Transportation

SEALEVEL®

Delivering Design & Manufacturing Excellence Since 1986

RELIABLE, SUSTAINABLE SOLUTIONS FOR THE COMPLETE TRANSPORTATION ECOSYSTEM

RAIL MANAGEMENT

Sealevel designs and manufactures “black box” intelligence and computing solutions for the leading provider of cloud-based remote monitoring solutions for locomotive management.

TICKET VENDING

The leading designer and OEM of payment solution for public transportation systems integrates Sealevel’s serial solutions for connectivity with peripheral devices as part of their ticket vending machines.

TOLLING

Sealevel’s data acquisition devices supply the digital I/O behind multiple top-15 toll authorities, processing billions of toll transactions every year.

INTELLIGENT PASSENGER ANALYTICS

As regional transportation agencies are upgrading their passenger analytics systems, the leading public transport integrator relies on Sealevel’s serial I/O for backward compatibility.

TESTING & DIAGNOSTICS

One of the primary suppliers of freight equipment relies on a standard embedded computer from Sealevel for high reliability in their automated test platform, combined with a wide operating temperature and a small footprint.

VISION SYSTEMS FOR ADAS

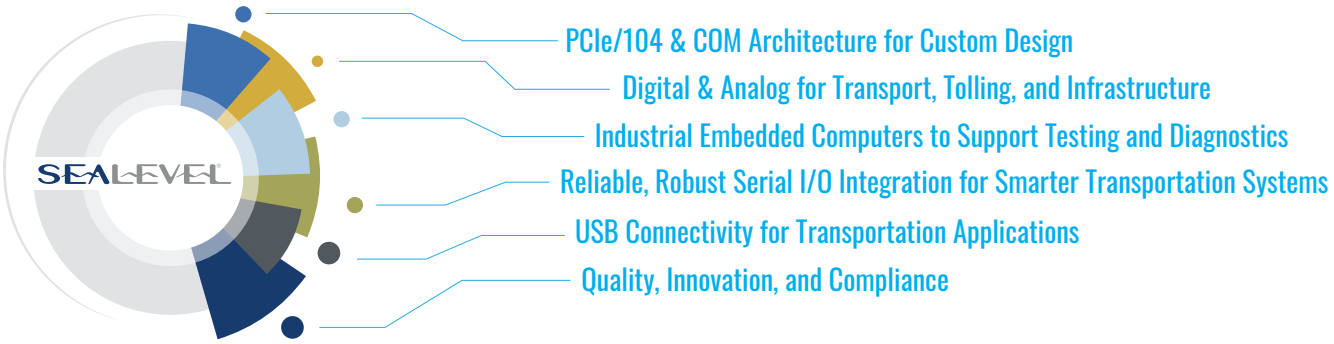
Sealevel partners with a provider of embedded computing solutions for Advanced Driver Assistance Systems (ADAS) to supply USB expansion for testing in virtual environments.

GOING FURTHER FOR AUTOMOTIVE, RAILWAY, AND PUBLIC TRANSPORTATION SINCE 1986

Sealevel Systems, Inc. is an American-owned designer and manufacturer of standard and full custom hardware and software. Our customers range from industry leaders to every major US and Allied nations military contractor including Northrop Grumman, Raytheon, BAE, Boeing, and L3Harris.

Sealevel delivers proven, integration-ready products and customized solutions for advanced systems, achieved by leveraging over 35 years of engineering and manufacturing experience. From automotive manufacturing to electric bus charging stations to industrial vehicle fleet management solutions, Sealevel's team delivers unparalleled performance while meeting industry-specific certifications and requirements.

Sealevel's 52,000-square-foot facility sits on a 17-acre site in Liberty, SC. To protect electronic components during design, assembly, and test, we have installed over 30,000 square feet of ESD tiling spanning our manufacturing, engineering, and tech support departments.



Sealevel's companywide standards and certifications include:

ISO 9001:2015 Registered
RoHS Compliant
REACH Compliant
ESD S20.20 Compliant
IPC-A-610 Certified
J-STD-001 Certified

Sealevel is a member of these associations to support, educate, and interact with leaders across the industry:

Intel® Partner Alliance
Intel® Solutions Marketplace
OpExChange
PC/104 Consortium
PCI-SIG
PICMG
South Carolina Manufacturing Extension Program (SCMEP)

Our Mission

Sealevel Systems, Inc. is committed to **engineering** leading-edge communications solutions, **manufacturing** our products to the highest quality standards, **growing** a creative team of trailblazers, and **sustaining** a legacy of community investment.

PCIe/104 & COM ARCHITECTURE FOR CUSTOM DESIGN

As PCIe/104 and COM Express offer similar benefits in terms of time to market, flexibility and scalability, evaluating the operating environment and available footprint can be key determining factors. Sealevel's award-winning team of electrical, mechanical, software, test, and compliance engineers have first-hand experience with COM Express and PCIe/104 to meet custom design requirements. We would welcome the opportunity to guide you through our COTS computing systems or discuss your application-specific needs.

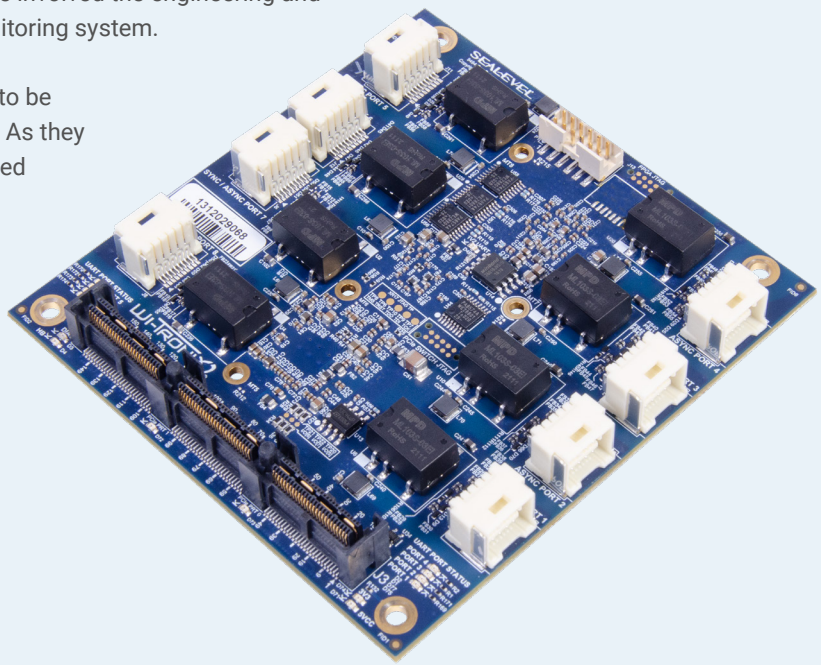
Compact Design
PCIe/104 and COM Express design allow for compact design and increase the likelihood of meeting SWaP-C² challenges. PCIe/104 achieves this through a vertical stacking approach while with COM Express, the size of the board can increase (or decrease) horizontally to meet the desired footprint.

Future-Proof
Both approaches allow for the application of FPGA to the COM module or carrier board, further future-proofing the design as I/O can easily adapt as technology evolves without the need to redesign the entire system.

Case Study: NextGen Locomotive Monitoring

On an ongoing basis, Sealevel partners with the leading provider of cloud-based remote monitoring solutions for high-value mobile assets. The company specializes in locomotive management solutions that monitor all operational functions of the locomotive including speed, fuel efficiency, time of day, distance traveled, and braking systems. One of their largest projects to date involved the engineering and manufacturing of a next-generation locomotive monitoring system.

The specific product in mind was a PCIe/104 board to be incorporated as part of the locomotive's "black box." As they evaluated potential partners, Sealevel quickly emerged as the only candidate that they had the confidence in to deliver the technology they required, accompanied by the high-reliability performance and design to meet specific railway certifications.



Sealevel's Solution

Sealevel's team architected a PCIe/104 embedded computer board with both synchronous and asynchronous serial ports. The board is installed as part of a complete stack, resulting in an advanced system for event recording and system performance monitoring. In addition to the environmental conditions and challenges of incorporating synchronous and asynchronous ports, the Sealevel team's solution also met the conditions for the following certifications:

- EN 50155:2017 – Electronic equipment used on rolling stock
- EN 50121: 2017 – Electromagnetic compatibility
- AAR S-5702:2017 – Railroad Electronics Environmental Requirements
- AAR S-9101:2012 – Locomotive Electronics System Architecture

Featured Product: PCIe/104 Embedded Computer Board

- (5) Gigabit Ethernet (2 Isolated PoE PSE)
- (2) Isolated Synchronous Serial Ports
    - Software configurable for RS-232/422/485/530/530A/V.35
    - Data rates up to 10Mbps
    - Port-to-Port and Port-to Host Isolation up to 3000V
- (6) Isolated Asynchronous Serial Ports
    - Software configurable for RS-232/422/485
    - Data rates up to 1Mbps
    - Port-to-port and port-to-host isolation up to 3000V
    - Operating temperature of -40°C to 85°C
    - Designed for high vibration and shock resistance

DIGITAL & ANALOG FOR TOLLING AND INFRASTRUCTURE

Sealevel digital and analog I/O products enable you to monitor — and control — real-world signals. Whether you need to monitor environmental conditions on highways, analyze road deterioration, or monitor train cars, passengers, and tracks, our digital and analog I/O products can meet the challenge. Select from field-proven optically isolated inputs, Reed and Form C relay outputs, TTL interfaces to solid-state relays, and A/D and D/A functionality. Whether you need to monitor just a few inputs or need to create a distributed control network, we'll help you configure a solution that is perfect for your application.

Seal/O Data Acquisition Devices

Sealevel's Seal/O data acquisition devices provide powerful digital, analog, and serial expansion to any monitoring and control system. With robust optical isolation, as well as wide operating temperature ranges, Seal/O DAQ devices are engineered and manufactured for reliable performance in extreme environments. Connect to the host via wireless, Ethernet, USB, RS-485, or RS-232 to add the functionality required for your particular DAQ application. Multiple units can be daisy-chained using convenient pass-through connectors to create a versatile remote and monitoring network.

Ethernet & PoE Adapters

Sealevel's eI/O Ethernet and PoE I/O adapters are cost-effective and allow remote monitoring of analog and digital I/O from anywhere on an Ethernet network. I/O options include optically isolated inputs, Reed, Form C, and solid-state relay outputs, and analog to digital inputs. Sealevel's Seal/O Ethernet modules are also compatible with 10/100Base-T Ethernet. For new technology builds, as well as retrofitting legacy equipment, these devices provide reliable control and monitoring across transportation networks.

Case Study: Expansive I/O for Tolling
Sealevel partners with an IT services and integration company that specializes in solutions for the tolling and transportation industries. The company services several of the top 15 toll authorities across the United States, processing billions of toll transactions per year.

The company's roadside solutions include electronic tolling, dynamic pricing, express lanes, and asset management. As a result of reliability and availability issues with other vendors, they designated Sealevel as their primary source for digital I/O in support of a variety of tollbooth applications. In addition to a highly reliable solution with long-term availability, the customer needed a product that could trigger a wide variety of technology including cameras, bill acceptors, license plate readers, and gates. The requirements expanded to include the identification of vehicles and violations.

Sealevel's Solution
Sealevel's team specified the SeaI/O 463E DAQ Module to meet the application's extensive – and growing – needs. This Ethernet to digital I/O interface provides 96 channels of buffered drive digital I/O. Using standard, 50-in IDC ribbon cables, the customer was able to connect multiple relay racks for further control and automation of the various sensors and peripherals. Initially deployed to trigger the various peripherals, the 463E was able to also address the tolling-specific identification needs due to its capacity.

With Modbus TCP protocol compatibility as well as the Sealevel SeaMAX API, the customer was able to achieve quick communication and control. And the SeaMAX software driver simplified installation and allowed for flexibility with Microsoft Windows and Linux.

Featured Project: SeaI/O 463E DAQ Module
- 10/100Base-T Ethernet Modbus TCP interface
- (96) channels of buffered TTL I/O
- (12) 8-bit ports, individually configurable as input or output
- (4) 50-pin industry-standard solid-state relay rack connectors

INDUSTRIAL EMBEDDED COMPUTERS TO SUPPORT TESTING & DIAGNOSTICS

Industrial computers are an integral part of a larger system, as opposed to a standalone desktop computer. Generally, industrial computers perform a highly specific function, and are often require a more rugged design to withstand the environment in which they are deployed. Application areas for industrial computers range from controllers for autonomous vehicles to data logging devices for fleet vehicles to powering monitoring systems along railways.

Fanless Design
Sealevel's solid-state computing systems are designed without fans for improved reliability and long-term field deployment. Systems are also engineered without internal cables for performance in high-vibration applications.

Wide Operating Temperature Range
Through extensive thermal modeling – and prototype testing – Sealevel's computers are designed with certification in mind to meet and exceed temperature requirements.

Future-Proof COM Architecture
Utilizing Computer-on-Module architecture, Sealevel boards are designed to allow for easy changes, and upgrades, to the CPU functionality without a complete system redesign or replacement.

Embedded Computers

Designed for applications where reliable computing and SWaP-C² optimization is a must, the Relio™ family of embedded I/O computing systems combines the reliability of a PLC with the configurability of an industrial computer. Relio embedded computers feature a fanless, solid-state design and offer extended temperature and vibration tolerance. COM Express design allows for technology migration, future-proofing your industrial PC. Choose from a variety of compact form factors and processor options, all with long-term availability and superior life cycle management.

Rugged Touch Panel PCs

Achieve computing, I/O and HMI requirements with Sealevel rugged HazPAC® and SeaPAC® touch panel PCs. Our fanless, industrial panel PC systems are designed to operate over wide operating temperatures for unmatched reliability. HazPAC touchscreen panel PCs are certified by ATEX, IECEx and for Class I, Division 2. These hazardous area computers also maintain NEMA 4/IP64 protection from sprayed liquids.

Case Study: Field Testing & Diagnostics for Locomotives

One of the primary suppliers of freight and transit equipment, systems, and digital solutions selected Sealevel to architect an update to their automated test platform for locomotives. This field testing and diagnostics system allows technicians to pull data from locomotives to isolate and/or correct issues. The system is designed to automate processes to reduce direct human contact and improve efficiency.

Historically, the system relied on a commercial touchpad with limited processing capability. Not only were they experiencing issues with reliability, but the customer needed a solution that could perform dependably with an operating temperature of up to 70°C and also meet their requirements for a small footprint.

Sealevel's Solution

Sealevel's team recommended our Relio R1 Industrial Computer. The Relio R1 is based on COM Express architecture and uses strategic circuit placement and component choice to minimize the amount of heat produced. With these thermal design solutions, it can withstand operating temperatures from -40°C to 71°C. This solid-state design, complete without moving parts such as fans, requires zero maintenance. Made from a block of aluminum alloy using a ram extrusion process, the computer's body efficiently dissipates thermal energy with its unique fin design. To meet additional needs for a variety of peripherals, the customer now also integrates the Rugged SuperSpeed 4-Port USB 3.1 Hub in the complete system. The USB 3.1 Hub allows for backward compatibility with existing systems while achieving the desired SuperSpeed performance for newer installations.

Featured Product: Relio R1 Industrial Computer

- Dual Gigabit Ethernet
- (1) USB 3.0 port and (3) USB 2.0 high-retention ports
- (1) DVI-D; (1) VGA video
- CFast SATA II card slot
- 18-36 VDC source
- COM architecture with Atom processor
- Wide operating temperature of -40°C to 71°

Featured Product: Rugged SuperSpeed 4-Port USB 3.1 Hub

- Self-powered USB 3.1 Hub provides (4) downstream USB ports (4 CDP)
- Supports SuperSpeed (5Gbps), high-speed (480Mbps), full-speed (12Mbps), and low-speed (1.5Mbps) operation
- One CDP supplies up to 2.4A while the other three supply 1500mA each
- USB Battery Charging Specification BCv1.2 compliant
- Wide operating temperature of -40°C to 85°C
- ESD, overvoltage, and overcurrent protection

RELIABLE, ROBUST SERIAL I/O INTEGRATION FOR SMARTER TRANSPORTATION SYSTEMS

Sealevel offers the widest selection of asynchronous and synchronous serial interfaces for data intensive applications. Our serial adapters are trusted for public transportation, railway, ADAS, industrial, and commercial applications where reliable, high-speed communications are required. These interfaces support RS-232, RS-422, RS-485, and RS-530 electrical interface standards and offer a traditional bus-based approach as well as USB and Ethernet solutions.

Ethernet Serial Servers

SeaLINK® Ethernet serial servers offer the easiest way to connect RS-232, RS-422, and RS-485 serial devices to your Ethernet network. All SeaLINK devices use industry-standard TCP/IP protocol enabling any host to access serial ports as virtual COM ports. Designed using a powerful embedded microprocessor, SeaLINK products are able to communicate over multiple ports at sustained data rates up to 230Kbps. Sealevel industrial Ethernet serial servers support custom baud rates and 9-bit protocol and are housed in rugged enclosures for reliable performance in public transportation, fleet management, and railway applications.

PCIe Asynchronous Serial Adapters

Sealevel PCI Express serial boards utilize 120-byte FIFOs for maximum reliability in data-intensive applications. Software developed for standard PCI boards will also work with Sealevel PCI Express boards, simplifying your transition to this next-generation PCI bus. Sealevel PCIe serial boards are configurable for RS-232, RS-422, and RS-485 electrical interfaces. These PCIe serial boards are fully compatible with X2, X4, X8, X16, and X32 PCI Express slots.

PCI Asynchronous Serial Adapters

Sealevel's PCI bus serial boards offer the widest choice of I/O connectivity available. Products include RS-232, RS-422, and RS-485 PCI serial solutions. Our PCI boards are available with a wide range of accessories to make installation easy. Sealevel low profile Universal Bus PCI boards are designed for many newer computers that lack standard height PCI slots.

PCIe Synchronous Serial Adapters

Sealevel PCIe X1 synchronous serial cards are fully compatible with X2, X4, X8, X16, and X32 PCI Express slots. Software developed for standard PCI adapters will also work with Sealevel PCIe synchronous serial adapters, simplifying your transition to this next-generation PCI bus. Our synchronous serial adapters are an ideal solution for fleet management, infrastructure monitoring, passenger ticketing, rail monitoring, and other specialized transportation applications.

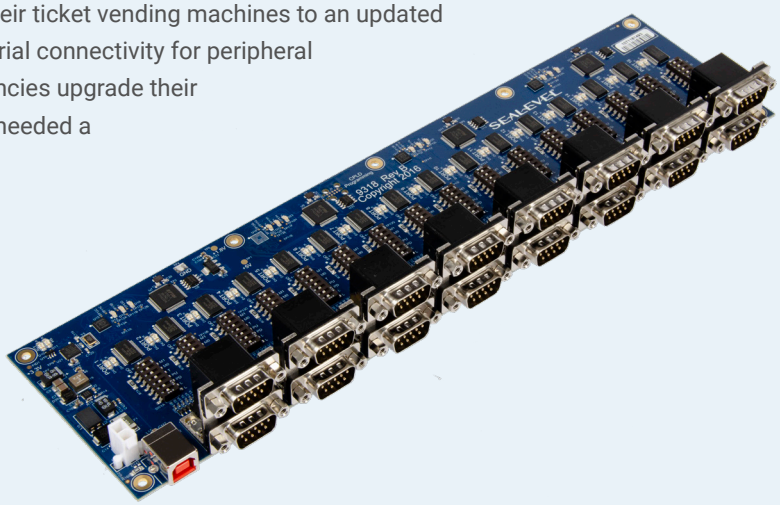
PCI Synchronous Serial Adapters

Fleet management, ADAS, and many other transportation applications use synchronous communication to achieve necessary high-speed data transfer. All Sealevel synchronous serial products are engineered with strict attention to timing to achieve the most reliable, high-speed communication possible. Choose from a variety of RS-232/422/485 multi-interface products that support HDLC/SDLC and other protocols.

Case Study: Serial I/O Upgrades for Smart City Transportation

Sealevel partners with a leading designer, OEM, and integrator of payment and information solutions for public transportation systems. Their suite of products includes ticket vending machines, passenger analytics devices, revenue management systems, and complete backend systems such as charging systems used in toll roads. The company's systems are deployed in support of local and state government transportation agencies in San Francisco, Los Angeles, Chicago, and Miami.

As they began migrating the single-board computers (SBCs) in their ticket vending machines to an updated operating system, they needed a long-term solution to provide serial connectivity for peripheral devices. Additionally, they saw many regional transportation agencies upgrade their buses to include a more robust passenger analytics system and needed a reliable serial I/O solution to support these integrations.



Sealevel's Solution

To meet their specific needs, Sealevel's team recommended our 2165-OEM and 2223 serial adapters. The SeaLINK® 2165-OEM USB 2.0 serial adapter is used to upgrade their ticket vending machine kiosks and features on-board status LEDs to display serial data activity, the board heartbeat, electrical interface selection, and line termination state. The serial ports are recognized as standard COM ports by the host system, enabling compatibility with legacy software, too. Our SeaLINK® 2223 USB to serial interface, with a firmware upgrade from Sealevel's software engineers, provides I/0 for their passenger analytics system. The 2223 provides an easy way to connect two serial devices to a single USB port. And the electrical interface settings are maintained locally which allows the host computer to be repaired or upgraded without reconfiguring the serial ports.

Featured Product: SeaLINK® 2165-OEM Serial Adapter

- (16) multi-interface serial ports
- Each serial port is individually configurable
- Supports a wide range of standard and non-standard baud rates
- Wide operating temperature range of -40° to 85°C

Featured Product: SeaLINK® 2223 Serial Adapter

- Connects two serial devices to a single USB port
- Each port is individually software configurable for RS-232, RS-422, or RS-485
- Electrical interface settings are maintained across multiple computers
- Standard operating temperature range of 0° to 70°C and optional extended temperature range

USB CONNECTIVITY FOR TRANSPORTATION APPLICATIONS

As smart and connected transportation advances, the need for compatible expansion and communication devices increases. And with the incorporation of machine vision and embedded vision systems, the emphasis on reliability is at an all-time high. Sealevel's USB serial adapters and USB 3.1 hubs are backward-compatible with legacy technology while achieving the fastest speeds available.

USB Serial Adapters

From one to sixteen ports, SeaLINK® USB serial adapters allow for quick integration with RS-232, RS-422, and RS-485 peripherals – invaluable for transportation applications like emergency response and roadway monitoring, as well as other infrastructure and fleet management systems. Unlike traditional UART-based products, SeaLINK USB serial adapters use a state-machine architecture that reduces host processor overhead for faster, more reliable communications in critical environments. Sealevel offers the largest selection of USB serial adapters available, many featuring high-retention USB connectors to prevent loss of connectivity.

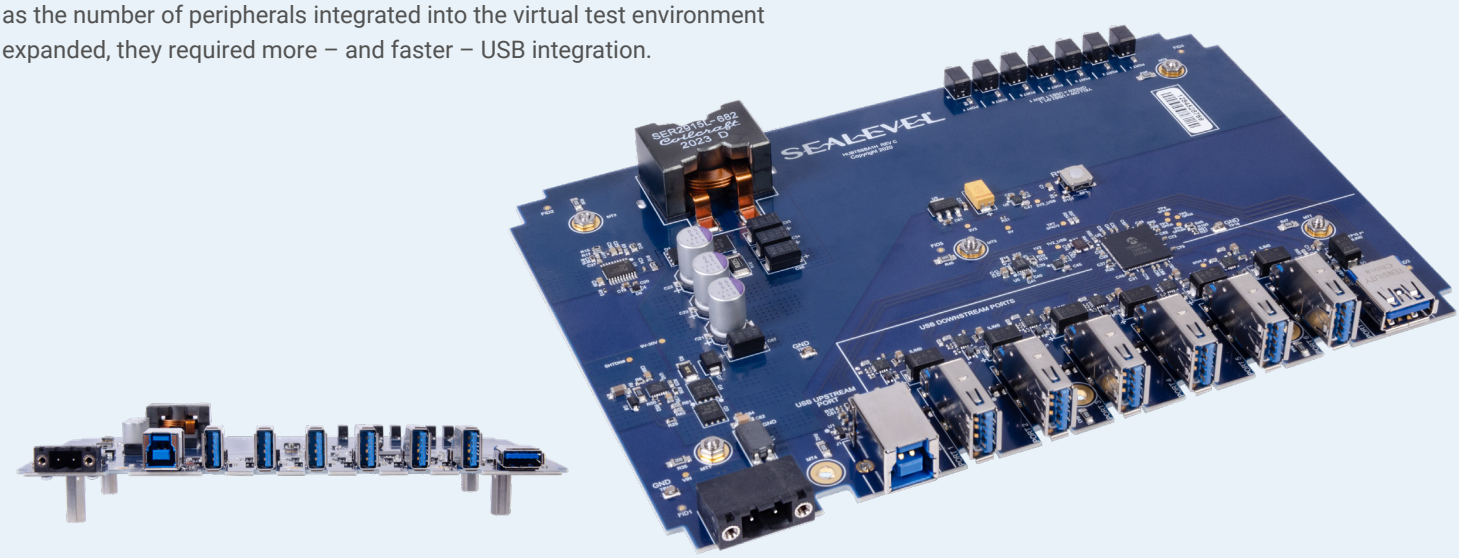
Rugged USB 3.1 Hubs

Sealevel industrial USB hubs are designed for rugged applications requiring wide operating temperature range and long-term availability. Choose hubs with charging downstream ports that are perfect for charging batteries or powering high-current USB peripherals. Hubs are available with up to 7 ports and up to USB 3.1 speeds and are backward-compatible to support legacy hardware. Optically isolated hubs protect computers from damaging surges, spikes, and ground loops commonly found in rail and other transportation applications.

Case Study: Supporting Vision Systems for Virtual Testing
Sealevel partners with a leading provider of embedded computing solutions for Advanced Driver Assistance Systems (ADAS). The customer provides technology systems specifically for testing in virtual environments. Common feature testing includes automatic emergency braking, collision warnings, lane departure warnings, blind spot warning, and adaptive cruise control.

As the United States and European Union now require ADAS technology on all new cars, the customer's product needs have increased dramatically.

Initially, the customer relied primarily on our SeaI/O 450U and 430U digital acquisition devices. However, as the number of peripherals integrated into the virtual test environment expanded, they required more – and faster – USB integration.



Sealevel's Solution
Sealevel's team recommended the Embedded Rugged SuperSpeed 7-Port USB 3.1 Hub. After an initial evaluation, the customer standardized on the USB 3.1 Hub from Sealevel across their test platforms. This solution enables backward compatibility while allowing the customer to incorporate newer, faster technology simultaneously. Intentionally designed to meet the advanced requirements for connecting multiple USB peripherals at once while achieving SuperSpeed operation, the USB 3.1 Hub enables the customer to achieve multiple goals.

Featured Product: Embedded Rugged SuperSpeed 7-Port USB 3.1 Hub
- USB 3.1 compliant, providing up to 5 Gb/s data rate to the host
- Supports SuperSpeed (5Gbps), high-speed (480Mbps), full-speed (12Mbps), and low-speed (1.5Mbps) operation
- One CDP supplies up to 2.4A while the other six supply 1500mA each
- USB Battery Charging Specification BCv1.2 compliant
- Wide operating temperature of -40°C to 85°C
- ESD, overvoltage, and overcurrent protection

QUALITY FOCUSED OPERATIONS FROM START TO SHIP

Sealevel's team of over 90 employees spans our engineering, manufacturing, and business departments. Our fully integrated staff is committed to customer satisfaction as demonstrated by our ISO 9001:2015 certification and rigorous quality processes. Every employee stands behind our first-in-industry lifetime warranty on I/O and the long-term availability of all products, beyond the life of your mission.

Dedicated Hardware & Software Engineering Resources

Sealevel is the leading designer and manufacturer of industrial computers, Ethernet serial servers, USB serial, PCI Express and PCI bus cards, and software for critical communications. We partner with OEMs and industry leaders to meet their specific application needs through our complete standard product line and custom design and manufacturing capabilities. We offer over 350 standard products in a wide variety of configurations and have successfully designed and deployed over 90,000 embedded computers since 2004.

Areas of Expertise

- COM Baseboard Design including COM Express® Type 6, 7, and 10, SMARC®, and Qseven
- x86 Architecture
- RISC Single Board Computer Design
- PCIe/104
- 8, 16, and 32-bit Microcontroller-Based CPUs
- Serial I/O – Asynchronous or Synchronous
- 10 Gigabit Ethernet
- USB 3.2, 2.0, 1.1, 1.0
- MIL-STD-1553
- High Density/BGA
- PCB Layout
- Thermal Modeling
- Functional Density
- SWaP
- Device Drivers for Windows, Windows Embedded and Linux
- Embedded Firmware
- Microprocessor Control

Manufacturing

All product design and assembly take place at our ISO 9001:2015 registered manufacturing facility, located in the United States of America. These processes are subject to our rigorous quality standards to meet our high-reliability guarantee for critical communications electronics. Our state-of-the art Surface Mount Technology (SMT) line consists of an Automated Screen Printer with 2D Inspection, four High Speed SMT pick and place machines, a Ten Zone Forced Convection Reflow Oven, and a 5-Camera Automated Optical Inspection system. Following initial build, our in-house team of J-STD-001 and IPC-A-610 certified technicians completes through hole soldering.

Areas of Expertise

- High Speed Surface Mount Technology (SMT)
- Printed Circuit Board (PCB) Assembly
- Through Hole Assembly
- Board Level Assembly
- Box Build Assembly
- Automated Screen Printing with 2D Inspection
- Automated Optical Inspection
- Closed-Loop Inline Aqueous Cleaning
- Automated Conformal Coating
- Multi-Angle Transmissive X-Ray
- Vibration & Thermal Screening

Design – and Test – for Certification

Sealevel's "design for certification" approach to engineering and manufacturing ensures that our compliance, test and certification engineers are involved beginning with initial concepts. Every custom embedded computer and industrial I/O design is refined to meet safety, security and environmental requirements. Sealevel's in-house Compliance & Test engineers complete in-house evaluations utilizing our multi-angle transmissive x-ray, 2-axis vibration table and multiple thermal chambers. This pre-certification analysis, validation, and test methodology reduces time to market as well as costs for our customers.

Areas of Expertise

- MIL-STD-810, MIL-STD-461, MIL-STD-1472, MIL-STD-901, MIL-STD-464, MIL-STD-167-1
- EMC (FCC, CE)
- EFT
- IEC/EN
- IP (Ingress Protection)
- NEMA
- ATEX
- IECEx
- CID1 and CID2
- Thermal Shock
- Environmental Stress
- Radiated Emissions
- Endurance Testing
- Impact Resistance

MADE IN THE USA

2779 Greenville Highway | PO Box 830 Liberty, South Carolina 29657 USA
864.843.4343 | Fax 864.843.3067 | **sealevel.com**

SL SL9693H23