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COM-BASED RUGGED CONTROLLERS

Embedded computers and touch panel PCs combine the advantage of COTS and custom to provide ruggedized computer solutions to meet and exceed specific application requirements. Ideal for use in energy automation, oil & gas exploration, and solar and wind farms. These computers are designed to operate reliably in extreme conditions. Our COM Express solutions offer unmatched computing power combined with versatile I/O configurability.

The global move towards more sustainable and environmentally friendly energy sources puts a premium on overall system efficiency. This increases the focus on energy automation at all levels: from the autonomous operation of wind turbines and other energy plants to the sophisticated automation of power grids, to the operation of smart home IoT consumer applications. Sealevel's engineering team specializes in rugged computing and I/O systems that support the variable conditions often inherent to energy applications.

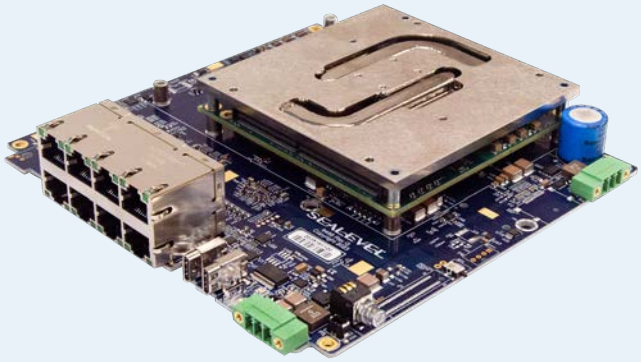
Fast Time to Market
The COM module provides the high-speed computing functions common to most applications including the CPU, memory, graphics, Ethernet and USB communications, SSD interface, and expansions buses. This improves time to market as engineering resources can be dedicated to designing the technology required for the specific application.

Scalability & Long-Term Availability
The carrier board can be designed to enable interchangeability of the COM module and easily change or upgrade the CPU functionality as needed in the future without the need to redesign the entire system. Additionally, COM modules are available with an up to 15-year lifecycle guarantee – allowing installations to exceed natural lifecycles.

Rugged & Industrial System Design
Sealevel specializes in rugged hardware designed to withstand environmental challenges including hazardous locations, shock & vibration, and temperature extremes. With COM architecture, the connectors are mounted directly to the carrier board, eliminating cable connections and enabling maximum reliability. COM modules are available with a -40°C to +85°C operating temperature change, allowing for fanless operation.

Case Study: Robust Controller for Gas & Wind Turbines

One of the primary suppliers of energy worldwide selected Sealevel to design and manufacture the next generation of their controller for gas and wind turbines. The design required robust I/O capabilities and flexibility to meet a wide variety of application requirements. Additionally, the system needed the ability to withstand environmental extremes and meet rigorous compliance certifications. The design would also be software heavy: the firmware would need to be completely compatible with client software and allow for future configurability.



Sealevel's Solution

Sealevel engineered a COM Express Type 6 design with highspeed, networked I/O for simplex, dual, and triple redundant systems. The COM architecture future-proofs the system as updates can easily be completed to meet new specifications and accommodate changing needs. Driven by FPGA, the Ethernet ports support time synchronization, network protocols including High-availability Seamless Redundancy (HSR) and Parallel Redundancy Protocol (PRP), and Time Sensitive Networking (TSN). The fanless controller achieves a -40°C to+70°C operating temperature through intentional component placement, heatsinking, and a finned enclosure design.

Featured Product: NextGen Turbine Controller

- COM Express Type 6 architecture with i7 processor
- (6) and (12) Gigabit Ethernet Ports
- Thunderbolt Port for USB-SS, PCIe, and DisplayPort
- USB Debug Serial Console
- -40°C to +70°C Operating Temperature
- Wide Input DC Power

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EMBEDDED COMPUTERS

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 often require a more rugged design to withstand the environment in which they are deployed. Application areas for industrial computers range from controllers for solar farms to controllers for hydraulic fracturing equipment, to edge computing systems powering asset management, data analysis, and crisis control operations at natural gas wells.

Designed for OEM applications where reliable computing and SWaP 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.

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 systems boards are designed to allow for easy changes, and upgrades, to the CPU functionality without a complete system redesign or replacement.

Embedded Computers

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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: Fracking Monitoring & Control

In fracking operations, an energy company uses a fleet of trucks that travel to and along oil fields, often on unpaved roads. The computer used to control the fracking equipment needed to be tough enough to withstand intense conditions. However, the company's previous industrial computers often failed when exposed to high shock, intense vibrations, or extreme temperatures. The company asked Sealevel for a standardized computing solution that would meet their shock, vibration, and temperature specifications, some of which are more stringent than MIL-STD-810.

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. Compatible with the rig mounts, the Relio R1 attaches on rugged brackets expected to outlast any standard DIN rail. The customer told Sealevel that "the Relio R1 was the only unit tested that passed all tests without any failures."

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 Temperature Operation -40°C to 71°C

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INDUSTRIAL 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; these hazardous area computers also maintain NEMA 4/IP64 protection from sprayed liquids. Certified by ATEX, IECEx, and for Class I, Division 2, our touch panel controllers deliver unmatched reliability and versatility in the most extreme environments for wind, solar, and oil & gas applications.

Resilient & Reliable
With aluminum front bezels, Sealevel's rugged touch panel PCs have NEMA 4/IP64 protection from sprayed liquids including rain, snow, splashes, hose downs, and other pressurized water streams. For further protection, the bezel is sealed against dust and dirt. With its Class I, Division 2 rating, the HazPAC 10 is also approved for locations where flammable liquids or gases are handled and processed.

Intense I/O & Future Proof Design
Intentionally designed to meet the demands of energy automation and control applications, our touch panel PCs enable maximum performance in embedded systems.

Standard I/O includes Ethernet, serial, USB and digital interfaces, and mPCIE expansion slots. Our COM-based designs allow for potential upgrades, future-proofing the hardware.

Secure Software for the Edge
Compatible with Microsoft Windows and Linux, our touch panel solutions provide the fastest time to market and flexibility for customer-specific software. Sealevel SeaCOM and SeaMAX hardware drivers are included to support system I/O. Serial application code samples assist with custom application development and complete support documentation expedites configuration.

Case Study: C1D2 Computing for Thermal Energy Management

Sealevel partners with a customer that specializes in the design and manufacture of heat tracing and leak detection equipment for industrial, commercial, and residential applications. The company's main focuses are the petrochemical and oil & gas industries, but they make products for a wide array of commercial and residential heat tracing applications as well. Sealevel has designed and manufactured multiple generations of rugged touchscreens for the customer that meet the extreme requirements for hazardous location certification, IP protection, impact resistance, and wide operating temperature range.

Sealevel's Solution

Sealevel's engineering team overcame the thermal challenge by designing a COM Express-based HMI capable of operation between -40°C and +60°C without heaters or fans. The system includes a machined front bezel that maintains NEMA 4/IP64 standards for protection from liquids. Designed for Windows 10® IoT Embedded, and fully supported in Linux® as well, the system delivers powerful Intel® processing combined with a bright, LCD, five-wire resistive touchscreen. The touchscreen integrates a glass surface that is waterproof, and impervious to flames, chemicals, solvents, and stylus use for maximum abrasion and scratch resistance.

Featured Product: HazPAC 10® Rugged Panel PC

- Certified by ATEX, IECEx, and for Class I, Division 2 (Groups A, B, C, D, T4)
- Intel Atom E3845 quad-core processor
- Designed for Windows 10® IoT Embedded with full support for Linux®
- Durable 5-wire glass resistive touchscreen interface
- (2) Isolated 2-wire RS-422/485 ports
- (2) Non-isolated 3-wire RS-232 ports
- (3) Gigabit Ethernet ports
- (4) USB 2.0 ports
- (4) Open collector digital outputs
- -40°C to +60°C operating temperature range

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DIGITAL & ANALOG FOR I/O-DENSE APPLICATIONS

Sealevel digital and analog I/O products enable you to monitor — and control — real-world signals from wind turbine to oil well output. Select from field-proven optically isolated inputs, Reed and Form C relay outputs, TTL interfaces to solid-state relays, 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 SeaI/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, SeaI/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 SeaI/O Ethernet modules are also compatible with 10/100 Base-T Ethernet. For new technology builds, as well as retrofitting legacy equipment, these devices provide reliable control and monitoring across autonomous infrastructure.

Case Study: I/O-Intensive Solutions for Nuclear Operations

The leading provider of nuclear components and service partners, specifically nuclear reactor components for U.S. Navy submarines and aircraft carriers, contracts with Sealevel for monitoring devices. The integrator utilizes a very I/O-dense cabinet to monitor valves and peripherals for gas analysis in their clean rooms as part of the building process for nuclear aircraft cores. At their site for reactors for submarines and aircraft carriers, they have a series of such cabinets that also require embedded controllers.

Sealevel's Solution

Sealevel's engineering team specified two SeaI/O USB data acquisition devices, the 450U and the 470U, coupled with the HUB7M Rugged USB Hub and the Relio R1 Industrial Computer. To achieve the mounting configuration, the customer also utilizes the KT125 VESA bracket and the KT123 flush mount bracket. The resulting configuration provides the high-density I/O and embedded control necessitated by the application.

The SeaI/O-450U provides 16 SPTDT Form C relays while the SeaI/O-470U allows for expansion via 8 differential or 16 single-ended 12-bit inputs, 2 12-bit D/A output channels, 8 optically isolated inputs, and 8 open-collector outputs. Additional peripheral connection is achieved through the 7 USB ports on the HUB7M. The entire system is controlled by the Relio R1 for a fully configurable, reliable network within a small footprint.

Featured Product: SeaI/O-450U USB DAQ Device

- (16) SPDT Form C relays
- Removable screw terminals for simplified field wiring
- Input power via terminal block or modular connector

Featured Product: SeaI/O-470U USB DAQ Device

- (8) differential or (16) single-ended 12-bit inputs
- (2) 12-bit D/A output channels
- (8) optically isolated inputs
- (8) open-collector outputs

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USB CONNECTIVITY FOR AI & OTHER PERIPHERALS

As energy technology advances, the need for compatible expansion and communication devices increases. And with the incorporation of autonomous solutions, 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 receiving intelligence from autonomous drones and underwater remotely operated vehicles (ROVs) as well as other communication and vision 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.

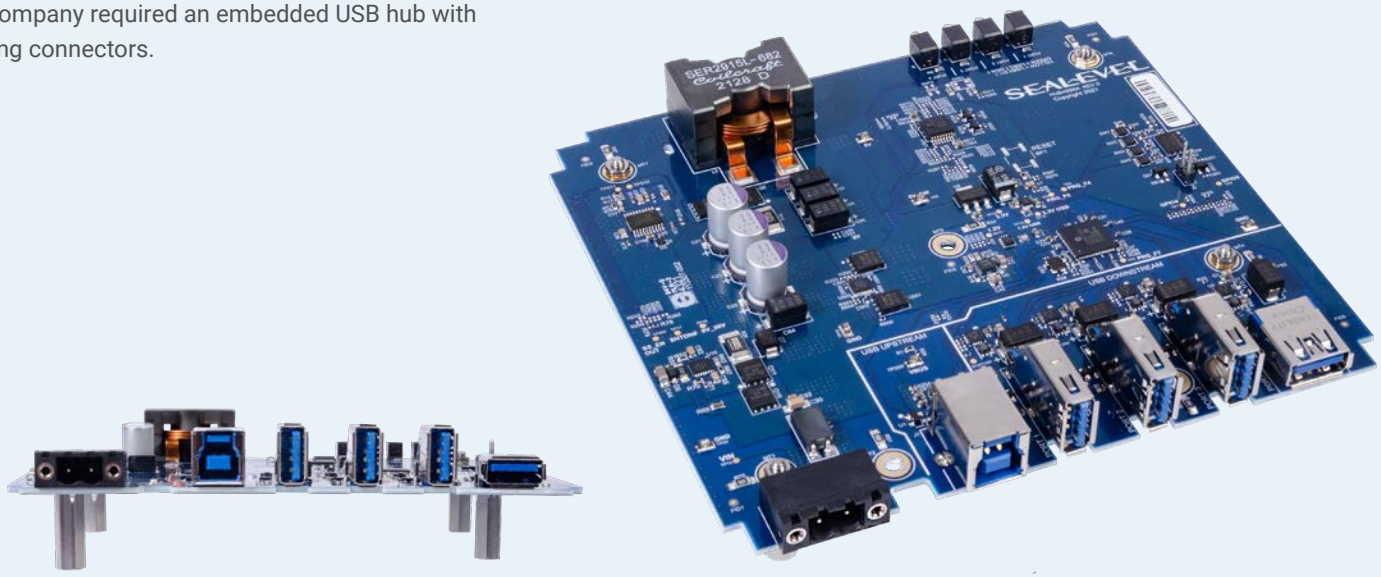
Rugged USB 3.1 Hubs

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 industrial and OEM applications.

Case Study: Drone Support for Autonomous Power Line Inspections

Sealevel partners with a company that develops AI-driven software to equip smart drones specifically for utilities. One of their software solutions enables drones to complete autonomous power line inspections and monitor power grids. This eliminates the need for traditional helicopter inspections resulting in improved safety and efficiency. A secondary benefit is the reduction of carbon emissions.

Within the drone architecture, multiple USB peripherals interface to contribute to the complete solution. However, due to intense vibration on the drones, the company experienced repeated USB hub failures largely because of loose connections. To ensure reliable, consistent operation, the company required an embedded USB hub with locking connectors.



Sealevel's Solution

The company evaluated a variety of industrial USB hubs and ultimately selected Sealevel's Embedded Rugged SuperSpeed 4-Port USB 3.1 Hub. This embedded hub's rugged design and locking Molex USB connectors eliminate the vibration tolerance concerns that had been a factor with previous designs. As with all Sealevel products, 100% of the functionality is tested prior to shipment to the customer, guaranteeing reliable performance in the field.

Featured Product: Embedded 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