ports.

When the third port on the “industry standard architecture” adapter was opened at 115.2K bps, the data rate on the first serial port dropped to only 33K bps.

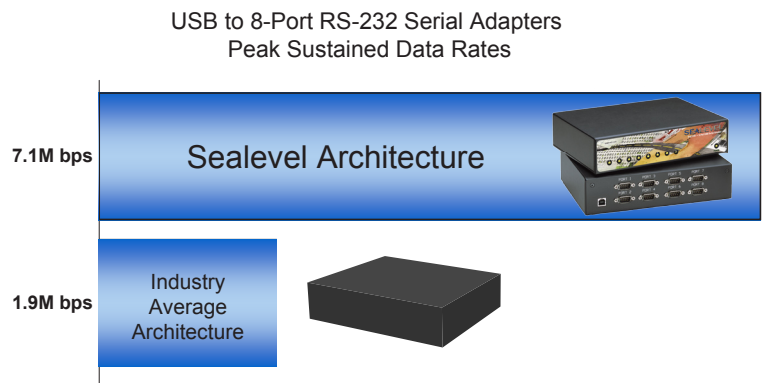


When attempting to open all eight serial ports on the “industry standard architecture” adapter, the Loopback Pattern Test in WinSSD showed that the data was corrupted. Additionally, a lock-up occurred on multiple serial ports necessitating that they be closed and re-opened in order to regain functionality.

C. Total Throughput

At the maximum baud rate specified for the product, the bi-directional data rate for the “Sealevel architecture” USB serial adapter was a peak 7.1M bps across all eight serial ports running concurrently.

The bi-directional data rate for the “industry average architecture” USB serial adapter at the maximum baud rate was a peak 1.9M bps across only four ports running simultaneously. Opening additional serial ports beyond four resulted in the ports locking up. Only four serial ports would operate concurrently at the specified maximum baud rate.



VI. Conclusion

“Sealevel Architecture” Provides Faster, More Reliable Data Transmission.

Testing revealed that two key design and component advantages contribute to this superior performance.

1. “Sealevel architecture” allows each port to run at maximum speed

The “Sealevel architecture” couples each port with a dedicated USB UART chip. This is a superior design because it is equivalent to connecting eight single-port USB serial adapters to the host, thereby allowing each serial port to run at maximum speed. (All Sealevel SeaLINK USB serial adapters have this architecture advantage.)

2. “Sealevel Architecture” Produces Continuous Transmission Stream

When the first port on the “Sealevel architecture” USB serial adapter was opened, the oscilloscope confirms that the throughput matches the baud rate with a continuous stream of data. Even as additional ports were opened, the first serial port delivered a continuous stream of data.

Information on Sponsor

Sealevel Systems, Inc. performed this research in June 2007 at its ISO certified research, design, and testing facility.

Sealevel Systems, founded in 1986, provides industrial computing solutions in addition to a variety of communications and I/O products including PCI Bus cards, Ethernet serial servers, USB serial adapters, PCMCIA cards, and PC/104 modules. Sealevel’s product line includes multi-port RS-232, RS-422/485, RS-232/422/485 multi-interface high-speed sync/async, and digital/relay I/O.

Sealevel offers USB serial adapters with one to 16 ports and support for RS-232, RS-422, and RS-485. Please visit the SeaLINK USB serial webpage for more information at www.sealevel.com or call (864) 843-4343.